SECOND EDITION

RESEARCHING MEDICAL EDUCATION

EDITED BY

JENNIFER CLELAND ▪ STEVEN J. DURNING

ASME
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An International Association for Health Professions Education
WILEY Blackwell

Researching Medical Education

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Second Edition

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Foreword

The publication of the second edition of *Researching Medical Education* is welcome evidence that the field of health professions education research is thriving and maturing. It requires only a rapid survey of topics in the book to see the evolution – more diverse theoretical perspectives, a closer alignment of theory and methodology and increasing synergies with cognate disciplines that are themselves advancing. Social sciences such as sociology, anthropology and communication studies are refining constructivist and critical perspectives, while the sciences of measurement and experimental method are evolving post-positivist approaches for a changing world. The authors of the chapters in this book are alive to these larger developments.

There could be no more urgent time to consider and debate questions of the value of research. Since the publication of the last edition, much has changed in the world. A global pandemic, a climate emergency, conflict on a scale not seen since the early twentieth century, and the rise of leaders who profit from discrediting science confront us. Questions about what is true, what is evidence and who has authority to claim either are more pointed now than at any time in my life. Today, it is insufficient to make a claim about anything, no matter how rigorously researched, without providing information about the worldview, theoretical perspective and methodology of the claimant. This puts tremendous pressure on researchers to articulate and effectively communicate what they understand to be 'evidence'. And I write, 'research teams' deliberately, because it is more apparent than ever that knowledge advances through the work of teams and scholarly communities, not individuals working alone, no matter how brilliant.

The editors of this book state a desire to draw in a 'wider circle' of those active in health professions education research. This is a notable goal in an era when too few voices are given disproportionate opportunity to promulgate their views, including about scientific discovery, insight or truth. Research in the health professions will only realise its full potential when those caring for patients and families (and those educating them) in all parts of the world, regardless of language, culture or model of healthcare, participate in research. This book takes the field very much further in that direction.

As with the first edition, Cleland and Durning's book is an indispensable resource for those new to the field of health professions education research but also those who have deep expertise. The book illustrates in equal measure the journey that our field has taken and the challenges that continue to lie ahead. *Researching Medical Education* owes its existence to The Association for the Study of Medical Education (ASME) which, through its journals and conferences, is an important voice for high-quality research in health professions education.

I recommend trying to approach this book with 'cognitive flexibility', that challenging frame of holding multiple perspectives in mind at the same time. It is not easy, as F. Scott Fitzgerald noted, to do so and still 'retain the ability to function'. Yet it seems to me that in recognising that more and different lenses increase our understanding of the world, health professions researchers, teachers and students but also patients and communities benefit most. By contrast, clinging with narrow-minded devotion to one theorist or one method is more likely to lead to impoverished understanding and the balkanisation of knowledge. Theorist Donna Harraway wrote that each of us can only ever aspire to a 'partial perspective' on the world. This book provides a blueprint to retain openness, to locate where each of our worldviews and expertise fit, and to help each of us to being something of importance to our exciting and evolving field.

Brian D. Hodges, Toronto

Foreword from ASME

I am delighted that this new version of *Researching Medical Education (RME)* was commissioned. The original genesis for the book, bringing together world experts in the field of health professions education to inform and educate in a wide range of relevant research theories and approaches, has been brought up to date with refreshed chapters alongside new ones. This reflects the rapidly changing and expanding world that is health professions education today.

The editors have once again produced a stimulating and inspiring book. The sections, 'Developing your practice', 'Methodologies' and 'Theory' are the three academic themes. These are complemented and reinforced by the individual chapters which provide the knowledge for the many scholarly topics which are important to consider at any stage of research. This book will provide a resource which any health professions education researcher will need to push the boundaries of research and extend knowledge in the field.

Researching Medical Education, alongside it's sister publication *Understanding Medical Education* (now in its third edition), exemplifies the ASME vision of Advancing Scholarship in Medical Education. The book showcases essential qualities for research, including collaboration, working across contexts, aiming for excellence, enabling researchers and, importantly, focusing on the future of health professions education. This book should be a 'must have' for any healthcare researcher to progress their knowledge and understanding.

Dr Kim Walker
Director of Publications, ASME

Foreword from AMEE

Whilst some may consider that education, training and research are separate entities, there is increasing evidence that they are intrinsically connected; modern methods of education eventually lead to health improvement; research into newer approaches and methods of education and training lead to improved learning.

Introducing research into the undergraduate medical curriculum is becoming standard in many schools. Much of this research is what can be called scientific or clinical research, but students and early researchers are slowly becoming more involved in educational research; intercalated degrees in medical education, student publications in educational journals and graduates concentrating more on education than clinical research are becoming more prevalent. Activities in education move quickly, however, and this second revision of the book has come at a particularly interesting time when newer educational strategies are being put into place as a result of global challenge. AMEE congratulates the many authors who have contributed to this new edition, their contributions will not go unnoticed, and to the editors whose passion for medical education and vision for educational research led to this new edition, which will enhance the importance of the topic immensely.

Trevor Gibbs
President, Association for Medical Education in Europe

Preface

The intent of the first edition of *Researching Medical Education* (2015) was to provide an authoritative guide to promote excellence in health professions (which includes medicine, nursing, dentistry and other fields) education research. We believe we were successful in doing so. *Researching Medical Education* was adopted as a core text by many Masters and Doctoral programmes, and had clear international appeal as represented by healthy sales throughout Europe, North America, Africa, Asia and Australasia. It is clear that *Researching Medical Education* (2015) 'hit the spot' and is highly valued.

We are delighted to have received feedback over the years about what learners and colleagues would like to see more of in the next edition. With this in mind, our aim for the second edition of *Researching Medical Education* was to have a balance of established and new areas of research and ideas, increasingly popular theories and methodologies, and draw in more people who are active in the field of health professions education research. We had to make some hard decisions. Three chapters from the original edition are not present in the second edition, because their focus was no longer highly topical or because the topic is well covered in other books, particularly *Understanding Medical Education*. An additional eight chapters provide more content and a broader representation of authors.

Although seven years have passed since the original publication, our position remains the same: rigorous and original educational research in the health professions is critical to the future of health professions education and hence, ultimately, patient care. By encouraging thinking, discovery, evaluation, innovation, teaching, learning and improvement via research, the gaps between best practice and what actually happens in medical (and other health professions) education can be addressed. In this way, knowledge can inform and advance education and practice, while education and practice can, in turn, inform and advance future research. Our objectives in this second edition of *Researching Medical Education* are thus to provide readers with the basic building blocks of research, introduce a range of theories and how to use a theory to underpin research, provide examples and illustrations of a diversity of methods and their use, and give guidance on developing your practice as a researcher. By linking theory and design and methods across the context of health professions education research, this book supports the improvement of quality, capacity building and knowledge generation within our field.

Researching Medical Education is written for health professions education, firmly embedded within health professions education and illustrated throughout with examples from health professions education (HPE). Reflecting our own backgrounds and the relationship of this book with the very successful *Understanding Medical Education*, most examples are drawn from medical education. However, the aims and objectives of the book, and its key messages, are generalisable across any healthcare profession, or indeed any other profession where learning knowledge, skills and attitudes are central to professional development.

As per the original book, this edition of *Researching Medical Education* provides a guide for Masters and PhD students in health professions education and their supervisors, those who are new to the field, those who are generally inexperienced in research, those who are new to the field of educational research but have prior research experience in the clinical or biomedical domains, and experienced researchers seeking to explore new ways of thinking and working. To achieve this, our authors are a blend of clinicians and PhD researchers in health professions education, representing a range of disciplines and backgrounds. Many are well established and later in their careers. However, we also welcomed contributions from mid-career and emerging researchers. Their contributions provide a blueprint of how to pose and address research questions, illustrated by practical examples. International examples help ensure that the messages in this textbook are relevant to all health profession educators even though the structures, systems and processes of healthcare delivery and education vary across countries.

Researching Medical Education (Edition 2) is presented in three sections.

The first is labelled 'Developing your practice as a health professions education researcher'. This section systematically introduces the initial steps in the research process. It starts with a broad overview of the two main research philosophies relevant to the educational research in healthcare professions and how these differ in terms of assumptions about the world, about how science should be conducted and about what constitutes legitimate problems, solutions and criteria from Cleland. McMillan then considers the influence of the individual researcher's preferences or 'worldview' on the research process, and introduces and explains the critical concepts of ontology, epistemology and reflexivity in research. Macleod, Burm and Mann then introduce a 'grand theory' (a very general theory that provides a framework for the nature and goals of a discipline), that of social constructivism. They promote alignment of worldview, theoretical frameworks and research approaches (methods) in relation to constructivism and its philosophical underpinnings. The use of theory is picked up further by Nicholson and colleagues, whose focus on widening access to medicine (increasing the diversity of medical students) provides a framework to examine the use of mid-range theory, theory which acts as a bridge between grand theory and empirical findings. They provide a story of how a field of research evolves from atheoretical evaluation to the use of robust methodologies and mid-range theory, thus building knowledge.

Bezuidenhout and colleagues describe how to move from an idea or a problem to formulating a research question, using the analogy of distillation and concrete worked examples to illustrate the steps in this process. Following on from this, Ellaway invites you to consider asking better questions about technology use in health professions education, linking this to the use and variety of theory, methodologies, study designs and methods that can be used to frame both subjects and approaches to inquiry.

We then shift to considering a fundamental of quantitative research studies. Stansfield and Gruppen discuss how to conduct a power analysis to help ensure your quantitative study has an adequate number of participants to find effects such as the impact of an intervention, an educational outcome or the relationship between variables.

We finish this part of the book with two chapters which focus on developing yourself as a researcher. Frambach and colleagues invite you to be intentional about your researcher identity, your topic area and your research community. Driessen and Lingard focus on dissemination, taking a rhetorical approach to get writers and speakers thinking about how to tell a compelling story from their research work.

The second part of *Researching Medical Education* is labelled 'Methodologies and methods for health professions education research'. Methodologies, study design and methods are present in just about all chapters, but this part of the book focused on introducing key approaches to help you plan your study. This is where most of the new book content can be found. Morris focuses on identifying, then critically examining, the quality, methodological and/or theoretical contribution of the existing literature on a particular topic, then explains the different purposes and approaches to producing a literature review. Varpio, Martimianakis and Mylopoulos focus on the necessity of acknowledging the differences within qualitative methodologies that make a difference, because these variations enable carefully directed research.

Kitto, Alexanian and Goldman then introduce the building blocks of ethnographic research and focus on three contemporary types – focused ethnography, autoethnography and digital ethnography – to illustrate how ethnography can reveal the social and cultural organisation of everyday education practices. Following from this, Cristancho, LaDonna and Field offer an overview of the purposes, features and uses of visual methods in health professions education research. They offer insights into how to think about visuals, why education researchers might wish to incorporate visuals in their research, when to use them and why and what challenges and opportunities visual researchers might encounter.

We then look at language and what is communicated in texts. Paton and colleagues describe the utility of critical discourse analysis (CDA) as a method to rigorously examine, and potentially navigate, complex challenges in healthcare and education. Konopasky and Diaz discuss two approaches to linguistics that HPE researchers can use to make sense of the educational contexts they study: functional and corpus linguistics. Both chapters offer definitions, describe the method(s), provide examples and illustrate the utility of these approaches in opening up dimensions in data which may not otherwise be seen.

Razack, McKivett and de Carvalho Filho provide frameworks such as critical pedagogy, critical race theory and participatory action research (PAR) through which research questions related to equity in HPE can be done rigorously and with attention to the researchers' own social positioning as the research is conducted.

Finally in this section, Sambeth and colleagues introduce the multi- and interdisciplinary research field of educational neuroscience which aims to learn more about the brain's role in processes that are relevant for education. They introduce a number of methods that are common in educational neuroscience and give examples are given how these may be applied in health professions education.

The third and final part of *Researching Medical Education* is labelled 'Theory informing health professions education research'. As introduced earlier in the book, a good theory (one which is internally consistent and coherent) should describe, explain, enable explanations (not just the what, but the why and the how) and yield testable hypotheses or research questions. The use of theory should generate new routes for research – routes that are conceptually related to and build on prior research. This section introduces a number of specific theories that are intended to guide empirical inquiry, action or practice. Each chapter provides additional recommended references to help readers explore topics of interest in more detail. When reading, you will see that different theoretical approaches align more with certain study designs and methodologies: in some chapters, the research studies are predominantly quantitative, to enable the measurement of cause–effect relationships, whereas in others, the methodologies and methods are typically qualitative, reflecting the nature of the phenomena and hence the research questions.

We first focus on theories that emphasise the collective, or social, where relationships between context, environment, people and things matter. Bleakley and Cleland focus on complexity theory as an overarching framework to inform and guide how healthcare professions researchers can meaningfully engage with highly complex contexts, such as clinical teams or educational systems, and where the outcomes of interactions are not always predictable. Ajjawi, Bearman and MacLeod provide an overview of some main ideas shared across different sociomaterial theories and methods, those which foreground materials – bodies, objects, substances, settings, technologies and so on – to examine how they act with and on the human activity and thought. Johnson and Reid then introduce activity theory, a sociocultural perspective, which places a person's social and cultural surroundings, and history, as central to what they do. We continue with a chapter by Torre and Durning who discuss social cognitive theories, those that consider learning and performance as inherently social and where the uniqueness that each situation brings (in terms of environment, participants, interactions) can often lead to different learning and performance experiences and outcomes. We finish this subsection with Billett, Sweet and Noble who introduce the concept of participatory practices – what opportunities for learning are provided in healthcare workplace settings and how individuals elect to engage in and learn through those practices – for understanding, supporting and developing workplace-based learning.

We then move on to areas where the dominant theories are those that focus solely on individual-level beliefs, processes and/or performance. Cilliers, St Onge and van der Vleuten outline a number of different health behaviour theories and illustrate how these can be used as a means of illuminating, explaining and changing behaviour in teaching–learning settings, whether campus-based or practice-based. Artino and colleagues introduce theories of self-regulated learning (SRL), which describe the processes that individuals use to optimise their strategic pursuit of personal learning goals. McConnell and Eva provide an understanding of the role that emotions play in the training, assessment and development of clinicians and, using a cognitive psychology lens, introduce common theoretical constructs and key methodological issues inherent in studying emotion. Frèrejean, Dolmans and van Merrienboer introduce the field of study of instructional design, a field that aims at developing evidence-informed guidelines and models for the design of instruction, ranging from the design of particular instructional materials, via lessons and courses, to complete curricula. Szulewski and colleagues take this forward by setting out a comprehensive overview of the utility of cognitive load theory for effective instructional design that facilitates learning and problem solving in medical education and practice. McGaghie and Kristopaitis provide a critical-realist review of the state of knowledge on deliberate practice and clinical skill acquisition, including how clinical skills acquired in the medical education laboratory can transfer to patient care practices and patient outcomes.

These are not the only theories, or ways of applying particular theories, which may be suitable for HPE research. Others are not presented, for no other reason than that no one book can cover everything. Whatever your question and natural inclination towards particular schools of theory, consider different theories and methods carefully. Do not jump too quickly, consciously or not, onto a single option without exploring others. The time spent on reflecting on which theory and methods are appropriate for your purposes early in the research process is time well spent. This is reinforced by two concluding chapters. Taylor and Gibbs explain the importance of planning research in a way that ensures sustainability and long-term effectiveness, and we (Cleland and Durning) also provide some final thoughts.

We hope that *Researching Medical Education* stimulates fresh thinking and new ideas for educational research in medical and healthcare professions and encourages you to engage further with the many exciting theories, models, methodologies and analysis approaches introduced here, the use of which will progress our field of study.

Jennifer Cleland
Steven J. Durning

Words of Recommendation

This is an extraordinary text that combines theory and practice in medical education research. The authors represent the who's who of medical education research, and their wisdom and insights will help guide novice and experienced researchers alike.

David M. Irby, Professor Emeritus of Medicine, University of California, San Francisco, USA

Research in health professions education is maturing. This is clearly evidenced by the second edition of Researching Medical Education. In 30 chapters this book takes you on an exciting voyage on research theories and research methodologies. This book is a comprehensive resource for anyone engaging in research in health professions education.

Cees van der Vleuten, former Director of the School of Health Professions Education, Maastricht University, The Netherlands

This book will be hugely beneficial not only for health professions educators across the spectrum but also for social science and health policy researchers of varied backgrounds and interests.

Zubair Amin, Associate Professor, Department of Paediatrics, National University of Singapore

A must-have for everyone who is curious or serious about how to do rigorous/excellent research in health professions education. A collection of essential ingredients (theories, methodologies, tools, and examples) that help make up the rigor/excellence.

You You, Assistant Professor and Research Acientist, National Center for Health Professions Education Development, Peking University, China

Medical education is in constant need of review and reform to stay relevant to the health care needs of people. "Researching Medical Education" addresses some of the most important aspects of research on Medical Education to inform and improve current practices.

Anna B Pulimood, former Principal of Christian Medical College Vellore, Tamil Nadu, India

PART I

Developing your practice as a health professions education researcher

1 Exploring, measuring or both: considering the differences between qualitative, quantitative and mixed methods research

Jennifer Cleland

I overheard some of the trainees/residents talking about the things that are important to them in terms of career decision making. It struck me that they seemed much more concerned with work–life balance and being near friends and family than had been the case when I trained. After looking at the literature and many discussions, a colleague and I started a programme of work examining the factors that influence medical student and trainee careers decision making in our country. We first carried out some telephone interviews to gather the views of students and trainees (residents). We used this to inform a survey to find out which factors were most important to the majority of trainees. Over time, how training was structured changed and so too did the behaviour of trainees, particularly at the stage of training before choosing a specialty. So we did more qualitative and quantitative studies, including collaborating with colleagues from health economics to develop and use a methodology which allowed us to identify what was most important in trainee (resident) career decision making and if there were differences across learners at different stages of training.

This overview of a 10-year plus series of studies (e.g.,[1–6]) highlights some of the differences between quantitative and qualitative research, but also how they can be used in a complementary manner in the same programme of research.

It is easy to assume that the differences between different types of research are solely about how data is collected – the randomised controlled trial (RCT) versus ethnographic fieldwork, the cohort study versus the semi-structured interview. These are, however, research methods (tools) rather than approaches (methodologies). There are very important consequences of choosing (implicitly or explicitly) a particular methodological stance or position to guide and inform your research practice or an individual study. Quantitative, qualitative and mixed methods approaches make different assumptions about the world,[7,8] about how science should be conducted and about what constitutes legitimate problems, solutions and criteria of 'proof'.[9,10]

In this chapter, drawing on Bryman[11] and Crotty,[12] I will talk about these assumptions and their implications for research practice. I will then compare and contrast the three approaches in terms of research design, methods and tools, analysis and interpretation. I will draw on examples from health professions education research to illustrate these points. The content of this chapter is more heavily 'weighted' towards quantitative and mixed methods research because qualitative research is well covered in other chapters in this book.

Philosophical differences

Quantitative, qualitative and mixed methods research (MMR) come from different underlying assumptions of what is reality (ontology) and what is knowledge (epistemology) (see also chapters by McMillan, and Macleod, Burm and Mann in this book).

Quantitative research

Quantitative research draws originally from the positivist paradigm. The underlying premise of this paradigm (basic belief systems, or universally accepted models providing the context for understanding and decision making) is that the goal of knowledge is simply to describe the phenomena that we experience, and hence can observe and measure (i.e., objectivity). The researcher and the focus of the research are in this way independent of each other: the researcher has no influence on the research process. In a positivist view of the world, the goal of knowledge is to observe, measure and describe the phenomena experienced because reality is tangible and measurable. Knowledge of anything beyond that (a positivist

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would hold) is impossible. This might seem a little extreme to us now, and much quantitative research has moved on from purely positivist views to post-positivism. Post-positivism does not reject the basic tenets of observation and measurement, but it recognises that all observation is fallible and that all theory is revisable. Post-positivism is also characterised by an acceptance that the background, knowledge and values of the researcher can influence what is observed.

In post-positivism, a variety of epistemologies underpin theory and practice in quantitative research.[13] One of the most common post-positivism stances is that of critical realism or criticality. A critical realist believes that there is a reality independent of our thinking about it that science can study, and questions (hence the 'critical' label) the infallibility of observation and theory. Moreover, they also believe that researchers can put aside their biases and beliefs to strive for objectivity. The differences between positivism and critical realism are discussed further in the chapter by MacMillan later in this book. For the purposes of the current chapter, however, it is sufficient to know that those working from a (post-) positivist position believe that the scientific method (i.e., the approaches and procedures of the natural science such as chemistry, biology and physics) is appropriate for the study of social phenomena (e.g., learning).

Qualitative research

The premise of qualitative research is subjectivity.[8,11,13] Qualitative research is concerned with how the social world is interpreted, understood, experienced or produced. Reality cannot be measured directly. Instead, reality is relative and multiple, perceived through socially constructed and subjective interpretations. There are many structured approaches to apprehending such realities and the methods and procedures of the natural sciences are not (generally) suitable for doing so (see later). The qualitative tradition is also underpinned by a number of different theories. These give researchers different 'conceptual lenses' through which to look at complicated problems and social issues, focusing their attention on different aspects of the data and providing a framework within which to conduct their analysis.[14] Many of these are described elsewhere in this book (for example, see chapters by McLeod, Burm and Mann, Nicholson and colleagues, Varpio and colleagues) and see also Reeves *et al*.[15] for a very useful overview.

The philosophical differences between qualitative and quantitative research are reflected in the language associated with each approach (see Figure 1.1).

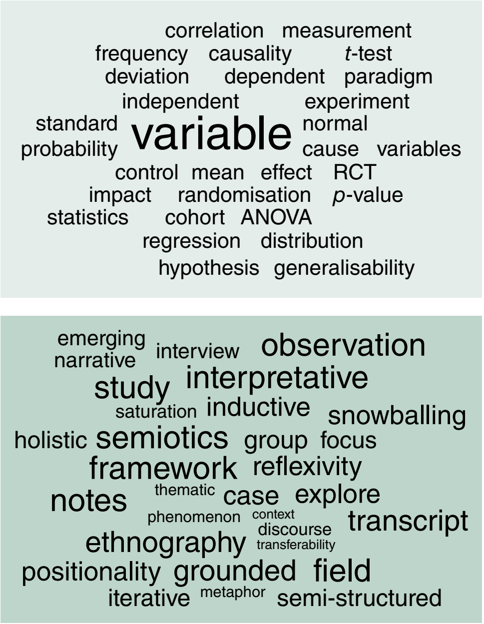

Figure 1.1 Word clouds of quantitative and qualitative language.

Mixed methods research

Mixed methods research (MMR) is underpinned by pragmatism which – rather than committing to any sort of philosophical stance – 'is pluralistic and oriented towards "what works" and practice'[16] (p. 41). In other words, pragmatism uses multiple methods but the use of the methods should always be guided by research problems.[16–18]

Taking a pragmatic stance frees the researcher from any philosophical commitments or obligations:[18] (s)he can instead use the most suitable design and methodology in terms of what is best suited to the purpose of their investigation.

So what do these differences mean in practice?

Broadly speaking, quantitative research involves hypothesis testing and confirmation whereas qualitative research is concerned with hypothesis generation and understanding (see Table 1.1). MMR is a combination of both (how qualitative and quantitative approaches can be combined is discussed later).

Expanding on this, quantitative research tends to be deductive, seeking to gather validity evidence for an idea or theory by conducting an experiment and analysing the results numerically (see Table 1.1). Theory is often seen as something from which to derive a hypothesis, a tentative explanation that can be tested by further investigation. For example, one hypothesis we might want to test (the null hypothesis) is that there is a relationship between students' self-confidence in examination skills and the amount of time they spend on the wards. Hypotheses are often in the form of an if/then statement; for example, if we teach handwashing, then infection rates will reduce. A hypothesis is always provisional as data may emerge that cause us to reject it later on (i.e., the outcome might be to reject the null hypothesis if the data indicates no significant relationship between self-confidence and time on the wards).

In this way, in quantitative research, the theories determine the problems (the research moves deductively, from theory to the data), which generate the hypotheses, usually about causal connections. On the other hand, the use of theory in qualitative research tends to be inductive; that is, building explanations from the ground up, based on what is discovered (although more deductive qualitative studies are possible). Inductive reasoning begins with specific observations and measures, for detecting patterns and regularities, formulating tentative hypotheses to explore, and, finally, ends by developing some general conclusions or theories.

MMR integrates the philosophical frameworks of both post-positivism and interpretivism (which assumes that there are multiple realities because meaning is grounded in experience)[19] interweaving qualitative and quantitative data in such a way that research questions are meaningfully explained. Creswell and Plano Clark[16] described six scenarios or examples of research problems that are best suited for MMR: when one data source is insufficient; further explanation of results is needed; when there is a need to generalise exploratory findings or enhance a study with a second method; where a theoretical perspective dictates the need to collect both quantitative and qualitative data; and, finally, where multiple, sequential research phases are needed achieve the overall research goal. These same purposes have been articulated in other ways by other researchers. For example, Greene, Caracelli and Grahan[20] suggest five purposes of using MMR: triangulation, complementarity, development, initiation and expansion.

Table 1.1 The hypothesis

To use the word hypothesis in qualitative research is incongruent (see Figure 1.1). However, all studies have a research question. How these are decided, and written, differs depending on the philosophy of the study. For example, here is a reasonably typical example of a hypothesis from a quantitative study in medical education research: 'We examined whether students who were selected via the local outcomes-based selection procedure . . . performed better . . . compared with students who . . . entered medical school via an alternative route' ([21], p. 1412). In this study, we wanted to know if x (early poor performance) predicted y (later poor performance). Compare that statement with this one from a qualitative study published in the same year: 'How do medical students from non-traditional backgrounds experience the journey of getting ready for medical school?' ([22], p.148). This is a much more open and exploratory approach, as befits a study which was concerned with exploring the views and beliefs of a particular group of applicants to medical school. See the chapter by Bezuidenhout and Schalkwyk in this book for a more in-depth discussion of the research question.

Comparing research design in quantitative, qualitative and mixed methods research

If quantitative research is concerned with establishing casual connections while qualitative research is concerned with describing phenomena in their natural setting, then different study designs are needed. Given MMR uses both qualitative and quantitative research designs, it is important to be explicit as to how and why different designs and approaches are combined.

Quantitative research design

There are four broad approaches to study design within quantitative research: descriptive, correlational, quasi-experimental and experimental. These are described briefly in Table 1.2 and illustrated with hypothetical examples in the table. Published examples of each design are discussed in the text.

Descriptive research is used to describe characteristics of a population or phenomenon – for example, how many students failed a certain assessment, how positively trainees rate the teaching in a particular department, what factors are important in medical student career decision making. Descriptive studies do not answer how/when/why questions, just the 'what' questions (e.g., what are the characteristics of the population or situation being studied?).

Correlational research is used to identify trends and patterns in data. For example, much research has used statistical analysis to compare performance on medical school admissions tests on later performance, or to examine the relationships between individual characteristics (e.g., gender, age, socioeconomic class, ethnicity) and performance on assessments during medical school and in training (e.g.,[23–25]).

Quasi-experimental research is used frequently in health professions education research where random assignment to study conditions is often difficult due to practical and ethical constraints (e.g., it would be unethical to withhold teaching from a 'control' group of students), or where there is not a comparable

Table 1.2 Types of quantitative design

Descriptive research seeks to describe the current status of the variable under study ('what is'). Designed to provide systematic information about a phenomenon. *Example*: a description of the alcohol use of medical and nursing students.	*Correlational research* explores relationships (associations) between study variables using statistical data. This type of research will recognise trends and patterns in data, but it does not go so far in its analysis as to prove causes for these observed patterns. *Example*: the relationship between early and later performance on degree assessments (see previous sections).	*Quasi-experimental research* attempts to establish cause–effect relationships among the variables. Groups are naturally formed or pre-existing rather than randomised. *Example*: the effect of attending extra clinical skills sessions on exam performance.	*Experimental research* looks to establish the cause–effect relationship among a group of variables that make up a study. An independent variable is manipulated to determine the effects on the dependent variables. Subjects are randomly assigned to experimental treatments. *Example*: the effect of different types of curricula design on students' preparedness for practice.

control group. Quasi-experimental designs can be open to biases and confounders, (or 'threats to validity'),[20] but there are quasi-experimental designs which are very robust, such as Interrupted Time Series (ITS; e.g.,[26]). ITS designs rely on repeated data collections to determine whether a particular intervention is associated with improvement on a given measure relative to pre-intervention trends. For example, in one of the few ITS studies in health professions education, Fielding *et al*.[27] used an ITS to assess if changes in selection processes for medical school resulted in increased diversity of the student population.

Finally, experimental research tests whether the independent variable(s) (controlled by the researcher) affects a dependent variable (the variable being measured for change) (see Table 1.3). An attempt may be made to control extraneous variables to ensure that the cause of change is, indeed, the independent variable. The RCT is an example of experimental research. A good illustration of an RCT in health professions education research is provided by Tweed, Desrosiers and Wilkinson[28] who compared student performance on a multiple-choice question (MCQ) examination under both closed- and open-resource conditions. The primary outcome measure was exam pass scores to assess the impact of exam format on performance. Students were randomised into either open resource or closed conditions and received one of two question pools for the first half of the examination. After a short break, students then took the questions from the other pool under the other conditions. This crossover design ensured fairness and balance, whereby all participants received the same experiences, just in a different order.

While the role of RCTs in health professions education has been hotly debated in the past,[29,30] they are now well established and have added much knowledge to the field.[31] RCTs are a major undertaking but, luckily, there is guidance on how to plan and report them. A recent AMEE guide is an excellent resource.[32] CONSORT (Consolidated Standards of Reporting Trials) provides a set of recommendations, checklist and flow chart for reporting randomised trials, known as the Consort Statement (http://www.consort-statement.org/). Another source of guidance is critical appraisal tools (for example, see the Critical Appraisal Skills Programme: https://casp-uk.net/).

Table 1.3 Independent and dependent variables in quantitative research

An independent variable is exactly what it sounds like. It is not changed by the other variables you are trying to measure. Examples would include age or gender – other factors (such as diet, amount of time spent studying or exercising, ward attendance) are not going to change a person's age or gender. The point is to see if the independent variable causes some kind of change in the other, or dependent, variables. Dependent variables would include exam outcome, performance on a task, things that can be changed by other factors, such as how much you studied or practised. Thus, an independent variable causes a change in a dependent variable.

A critical feature of quantitative research design lies is pre-planning and prescriptiveness. All aspects of the study – the study design, participants, data collection tools, data collection procedures (e.g., timing of follow-up) and the analysis plan – are carefully planned before data is collected. The aim of this is to ensure that each step of the study can be replicated or repeated using the same protocol at another time or by a different researcher, and the same findings will be the same. This protocol is planned in great detail, and often published in advance to ensure greater transparency of research and reduce unnecessary duplication of studies. Publishing your protocol may also facilitate subsequent publication of your study.

Qualitative research designs

Compare the above with the description of research design in Becker *et al*.'s[33] classic qualitative study of medical students:

> *In one sense, our study had no design. That is, we had no well-worked-out set of hypotheses to be tested, no data-gathering*

instruments purposely designed to secure information relevant to these hypotheses, no set of analytic procedures specified in advance. Insofar as the term 'design' implies these features of elaborate prior planning, our study had none. If we take the idea of design in a larger and looser sense, using it to identify those elements of order, system, and consistency our procedures did exhibit, our study had a design. We can say what this was by describing our original view of the problem, our theoretical and methodological commitments, and the way these affected our research and were affected by it as we proceeded. (p. 17)

In qualitative research, the design is predominantly determined by the research question and, as such, questioning and inquiring unfolds the process of understanding.[31] To do this requires scoping the project and considering what data is required in advance, with research design as 'a reflexive process operating through every stage of a project'.[33] Reflexive refers to being thoughtful, constantly examining what is affecting research decisions such as the wording of questions or how one interprets data. (A fuller explanation of reflexivity in the research process is provided by MacLeod, Burm and Mann later in this book.) In the qualitative approach, the activities of collecting and analysing data, developing and modifying theory, elaborating or refocusing the research questions, are usually going on more or less simultaneously, each influencing all of the others (see Maxwell[34] for a useful model of qualitative research design (p. 216)).

These differences are a matter of degree, however. Most qualitative projects would have some pre-structuring at least in terms of the equivalent of a research protocol, setting out what you are doing (aims and objectives), why (why is this important) and how (theoretical underpinning, design, methods, analysis). Generally, however, a qualitative research plan would be less fixed than its quantitative equivalent, but it is still a critical component of the research process. There are several excellent classic textbooks that go into this in more detail[8,16,34–36] and you can read examples of different qualitative designs throughout this book.

Mixed methods research design

A MMR design is a research design with its own philosophical assumptions and methods of inquiry.[16–18] As a methodology, it includes philosophical assumptions to direct the collection and analysis of data from multiple sources in a single study to ensure the research question is meaningfully addressed in a way which provides greater insight than a single method could.[37]

Creswell and Plano Clark[16,38] present three basic mixed methods designs:

The Convergent Design (also known as a concurrent parallel design):[18] quantitative data and results yield general trends and relationships, while qualitative results provide in-depth personal perspectives of individuals. The combination adds up to a more complete understanding than what would have been provided by each set of data alone. For example, researchers looking at the impact of the COVID-19 pandemic on teaching and learning collected quantitative and qualitative data together over time, then analysed and interpreted these data together to identify the various factors that may influence student learning and online curriculum delivery by teachers.[39]

Another similar design is that of **parallel-tracks** where 'the analyses are conducted independently, according to the strands of quality and excellence for each method . . . and the findings are brought together after each strand has been taken to the point of reaching conclusions'[18] (p. 268–269).

The Explanatory Sequential Design: a study begins with a quantitative component, then a subsequent qualitative component. The qualitative results help to explain the quantitative results. For example, a recent study used this design to identify and explore supervisor attitudes before and after implementing programmatic assessment in a dietetics programme.[40] A survey identified supervisor perspectives on work-based placements, programmatic assessment[41] and competency-based assessment.[42] Survey results were then used to develop focus group questions to further explore supervisor attitudes.

The Exploratory Sequential Design: a study begins with a qualitative data collection and analysis, which then informs a quantitative phase. This is nicely illustrated by the work of Scanlan and colleagues who carried out qualitative work exploring influences on career decision making in junior doctors, and then used this qualitative data as the basis of attributes for a discrete choice experiment.[3-5]

Lingard *et al.*[43] stress that good mixed methods research negotiates the differences between qualitative and quantitative approaches (in terms of philosophy, design, methods and analysis) by articulating how and why both are integrated.

Data collection methods

There is no one best way of quantitative or qualitative data collection: the method depends on what you need to know. Only a broad overview of different types of method is provided here. For more detail, go to one of the major textbooks recommended at the end of this section. Mixed methods studies will obviously use a combination of quantitative and qualitative data collection methods: how they combine methods is discussed above.

Quantitative data collection methods

Quantitative data collection methods involve objective measurements via structured data collection instruments that fit diverse experiences into predetermined response categories. The most common quantitative data collection tools are as follows:

- surveys (e.g., questionnaires, structured interviews);
- observations (e.g., number of students using the gym between 6am and 8am);
- measurements (e.g., ranking on graduation, number of doctors training in radiology).

Questionnaires or surveys (the terms are often used interchangeably) often look a relatively straightforward way to collect data. This is not the case. Designing a good questionnaire typically involves drawing on the literature, collecting some exploratory or consensus data, piloting a preliminary questionnaire for readability and acceptability, testing out the statistical qualities of the questionnaire, before actually using it in a study.[44–46] Unless questionnaire design is the focus of your research, it is generally better to use a published questionnaire, ideally one which has been used previously with a similar population (group of participants) to the one you are studying.

Observations in quantitative research are structured in that the precise focus of the observations is decided in advance. Collection of data by observations can be conducted on facts (e.g., the number of students in a classroom), events (e.g., the amount of collaborative work taking place between students in the classroom), behaviours (e.g., the number of incidents of antisocial behaviour in a classroom), or skills (e.g., checklist ratings of performance). Data collection is planned to allow for easy recording – for example, ‘done’ or ‘not done’; ‘excellent’, ‘good’, ‘borderline’. Workplace-based assessment tools such as the Mini-CEX are good examples of structured observation tools.[47]

Remembering that analysis in quantitative research is about number ‘crunching’ and statistics, it is worth emphasising that simple word data can be transformed into number data for analysis. For example, ‘excellent’, ‘good’ and ‘borderline’ can become 1, 2 and 3 for analysis. This is particularly useful in surveys, where responses to rating statements, such as ‘agree strongly’, ‘agree’, ‘disagree’ or ‘disagree strongly’, can be translated into numbers (e.g., 1 for ‘disagree strongly’, 4 for ‘agree strongly’).[44–46]

In terms of data collection procedures, quantitative studies need to be of sufficient size to enable statistical analysis and to demonstrate associative or causative relationships between variables (more about analysis later). Please see Chapter 5 by Stansfield and Gruppen for guidance on sample size and power calculations. Achieving statistical power is tricky in small-scale studies – where data is collected from one institution or one subgroup (e.g., surgical trainees/residents from one hospital, or even those from one surgical suspecialty). The sample also has to be representative to ensure generalisability of findings. For example, in Scotland at the time of writing, the medical student population is 60:40 female:male. In Singapore this proportion is reversed. A representative sample of medical students in these countries should include female and male subjects in these proportions.

Sampling of research participants in qualitative research is described as purposive, meaning there is far less emphasis on generalising from sample to population and greater attention to a sample ‘purposely’ selected for its potential to yield insight from its illuminative and rich information sources.[48,49]

Qualitative data collection methods

The qualitative methods most commonly used for research purposes are mentioned very briefly in this chapter, as these are covered in more detail elsewhere in this book. They can be classified in three broad categories as follows:

- interviews (individual or group)
- observation methods
- document review.

The qualitative research interview seeks to describe and gain understanding of certain themes in the life world of the subjects. Interviews can be organised one-to-one or in a group (focus groups) depending on the topic under study and the cultural context, and the aims of the project.[50] Observational data collection in qualitative research involves the detailed observation of people and events to learn about behaviours and interactions in natural settings (see[51] and chapter by Kitto, Goldman and Alexanian in this book). Such study designs are useful when the study goal is to understand cultural aspects of a setting or phenomenon. Written materials or documents such as institutional records, personal diaries and historical public documents may also serve as a valuable source of secondary data, providing insight into the lives and experiences of the group under study.[52]

Data collection in mixed methods

Both quantitative and qualitative data collection approaches can be used in mixed-methods research. As discussed earlier, the decision for a researcher is how to combine them.[16–20] The main guiding factor is typically to ensure that the design will be able to meet the most important goals or aims of the research project.

Data management

Different research approaches generate different types of data. Quantitative research generates (quantifiable) numerical data, that is (if the sampling strategy is appropriate) generalisable to some larger population, for analysis. Qualitative research may use some form of quantification, but statistical forms of analysis are not central to this approach. Instead, qualitative data analysis (QDA) aims to uncover emerging themes, patterns, concepts, insights and understandings. The data are allowed to 'speak for themselves' through the identification of conceptual categories and descriptive themes. Trying to squeeze narratives into boxes (like '0' and '1') would result in the loss of contextualisation and narrative layering. The researcher must immerse themselves in the data in order to be able to see meaningful patterns and themes, making notes as they go through the processes of data collection and analysis, and then using these notes to guide the analysis strategy.

In both approaches, data has to be managed before it can be analysed. Statistical and qualitative data management and analysis software are pretty much essential at this stage unless you are working with a very small dataset. If you are working with numbers, or data, which can be sensibly coded into numerical form, you need a software that is designed to store and analyse numerical data (e.g., SPSS). On the other hand, if your study design is qualitative and hence your data takes the form of 'words' and text, or images and visual material, you may want to use a specialist qualitative software (e.g., NVIVO) to facilitate data management and analysis. Your choice of software will be informed by the resources of your institution, your personal preference and/or what technical support is available locally.

A word of caution – data management software does not describe or analyse your data for you. You have to enter and manage data in such a way to facilitate the processes of description and analysis.[53]

Data analysis

As mentioned earlier, different research methods generate different types of data and these different types of data require different analysis approaches.

Quantitative data analysis

Aliaga and Gunderson[54] sum up quantitative research neatly as 'explaining phenomena by collecting numerical data that are analysed using mathematically based methods (in particular statistics) (p. 1). Quantitative data analysis usually starts with descriptive statistics and inferential statistics. Descriptive statistics give a 'picture' of the data in terms of, for example, number of male and female respondents, age of respondents, frequency of particular responses, and describe the pattern of the data in terms of averages (mean, median and mode) and measures of variability about the average (range and standard deviation). An overview of descriptive data and how to present descriptive data can be found in Cleland *et al*.[53]

On the other hand, inferential statistics are the outcomes of statistical tests, helping deductions to be made from the data collected, testing hypotheses and relating findings to the sample or population. In terms of selecting a statistical test, the most important question is 'what is the main study hypothesis and/or research question?' For example, are you looking for an association or relationship between x and y, or a difference between a and b? Different statistical tests are used for testing each type of question, and within each type of question, different statistical tests are used depending on the precise nature of your study design. The next question is 'what types of data are being measured?' Is your data in the form of frequencies or measured from a discrete scale (e.g., height)? Or is the data binary (e.g., pass/fail)? Is the data from two independent groups of subjects or from the same group before and after an intervention (such as training of some sort)? Is it from more than two groups? How many independent variables (see earlier) will be entered into the analysis, and how will you decide which ones to include? Identifying the appropriate statistical test for quantitative analysis can be complicated but luckily most statistical analysis books provide handy decision trees to help with this.[55–57] Major statistical software packages all have paper and online manuals, which can be invaluable.

Last, but not least, do seek advice and support from a statistician, statistics-friendly supervisor or able colleague when planning your project. This will save you hours of frustration when you reach the point of data analysis. Indeed, this point is equally made in relation to qualitative research. It is common for novices to qualitative research to have their papers rejected because the different components of their study – theory, design, methods and analysis – do not align appropriately.[11,12] Seek early advice and support from, and collaboration with, colleagues whose expertise lies in qualitative theory, research design and methods, and analysis.

Qualitative data analysis

While bearing in mind that qualitative data collection and analysis are iterative rather than linear (see earlier), Miles, Huberman and Saldana[57] explain the basic process of QDA as follows:

- data reduction (extracting the essence);
- data display (organising for meaning);
- drawing conclusions (explaining the findings).

The researcher must immerse themselves in the data in order to be able to see meaningful patterns and themes, making notes as they go through the processes of data collection and analysis, and then using these notes to guide the analysis strategy and the development of a coding framework. The researcher must be open to multiple possibilities or ways to think about a problem, engaging in 'mental excursions' using multiple stimuli, 'side-tracking' or 'zigzagging', changing patterns of thinking, making linkages between the 'seemingly unconnected' and 'playing at it', all with the intention of 'opening the world to us in some way' ([48], p. 544).

Good qualitative research has a logical chain of reasoning, multiple sources of converging evidence to support an explanation, and rules out rival hypotheses with convincing arguments and solid data. The wider literature and theory are used to derive analytical frameworks as the process of analysis develops and different interpretations of the data are likely to be considered before the final argument is built. For example, one of our recent studies[58] aimed to explore and identify what may keep an older doctor in the workforce ('stay') factors and ('go') factors that might prompt retirement. Data was collected via individual semi-structured interviews. We initially conducted a primary level thematic analysis to determine themes. We then explored the literature, identified and considered various theories, in some depth, before identifying the most appropriate framework for a secondary, theory-driven analysis.

Judging the quality of research

There are various criteria by which you can judge the quality of quantitative and qualitative research (see Table 1.4).[59] Validity refers to how well a measure captures what it is meant to measure. For example, how well does a questionnaire asking students to rate their satisfaction with a course assess satisfaction. Credibility, on the other hand, is about whether the study has been conducted well and the findings seem reasonable. External validity is the extent to which the results of a study can be generalised to other situations and to other people. For example, if peer-based learning in first year anatomy is found to be effective, will it also be effective in the clinical years or with students from another institution where the curriculum differs? Similarly, the transferability criterion asks if the findings of a study can be useful in other, similar contexts. Reliability refers to a measure's precision and stability extent to which the same result would be obtained with repeated trials. Judgements of the dependability of research findings consider the extent to which the research process was carried out in a manner, which may be reviewed or audited by another. Finally, in quantitative research, objectivity refers to freedom from bias. The qualitative equivalent of confirmability refers to researchers providing sufficient detail of data collection and analysis that readers can see how their conclusions were reached. The criteria for judging qualitative research[4] are discussed in more detail by MacLeod, Burm and Mann later in this book.

Conclusion

In this chapter, I have set out the fundamental differences between quantitative, qualitative and mixed methods research approaches, as summarised in Table 1.5. It may be clear from how I have done so that my personal stance is that all three approaches – quantitative, qualitative and mixed methods – have a place in health professions education research, can inform theory, practice and policy, and contribute to methodological and theoretical developments in the field.

Table 1.4 Criteria for judging research

Criteria for Judging Quantitative Research	Criteria for Judging Qualitative Research[4]
Internal validity	Credibility
External validity	Transferability
Reliability	Dependability
Objectivity	Confirmability

Table 1.5 Key characteristics of quantitative, qualitative and mixed methods research

Approach or philosophy	Quantitative	Qualitative	Mixed methods
Assumptions	• Positivism/post-positivism • Social phenomena and events have an objective reality • Variables can be identified and measured • The researcher is objective and 'outside' the research	• Constructivism/ interpretivism • Reality is socially constructive • Variables are complex and intertwined • The researcher is part of the process	• Pragmatism, integrates the philosophical frameworks of both post-positivism and interpretivism • Reality is both singular and multiple • Pluralistic – gather all sorts of data in order to best answer the research questions • Depends on the nature of the data
Purpose	• Generalisability • Prediction • Explanation	• Contextualisation • Interpretation • Understanding	• Both • Both • Both
Approach	• Hypothesis testing • Deductive, confirmatory, inferential – from theory to data • Manipulation and control of variables • Sample represents the whole population so results can be generalised • Data is numerical or transformed into numbers • Counting/reductionist • Statistical analysis	• Hypothesis generation • Inductive and exploratory – from data to theory • Emergence and portrayal of data • The focus of interest is the sample (uniqueness) • Data is words or language, minimal use of numbers • Probing/holistic • Analysis draws out patterns and meaning	• Guided by the research problem(s) • Inductive and deductive, the sequence of studies will depend on the research problem(s) • Allows researchers to answer research questions with sufficient depth and breadth • Quantitative and qualitative findings are triangulated • Combines strengths of each approach while compensating at the same time for the weaknesses of each

Practice points

- All research requires a philosophical stance, a research question, study design, data collection methods and data analysis.
- Quantitative and qualitative research differ fundamentally at each of these steps in the research process. Mixed methods research (MMR) negotiates the differences between qualitative and quantitative approaches (in terms of philosophy, design, methods and analysis) by articulating how and why both are integrated.
- Incongruence across different stages of any research project is very obvious to those reading and judging research.
- All designs and methods have their strengths and weaknesses, and it is critical to be aware of these when thinking about how best to address a particular research goal.

Recommended reading

Miles, M.B., Huberman, M. & Saldana, J. (2013) *Qualitative Data Analysis: A Methods Sourcebook*, 3rd edn. Thousand Oaks, CA: SAGE Publications. This update of Miles & Huberman's classic research methods text presents the fundamentals of research design and data management, followed by five distinct methods of analysis: exploring, describing, ordering, explaining and predicting.

Creswell, J.W. (2013) *Educational Research: Planning, Conducting, and Evaluating Quantitative and Qualitative Research*, 4th edn. Boston, MA: Pearson, a very practical and helpful book which is a recommended text for many courses.

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2 Theory in health professions education research: the importance of worldview

Wendy McMillan

Geoff teaches third-year dentistry students. He is puzzled that students frequently ask whether what he is teaching will be assessed in the final examination – because he carefully matches what he teaches with course outcomes and makes these connections explicit to the students. He decided to research the source of this question so that he can help his students to learn better. A colleague from his Faculty's Education Unit said that he should clarify what he believes about assessment before he starts the research. Geoff had not really thought about assessment – it is just something which you do to see whether students understood what you have taught. When Geoff started to read what other people thought about assessment, he was puzzled because different people had different understandings of assessment. He noticed that these understandings even affected study design. Some researchers said that students experience assessment as reward or punishment. This research studied how students' experiences of assessment as reward and punishment influenced their learning practices. Other research said that students are active participants in their own learning and constantly trying to make sense of what they learn. This research studied how students used assessment opportunities to help them make meaning. Geoff noticed that researchers seemed to take their own assumptions about assessment for granted and usually neglected to specify these assumptions to the reader.

This vignette about assessment highlights the important role that assumptions play in education research. Our assumptions are influenced by our worldview – in other words, by how we understand the world to be. Worldview influences how we interpret what goes on around us. This chapter is going to unpack how these assumptions work, and how they influence education research design, analysis and reporting. By the end of this chapter, the reader should be able to explain:

- the purpose of education research;
- the role that theory plays in research study design, method, analysis, and how theory informs the kinds of conclusions that might be drawn;
- the way in which research is shaped by the researcher's worldview;
- how worldviews are shaped by ontological and epistemological assumptions;
- the importance of reflexivity in research;
- how a summary of existing literature is different from a worldview or theory;
- different ways in which theory might be used to contribute to knowledge generation.

The purpose of education research

Why would one want to engage in education research? Geoff was clear that he wanted to understand how his dental students experienced assessment, in order to help his students to learn better and so to become 'good' dentists. Improved patient outcomes are the ultimate goal of medical education and medical education research.[1] The purpose of education research, thus, is to generate the kinds of information that healthcare educators need in order to understand, and thereafter to improve, teaching and learning – with the ultimate purpose of improving healthcare practice, patient care and patient outcomes.[1] Description alone is inadequate if the purpose of research is to generate insight.[2] Without an in-depth understanding, for example, of how students interpret assessment, such planning would be based on teachers' assumptions and conjecture.[2] By understanding the students' experiences and how these shape students' learning, the planning of assessment as part of the teaching and learning process can be evidence-based.[2] Understanding requires not just a description of what is happening, but some ideas about why it is happening – in other words, an explanation of what is happening. So, it would not be helpful for Geoff to know how many students passed (or failed) particular assessment activities in which performance categories. To understand why students want to know whether something will be assessed in the final examination, Geoff is going to need to find out

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about the motives, experiences, feelings, opinions, perceptions and choices of his students.[3] Qualitative research is most suited to getting answers for questions about people's behaviour.[3]

Qualitative research aims to generate an 'interpreted understanding' (p. xii) of people's social world through learning about people's experiences and their interpretations of these experiences.[4] Whitley suggests that there are three basic differences between qualitative and quantitative research.[5] First, qualitative research is designed to provide data which explores a topic of interest framed as a research question, rather than to test a hypothesis.[5] Thus Geoff's study would probably set out to collect data to help him answer the research question, 'How do students' understandings of assessment shape their learning behaviour' rather than to test the hypothesis, 'Perceptions of reward and punishment influence what students learn'. Second, sample size for qualitative research is usually quite small – often between 20 and 40 participants[5] – because the emphasis in qualitative research is on collecting detailed data so as to be able to create in-depth understandings of the lived experiences of a carefully selected representative sample of people. Thus Geoff would probably select students in his third-year dentistry class as participants, rather than studying dental students across a variety of institutions. If his dentistry class was very large, he might select a sample of 20–40 students within the class, from across the performance groupings, to serve as his cohort. Third, the study design for qualitative research is more fluid than for quantitative research. It is common and accepted practice for the study design to be modified as findings emerge.[5] Thus Geoff might find in his study that students learn only what they think will be immediately relevant in the clinical context. This finding might result in him deciding to administer an open-ended questionnaire to all 120 of his third-year students to find out what they believe are the aspects of his module, which are important for clinical application. This information will be helpful to him because he can use it to plan how to highlight the clinical relevance of the things which he teaches which the students do not necessarily see as clinically relevant. These differences are discussed in further detail in Chapter 1.

The importance of worldview to study design

Qualitative research, therefore, has the potential to provide the kinds of information that are really useful in understanding aspects of teaching and learning. However, much healthcare education research fails to actually generate these understandings because it stops short at description.[2] Analysis remains as a surface description of what people said and did.[3] Merely describing what his students think about assessment will not help Geoff to plan a teaching environment which better supports dental students' learning and professional development. In order to create that sort of environment, Geoff will need to know what the meaning is of all the data that he collects – in other words, he will need to understand what all the data tells him as a teacher about what motivates students to learn and how different kinds of teaching strategies, learning activities and assessment tasks cause students to make different decisions about how and what they learn.

However, in order to generate this kind of understanding, Geoff will need to be clear what he believes about learning and assessment. He will need a theory of learning and assessment in order to conduct his analysis.[6] Geoff has already encountered two theories of assessment, which draw on two different worldviews (see Table 2.1)[7–24] – that students experience assessment in terms of reward and punishment (which draws on the worldview of positivism and its associated theory of behaviourism[12] to understand assessment), and that students are active participants in their own learning and constantly trying to make sense of their learning experiences (which draws on the worldview of interpretivism[10,11,25] and its associated constructivist[13,14] theory of learning to understand assessment). There are many more theories and, as Geoff discovered, each theory is shaped by a particular set of assumptions about how the world is. In other words, worldview (and the theories which are generated by it) determines what gets studied, how it gets studied, how the data gets interpreted, and what counts as valid findings (see also Chapter 1).[7]

Two examples illustrate this relationship. If Geoff believes that students experience assessment as reward and punishment, his research will focus on this aspect of assessment. He might decide to use focus group interviews because talking with others helps people to think about and clarify their own beliefs and assumptions more easily than in a one-on-one interview.[26] He could ask students to explore what it is about assessment activities, and how they are conducted, that is experienced as positive or negative. However, while he might probe how assessment-as-reward or assessment-as-punishment affects what students choose to study and how they study it, he is unlikely to explore whether students perceive a relationship between preparing for assessment and learning to be a competent healthcare

Table 2.1 Summary of three worldviews. Adapted from[7–11]

	Positivism	Interpretivism	Criticalism
Ontology *(assumptions about the nature of reality)*	• There is a reality 'out there', and it can be known. • Laws and mechanisms govern the workings of that reality. • Research can (in principle) find out the true state of that reality.	• There are multiple realities because meaning is grounded in experience. • Knowledge can be derived from sources other than the senses. • Reality is complex, and context-dependent.	• Reality may be objective or subjective, but truth is continually contested by competing groups.
Epistemology *(assumptions about the nature of knowledge)*	• The investigator and the object under investigation are two independent entities. • It should be possible to study something without influencing it. • Part of good research is employing strategies to reduce or eliminate any influence. • What is found – if replicable – it true. • The investigator might acknowledge 'true for now', but the assumption is that 'true' can indeed be found with the correct techniques, information or research question.	• Knowledge is derived from people's experiences – both those of the researcher and the research participants. • Perceptions and experiences of both the researcher and the research participants affect what is seen and conceptualised. • There are multiple ways of knowing.	• Power relations determine what (and whose) knowledge counts. • Power is implicated in the relationship between the researcher and the researched. • What can be known is inextricably intertwined with the interaction between the researcher and the researched.
Related theories	• Behaviourism[12] • See also Chapter 20	• Social constructivism/social constructionist theory (emphasis on construction of meaning)[13,14] • Sociocultural theory (emphasis on context of complex social environments)[15] • Sociomaterialism, including actor-network theory[16] and complexity theory[17] (emphasis on inter-relatedness of all aspects within a system)	• Critical theory[18] • Critical realism[19,20] • Race[21]/class[22] theory[23]
Example of research question	Positivist research usually tests a hypothesis and does not ask a research question: • 'Perceptions of reward and punishment influence what students learn.'	• 'How do students' understandings of assessment shape their learning behaviour?'	• 'What is the influence of diversity and the educational climate in shaping clinical competence of oral health students?'[24]

professional, and if they do, how students understand this relationship. If, on the other hand, Geoff believes that students are active participants in their own learning and that students use assessment opportunities to assist themselves to make meaning, he will make use of different interview questions and will conduct his data-collecting interviews differently. He might interview individual students about how they learn and how they use assessment to support and direct their learning. He might ask the students to share examples of their study notes, and he may even try to analyse the annotations that they make on these notes. He might seek out groups of students who study together, and conduct focus group interviews with them about how they construct and share knowledge together and about the role which assessment plays in this process. In other words, Geoff's research focus will determine how he collects the data and what data he collects.

And it is not only the means and nature of data collection that will be different for these two studies. The analysis and the interpretation of the data will also be influenced by what Geoff believes about learning and assessment. A study of assessment through the lens of reward and punishment draws on the behaviourist theory of learning. Behaviourism assumes that learning is achieved through stimulus-response.[12] Analysis of the data would set out to find evidence of how assessment services as a stimulus, and how positive or negative assumptions about this stimulus influence students' response behaviour. Conclusions from this study would be framed in terms of what kinds of assessment stimuli lead to what kinds of student learning responses. Recommendations might suggest ways in which assessment stimuli could be adapted to ensure a positive response.

A study of assessment that explores how students use assessment activities as part of the construction of knowledge, in contrast, draws on constructivist theories of learning. Constructivism assumes that students are active participants in their own learning and constantly trying to make meaning of their learning experiences.[13,14] Analysis of the data would set out to find evidence of the kinds of actions and activities which students engage in as part of their learning and the ways in which they engage with assessment activities as part of this process. Conclusions from this study would be framed in terms of the kinds of assessment activities that best encourage students to engage with the knowledge, skills and dispositions of the subject and to construct their own personal meaning from that engagement. Recommendations might suggest ways in which the teacher could facilitate this kind of active engagement, and would include suggestions about assessment as a part of the entire teaching and learning environment.

It is clear that studies based on different worldviews – while even studying the same topic and trying to find solutions to the same classroom challenge – have different study designs, and will come up with different interpretations and different recommendations.

Personal assumptions and worldview

Before he can design his study, Geoff is now faced with the challenge of having to be explicit about what he believes about learning and assessment. We all have beliefs and assumptions about how the world is. Usually, we are unaware of these beliefs and assumptions until someone else appears to be thinking or behaving in an 'odd' way – or as happened with Geoff, when he was faced with apparently contradictory understandings of his research concept.

There are basically two kinds of assumptions about the world, which we tend to take for granted and seldom make explicit or examine.[25] We have assumptions about the nature of reality and what can be known about the world – that is, what counts as 'true'[25] and what we believe is 'real'.[27] For example, researchers who conducted research to test the hypothesis 'Perceptions of reward and punishment influence what students learn' would probably assume that the 'truth' was out there for them to find. In other words, they would be assuming that reality is static, fixed and ordered in accordance with a supreme and impartial 'truth'[25] – they would hold a positivist worldview (see Table 2.1). In contrast, someone who asked 'How do students' understandings of assessment shape their learning behaviour?' would assume that different students understand learning differently and that the question could not be answered without getting an insight into what the students themselves thought. For this person, who holds an interpretivist worldview, reality is subjective and changing, and there is no ultimate truth – only people's differing experiences of it. These assumptions about what counts as truth are referred to as ontological assumptions.[25]

In educational research, ontological assumptions will shape what a researcher accepts as evidence of the nature of teaching and learning and will determine the kinds of questions that the researcher believes can be asked about the teaching and learning reality and what the researcher will accept as valid answers to them.[25] These assumptions about the nature of knowledge are referred to as epistemological assumptions.[8–10,12,25,26,28] For example, if the researcher adopts a worldview that assumes that reality is ordered according to a supreme truth (i.e., a positivist worldview), then the purpose of research will be to generate a theory that accurately describes that reality – and only knowledge about reality that can be proved to be objective and neutral will count as valid.[25] Thus the researcher of the hypothesis, 'Perceptions of reward and punishment influence what students learn', would try to study student learning without influencing it and would conscientiously employ strategies to reduce or eliminate any influence by the researcher on the research topic, including on the students who would be the subjects of the study.[8–11,25] Validity of the study would depend on whether it could be replicated.[8–11,25] In contrast, the researcher of the question, 'How do students' understandings of assessment shape their learning behaviour?', would assume that knowledge is derived from people's experiences and would therefore expect there to be multiple of ways of understanding assessment and they would treat each as equally valid.[10,11,25]

Three broad worldviews can be identified: positivism, interpretivism and criticalism.[8–11,25] Each worldview is determined by particular beliefs, which in turn shape the research questions that can be asked, what counts as valid information about the research context, and what kinds of conclusions can be drawn. Table 2.1 summarises the three worldviews, their associated ontologies, epistemologies and educational theories. It also suggests the kinds of research questions that would emerge from each worldview.

Positivism

Healthcare practitioners will be familiar with the assumptions about reality and knowledge of what is referred to as positivism or the positivist worldview[7–10,25] (see Chapter 1). The study by Hodges and McIlroy[28] of the validity of global ratings for scoring Objective Structured Clinical Examinations (OSCEs) is an example of an education study designed within the ontological and epistemological assumptions of positivism.

However, it is hard to find out the truth about some aspects of reality – especially about things related to people such as their motives, experiences, feelings and reasons for doing or not doing things. Since insight into teaching and learning is usually about understanding the behaviour and motivations of students and their teachers, positivism may not be a very effective or suitable framework for understanding these aspects. Other worldviews might better help education researchers to understand the world of students and university teachers, their experiences and their assumptions.

Interpretivism

Interpretivism, as a worldview, argues that reality is subjective, and therefore that there can be no ultimate truth.[10,11,25] It is sometimes difficult for researchers who have worked in the positivist worldview to understand the assumptions that are embedded in the interpretivist worldview. The article by Frost and Regehr,[14] which draws on social constructionist theory, is helpful in this regard. Social constructivism is an interpretivist theory, which assumes that the people whose experiences are being researched each have a unique experience and a unique and subjective interpretation of that experience (see also the chapter in this book by MacLeod, Burm and Mann). In their study, Frost and Regehr[14] highlight how identity as a doctor is constructed in a variety of ways, resulting in many different identities within a single research cohort. The authors examine these different constructs and conclude that an interpretivist worldview allows for an examination of the construction of diverse identities that would be impossible through a worldview such as positivism, which assumes that there is only one truth. Similarly, Govaerts and Van der Vleuten[15] use sociocultural theory to understand how students and their assessors perceive learning and competence in the work-based environment. In two separate articles, Bleakley[16,17] suggests ways in which social materialism theories (such as actor-network theory[16] and complexity theory[17]) might be used to understand aspects of medical education.

Criticalism

Interpretivism allows for individual perspectives to be heard and for education researchers to examine understandings from the perspective of those involved in a particular teaching and learning activity or environment. Criticalism,[9,25] however, while also assuming that individual perspectives are important, argues that not all experiences can be treated as equal because some experiences are the consequence of prejudice, discrimination and exploitation on the part of more powerful others. Experiences of access to healthcare in apartheid South Africa would be an example of the way in which experience is determined by more powerful others.

Studies drawing on the assumptions of criticalism focus on power and the way in which power operates to marginalise some participants in social interactions. Criticalism has been used to study both patient care[18–21] and the experiences of healthcare students.[22,23] Drawing on qualitative interviews with first-year oral hygiene students, McMillan[23] uses race and class theory to examine the relationship between students' experiences of the transition to university, their first-year academic performance and the expectations that universities have of first-year students. She shows how university expectations serve to discriminate against those who come from homes with little or no prior experience of university. Her study shows how, while each individual student has a personal and subjective experience of university, race and social class shape common experiences for students. Beagan[22] uses class theory to reveal experiences of exclusion and marginalisation of working-class medical students.

Being 'up front' about worldview

Whether researchers are explicit about it or not, ontological and epistemological assumptions will underpin the worldview which they use as a lens to study aspects of teaching and learning. Differences in these assumptions shape not only study design, but also what emerges as data, how this data can be analysed and even the conclusions that can be drawn and recommendations that can be made from the study. However, what researchers frequently neglect to do is to make explicit the worldview and assumptions upon which their studies are based.[3,29]

In order for a research study to be evaluated for significance and validity and reliability – as well as to ensure that the reader understands 'where a study comes from' – the researcher needs to 'own up' to his/her worldview and its associated assumptions. Geoff's puzzlement when he was faced with different perspectives on assessment was exactly because the authors had not indicated the assumptions and worldviews that they took for granted and which had shaped the lenses which they used to look at assessment.

The demand to be upfront can be challenging to healthcare practitioners who have usually been educated and trained – and continue to work and research within – a positivist (or what is frequently referred to as a 'scientific') worldview. As a consequence, the positivist worldview takes on the semblance of being the only possible way to view the world. However, the preceding discussion about ontology and epistemology has highlighted that worldviews vary. It has been argued that different understandings of what questions might be asked of reality and what counts as convincing evidence of answers to these questions are appropriate for different research contexts and for different views about how the world actually is.

How then might a researcher be transparent in reporting healthcare education research? One way would be for researchers to actually reflect on their assumptions about knowledge and reality, and to consider what worldview would provide the most suitable lens and tools for understanding the particular healthcare education issue under investigation. Reflexivity is one mechanism for ensuring this kind of disciplined inquiry.[30,31] Reflexivity involves thoughtful analysis or disciplined self-reflection.[31] It involves continuous evaluation by researchers of what they are assuming, and a continuous checking that the assumptions are aligned with and appropriate for the research situation, the research question, and the methodologies and methods adopted. Thus, Geoff is going to need to ask himself what he believes about assessment. Does he believe that assessment comes after learning; that it is something separate from learning – in which case behaviourist understandings of reward and punishment will probably underpin his research question and study design. Or, does he believe that assessment is an integral part of learning and that students are active participants in their own learning – in which case constructivist understandings of 'making sense' will probably shape his research question and study design. Geoff will need to be alert to the worldviews that underpin each of these theories.

Geoff might ensure the rigour of this process – the ongoing self-evaluation and alignment of all aspects of the research process – through a number of mechanisms. An audit trail, tracking decisions made during the research process, is one such mechanism.[32] This audit trail of the thinking processes, which were integral to the study design and its implementation and subsequent analysis and reporting, might be kept in the format of a reflective journal.[32] Journalling allows researchers to think about what they are doing and why and about their assumptions and how these shape what they do and why they do these things. It is also an excellent mechanism for capturing personal inconsistencies, biases and even prejudices.[32,33] These reflections will be important for later claims regarding validity and reliability.[33,34]

It may now be evident that acknowledging a worldview or taking on a theory is not the same as reviewing the literature (see Chapter 10 later in this book for more on literature reviewing). A researcher may include articles from a number of different worldviews into a review of the literature. This indeed would be appropriate as the purpose of a literature review is to show what people are currently saying and researching in a particular subject. However, when the time comes to design the study, the researcher will need to be clear about his or her assumptions of how the world operates. This awareness of worldview will form the foundation for deciding on a suitable theory for the study – one that will allow the research issue to be adequately studied and reported.

The relationship between theory and research

The point was made at the beginning of this chapter that the purpose of healthcare education research is to generate the kinds of information that healthcare educators need in order to understand, and thereafter to improve, teaching and learning so as to improve the quality of healthcare delivery. The discussion so far has highlighted the importance of understanding how ontological and epistemological assumptions shape research study design. Table 2.1 indicates that a relationship exists between ontological and epistemological assumptions and the kinds of theories that a researcher might select. In this section, attention turns to how theory contributes to the knowledge generation required to understand, and thereby improve, teaching and learning. The issue being studied, the ontological and epistemological assumptions of the researcher, and the research question usually determine how theory is used to generate knowledge.

Theory in research contributes to knowledge generation in two different ways. Inductive inquiry uses theory to inform study design and analysis. A specific theory is taken up before the study is designed. All aspects of the study design – including the framing of the research question – are informed by the theory. Most importantly, the concepts identified in the theory as central are used in the analysis. Locating a study within an existing theory allows the researcher to draw on existing concepts, to justify the focus of and techniques used to conduct the study and to organise, analyse and interpret the data that is collected.[35] Theory used in this way provides an organisational framework for interpreting the data and for representing the data after analysis.[29] For example, McMillan[36] drew on self-regulated learning theory to study the learning strategies of academically successful dentistry students. She used the core concepts of this theory – cognitive strategies, metacognitive strategies, motivation – to interpret the data. From her findings, she made recommendations of how the ways in which academically successful students manifest these concepts might be developed in less academically successful students.

On the other hand, deductive inquiry contributes to the development of theory.[37,38] While ontological and epistemological positions are identified before these studies are conducted, a specific theory is not usually identified. The researcher waits for the concepts to emerge from the data. Grounded theory adopts this approach.[39–41] Some grounded theory studies explicitly develop theory – such as the study by Pratt,[38] which set out to theorise the professional identity development of surgeons. Others use findings to generate models or frameworks for understanding particular aspects of a discipline – such as the study by Sbaraini *et al*.,[37] which used grounded theory to develop a model of the process of adapting a preventive protocol into dental practice.

Conclusion

This chapter has highlighted the way that worldview – and associated ontological and epistemological assumptions – shapes how researchers understand the world, what kinds of questions they believe can be asked of that world and what kinds of information count as answers to these questions. The point has also been made that this worldview influences the actual study design, from the formulation of the research question to the collection and analysis of the data. The importance of reflection as part of research methodology has also been emphasised. Increasingly, in the writing up of research proposals and articles, researchers are being asked to 'own up' to their worldviews and theoretical positions. Frost and Regehr,[14] for example, state their theoretical position up front as part of their description of the structure of their article, 'We then survey the social science literature to describe the tenets of a social constructivist theory of identity. We draw on this theory to explore what the tension between the discourses of diversity and standardisation might mean for medical students and the ways in which they are constructing their professional identities.' Similarly, Clarke[42] describes how she used a reflective journal to understand her research process when studying the experiences of patients with chronic pain, 'My learning was clearly outlined as I realised the importance of suspending judgement and the influence of my beliefs and values. This was difficult on occasion and sometimes the diary was used to help me understand a situation from my viewpoint and then it allowed me to focus on the same situation from the patient's viewpoint.' The first step that Geoff will need to take in his study of assessment will be to define his own ontological and epistemological assumptions – for it is only once these have been made overt that he will be able to design a study that will allow him to address his concern and so help his students to better focus their attention when they learn.

Practice points

- The purpose of education research is to generate explanations of teaching and learning.
- Research design, data collection and analysis, and explanations generated from research are dependent on the researcher's assumptions about the nature of reality. These assumptions determine the kinds of questions that can be asked and what counts as an acceptable answer.
- Education researchers need to recognise and 'own up' to their assumptions, and make their assumptions clear when reporting on research.
- Worldview, study design, data collection and analysis need to be aligned in order to generate authentic and useful explanations of teaching and learning – which in turn will contribute to improved healthcare.

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3 Constructivism: learning theories and approaches to research

Anna MacLeod, Sarah Burm and Karen Mann

Your School of Medicine and Health Professions Education has begun to implement a programme of interprofessional education (IPE) for your pre-licensure students. An early initiative has involved bringing together second-year students from the different professional schools for discussions about their professional roles and about current healthcare issues. Following the experience students complete a standardised questionnaire surveying their attitudes, knowledge and feedback on the programme. The student evaluations of the programme have been mixed; a significant proportion of the class has expressed both dissatisfaction with, and low interest in, the experience.

You decide that it is important to understand why these results are occurring. You have questions such as: 'How do students understand "interprofessional education" and its goals? Do students from different professional schools hold different views? What is their experience, and what meaning do they make of it?' A colleague suggests that perhaps you need an approach that might help you to understand the evaluation results. They suggest 'constructivism' as an approach. You decide to learn something about it . . .

Constructivism forms the basis of one of the major ways in which we can view the world (see also MacMillan chapter). Creswell[1] describes a worldview as 'a general orientation about the world and the nature of research that a researcher holds' (p. 6). Like other paradigms, a worldview is the foundation of a group of beliefs about the nature of knowledge and how we come to know the world.

The term 'constructivism' has several meanings, all of which relate in some way to the idea of meaning-making, of making sense, both collectively and socially, of the world in which we live. This focus on meaning is integral to our work as health professions educators and researchers. First, it underpins our understanding of how people learn and forms the basis for what are called constructivist theories of learning. These theories, in turn, lead to particular approaches to teaching and learning. They also provide a framework for our questions about learning and teaching, as we try to improve our understanding and our educational practice. Second, the focus on meaning calls for approaches to research that help us to understand the ways that people make meaning of their experience.

In this chapter, our goal is to promote alignment of worldview, theoretical frameworks and research approaches in relation to constructivism and its philosophical underpinnings. We then turn to an overview of constructivist theories of learning. In the third part of the chapter, we focus on constructivist approaches to research: its traditions and methods. Throughout the chapter, we will provide examples from various disciplines including clinical medicine, health professions education and nursing.

By the end of this chapter, you should be able to understand or to explore further:

- the philosophy of constructivism;
- how it gives rise to certain theories of learning which we rely on in our daily practice;
- constructivist approaches to research and within them, five major research traditions;
- the role of the researcher in constructivist research;
- how research is conducted within this paradigm and the methods used in research;
- approaches to ensure quality and rigour; how they relate to such criteria in other paradigms;
- some important considerations and common pitfalls.

Distinguishing constructivism from positivism: a review of important terminology

Constructivism has arisen as an alternative to positivism as a way of understanding the world. In that sense, it differs from positivism in important and fundamental ways. These include ontology, epistemology and methodology.[2] We will explain each briefly, below.

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Ontology asks: 'What is the nature of reality? What is there to know? What can be known?' The positivist view holds that there is a real world and a single reality. While some uncertainty is acknowledged, the nature of that world can be understood through careful testing and measurement of a defined set of ideas. In contrast, constructivism holds that there are multiple realities or a 'relativist' view. In this view each of these realities arises from the 'construction' of meaning and understanding, based on the individual's context, previous experience and knowledge, attitudes and beliefs.

Epistemology asks: 'What is the nature of the relationship between the knower and the known?'[2] The positivist worldview takes an 'objectivist' approach, that, as researchers, we can separate ourselves from the process or event we are describing and therefore discover its true form or process. In contrast, in the relativist or subjectivist view of constructivists, the researcher and the researched are inseparable. The researcher brings to the exploration his or her beliefs, prejudices, experiences and values. These influence both what is studied and how the observations are seen.

Methodology asks: 'How can we know what can be known?' The constructivist approach differs from the positivist approach in the methodology regarded as appropriate to answer the questions raised. Constructivist approaches to understanding are mainly qualitative, including questions such as why and how events and processes occur and how individuals and groups make meaning of them. While quantitative approaches are not excluded, they complement the qualitative methods. Positivist researchers rely mainly on quantitative approaches to mitigate and minimise subjectivity, with the goal of uncovering true knowledge of the real world, to explain and predict causal connections.

Let's return to the case above to illustrate these different ways of viewing the world. To summarise, we are interested in understanding how prelicensure students from different health professions perceive interprofessional education to identify elements critical to its successful implementation. Using a positivist approach, we might search the literature to determine approaches to measuring the effectiveness of IPE. Having selected a validated scale, we might then choose to measure the effectiveness of our locally developed IPE programme by inviting participating learners to complete web-based surveys at pivotal moments throughout the programme, for example prior to IPE programme implementation, immediately following completion of the programme, and three and six months post implementation. We could measure any changes across these times, and try to understand what they mean through the scores obtained and the constructs which the scale purports to measure. We might compare these scores to scores obtained on other scales that evaluate the effectiveness of IPE programming. In contrast, using a constructivist approach, we might want to understand more about how learners understand IPE, their reactions to the newly developed IPE programming and its impact on enhancing their knowledge, skills and attitudes related to interprofessional care. This might involve interviewing learners from different health professions to gather their understandings of IPE and their personal experiences and perspectives on how IPE is taught. We would be interested perhaps in understanding what learners perceive to be the strengths and challenges to IPE and and inviting them to recall specific learning activities that had the most significant impact on their learning. Similarly, we could use interview methods to unpack some of the cultural barriers that may be impeding student buy-in and support for IPE initiatives. (Of course, positivists may look at this also, but from the worldview that there is only one truth.)

As can be seen from the comparisons above, these worldviews or paradigms influence choices and actions made as a teacher, as a researcher and as an individual or group. We now turn first to a brief introduction to constructivist theories of learning. (These will be addressed in more depth in other sections of this book.) Following that, we turn to constructivist approaches to research.

Constructivist theories of learning

The constructivist worldview has given rise to theories of learning which are increasingly relevant in health professions education.[3–7] In approaching these theories of learning it is helpful to see how they reflect the constructivist ontology (views of the nature of reality) and epistemology (the nature of the relationship between the knower and the known) (see also MacMillan chapter). In the constructivist view, learning occurs as learners actively construct the meaning of new knowledge in light of their previous experience, knowledge, attitudes and values. In this process, while there is general agreement about many things that are 'known', it is also recognised that individuals construct or represent their knowledge in different ways. Rather than being independent of context, meaning is closely related to context. Theories of learning based on constructivism generally fall into two main categories: personal or individual, and social. The personal constructivist aspect is generally included in cognitivist theories of learning, while social constructivism has generally been included among the social theories of learning. Each is explained briefly below.

Personal constructivism began in the first quarter of the twentieth century with Piaget.[8] According to Piaget's theory of cognitive development, cognitive schemata or mental structures are developed as persons make meaning of their environment. These schemata become increasingly complex as people learn, through actively thinking and problem-solving about activities. Individuals build their knowledge and construct and expand their schemata by testing them against their current knowledge, readjusting and expanding the schemata, and integrating the new knowledge into their existing structures. We see this in health professions education as students gradually build their clinical knowledge, adding to it with new knowledge and experience. A knowledge schema organised and encapsulated around a particular diagnosis is called an 'illness script'.[9]

Much of our knowledge of problem-solving, building knowledge, the effects of practice, development of expertise and other aspects of learning in medicine, is based in this framework of cognitive constructivism. The field of health professions education research was opened up significantly by the work of several researchers working in this area.[10–13] Indeed, the resulting understandings of the processes by which medical learners acquired and processed knowledge contributed beyond health professions education to the general field of cognitive psychology. This cognitivist-constructivist approach and the principles which underlie and derive from it have become established as a major theoretical foundation for problem-based learning.[13] These principles include: the importance of prior knowledge; activation of prior knowledge; elaboration of knowledge; learning in context; and transfer of knowledge. Principles of adult learning build on constructivist foundations of drawing on past experience and knowledge, motivation to learn and ability to be self-directed in learning.

Reflection, self-assessment and the development of clinical reasoning are also approaches to learning and development informed by constructivism. Each of these outlooks on learning presents issues of interest to researchers in health professions education, as they are regarded as essential capabilities of professionals. They have proven to be extremely complex issues, and many questions remain to be answered. For example, studies of reflection have defined it as a cognitive and affective process through which learning occurs as a result of reflection on experience. However, questions of how this reflection affects action, learning and decision-making are still being actively explored. Studies addressing these questions have been conducted using both qualitative and quantitative approaches, independently and in concert, in mixed methods studies. Readers wishing to read more will find a large literature to draw upon; two review papers may provide a useful start.[14,15]

The theories described above emphasise the individual learner and internal processes: the knowledge, skills and attitudes that are acquired in the process of active learning, experience and meaning making. In recent years, contemporary notions of constructivism have expanded to include a social aspect of learning, called 'social constructivism', in which the importance of social, cultural and environmental influences is emphasised. In this approach, learning occurs through dynamic interactions between the individual, the environment and the persons, objects and activities occurring there.

Social constructivism underlies and incorporates several important aspects of our current understandings of learning. Social cognitive theory[16] and other social theories of learning emphasise how learning occurs in interaction with others and with the environment. Sociocultural theories of learning, originating in the fields of sociology and anthropology, have also helped us to understand learning as a social process. These have been further developed by scholars such as Lave and Wenger[17] leading to the concept of communities of practice. Lave and Wenger[17] held that all learning occurs in a context and is tightly tied to the context. They used the term 'situated learning' to describe this connection to context. The idea of learning in a social context expands the notion of learning as an individual, internal process, to understand learning as a collective social process that occurs through participation in the authentic, real-life practices of the community. Individuals learn to do and in that process they come to understand ways of framing, thinking and talking about the profession they are entering. They learn from and contribute to the collective understandings and knowledge building of the community (see also Torre and Durning chapter). In this conception, constructivism includes knowledge and skills, attitudes, values and development of a professional identity.

Over the last two or three decades, the concept of 'learning in communities of practice' is commonly used to describe how knowledge, skills, cognition, etc. are learned through active participation in the work of a community.[18] Health professions education researchers have drawn on the expertise of social science research colleagues to understand better how learning occurs both at the level of the individual and at the level of the collective or community. The concept of learning and knowledge being socially constructed is also rooted in the constructivist worldview.

Studies of learning within the social constructivism paradigm include studies of teamwork, interprofessional learning, identity formation and learning in the clinical setting.[19] Other theories of learning which are underpinned by constructivism include Cultural Historical Activity Theory (CHAT), commonly called Activity Theory, Actor-Network Theory and the more recent sociomaterial theories (see several chapters in this book for further discussion).

In summary, constructivist outlooks on learning can be seen as encompassing those that focus on the individual learner, as well as those that focus a more collective construction of knowledge. They also include a range of theories from those that are quite applied, to those that are more abstract. Figure 3.1 may help to illustrate the range and number of such theories.

From this brief overview of theories of learning that are underpinned by constructivism, we now turn to consider how research is conducted within this worldview.

Constructivist approaches to research

When conducting research from a constructivist worldview, it is common to hear discussions of the following three terms: relativist, transactional and subjectivist. These ideas have a significant influence on the way constructivist research is actually conducted. What do they actually mean?

Relativist: Relativist ontologies influence constructivist approaches to research. Simply put, there is an underlying philosophical assumption characterising constructivist approaches, that 'there is no objective truth to be known'[20] (p. 278). Relativist assumptions emphasise the wide variety of interpretations that can be applied to a world, which clearly has an important influence on the way constructivists approach the processes of research.

Transactional: Transactionalism is at the core of constructivist epistemologies, and deals with issues of truth. From a constructivist approach, truth is a 'transaction' and is the product of these interactions and the individuals' thoughts, leading to what are termed 'constructed realities', or how individuals have constructed their understanding of reality. Transactionalism therefore influences the goals of any constructivist research project.

Subjectivist: Within constructivist epistemologies, the world is unpredictable. This includes the thoughts, feelings and psychologies of research

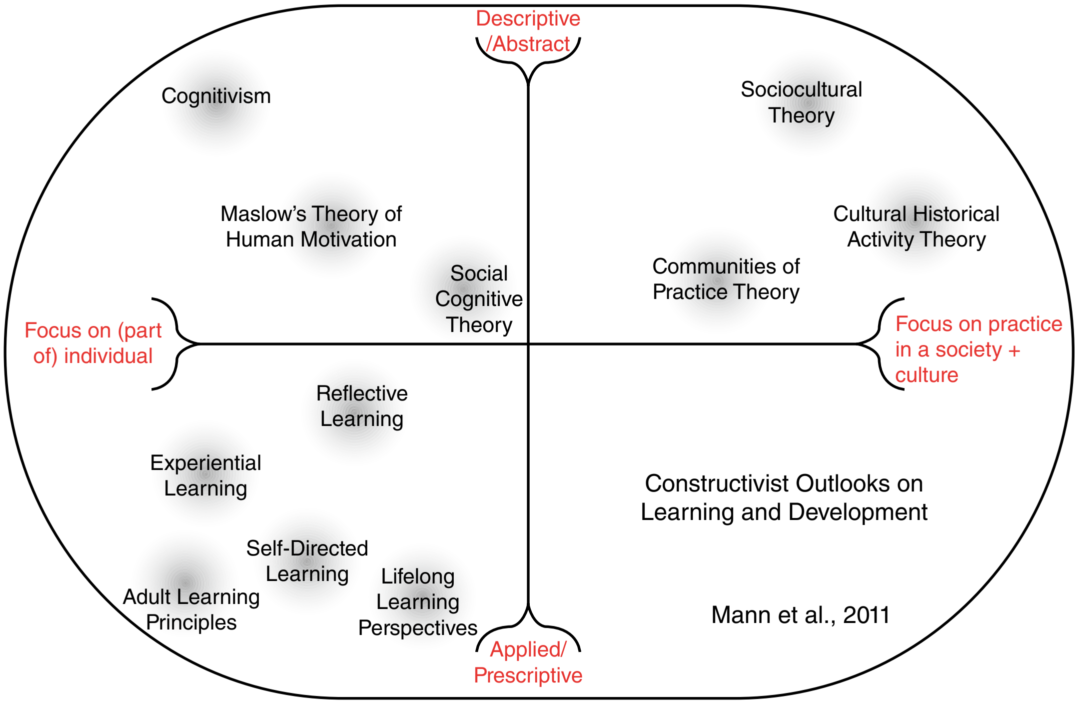

Figure 3.1 Constructivist outlooks on learning and development (reproduced with permission from[7]/ with permission of Elsevier).

participants. As a result, the researcher's work is to construct an impression of the world as they see it, rather than to reveal truth.[21] For these reasons, reflexivity (discussed below) is highly important within constructivist approaches.

Let's consider relativist, transactional and subjectivist in the context of a research interview. A constructivist would approach the research interview hoping to gain insight from a research participant rather than to learn the 'true story', because they recognise that there is no single truth. This is an example of relativism. Further, the constructivist researcher would accept that the information being shared through the interview process is the result of an exchange between the researcher and the participant, rather than the conveying of 'pure, unfiltered' fact. This is an example of transactionalism. Finally, a research interview constructed with a constructivist worldview would recognise that people – research participants and researchers – are unpredictable. The ways in which people respond to questions, for example, might be quite different depending upon many different factors. For example, is the participant particularly passionate about the issue at hand and taking the interview in an unexpected direction? Is the researcher feeling a time-crunch and trying to get through the interview as quickly as possible? Is the participant regularly consulted about the topic at hand and feeling 'tired' of talking about the same issues? Did the researcher have a particularly good rapport with a particular participant but not with another? These are examples of the subjectivism inherent in the research process that are acknowledged and taken into account in a constructivist worldview.

What do 'relativist, transactional and subjectivist' mean in terms of how to 'do' constructivist research? What does a constructivist research project look like in actual practice? As a rule, constructivist research would display the following five important characteristics:

1. It is (typically) qualitative.
2. The literature does not necessarily define the research question(s); rather, it informs the researcher.
3. It involves naturalistic methods (for example, interviewing, observation, document analysis).
4. It includes a dialogue between the researchers and the research participants in order to collaboratively construct meaning.
5. Meaning is emergent through the research process.

Constructivism is based upon the belief that reality is socially constructed and is therefore fluid. Constructivists believe that knowledge is in a constant process of evolution based on the negotiation of important factors like cultures, social issues and relationships. Therefore, multiple competing, even conflicting, yet valid claims about knowledge exist. We know this all too well within our own disciplines. For example, the Objective Structured Clinical Examination (OSCE) has been hailed as the gold standard in health professions education assessment and a body of research support this claim.[22] A parallel body of literature, however, simultaneously describes OSCEs as a problematic assessment method.[23] The same can been said for the transition to competency-based medical education (CBME). Proponents have applauded this training model for its focus on improving both educational and clinical outcomes.[24] Nevertheless, the operationalisation of this curriculum reform has sparked ongoing interest and debate, including some ambivalence about its implementation.[25–28]

For those who have mainly thought about research from a positivist stance, it may be unsettling and even uncomfortable to be untethered from the safety of traditional approaches in which there are established guidelines and processes in place to determine the rigour and quality of a particular research project. In response to this discomfort and desire for order, Angen[29] proposed a set of criteria to evaluate research conducted from an interpretivist approach (see McMillan), like constructivism. These include:

- a carefully-considered and well-articulated research question;
- a demonstration that the research was conducted respectfully;
- an articulation of the choices and interpretations the researcher makes and evidence that the researcher takes responsibility for those choices;
- a persuasive and well-argued account of the research;
- a transparent description of the methods and analysis;
- a plan and evaluation for the dissemination of results;
- an articulation of the validity of the research focusing on:
  - Ethical validity: The researcher should be clear that the choices made throughout the process have both political and ethical considerations.
  - Substantive validity: The researcher should evaluate the substance of content of an interpretive work.

If a researcher can demonstrate that they took these dimensions into account in the design, conduct and analysis of the research project, then it is our role, as audience, to make a determination about the quality of the research project based upon the information provided. We will discuss the criteria for ensuring quality of constructivist research in a later section of the chapter; however, for now, let's consider the above principles using an example.

LaDonna and colleagues[30] demonstrate the seven points above. Drawing on relevant education scholarship, the authors identified how the topic of health advocacy can often be quite a broad and unwieldy subject area, spending time in the introduction identifying current knowledge gaps and suggesting a compelling pathway for better understanding this notably difficult to define competency: 'we propose that engaging patients alongside physicians in conversations about health advocacy may not only inform more authentic teaching and assessment but also generate a better understanding about the role of advocacy in health care'. The research purpose follows, focusing the inquiry on 'generating a multi-perspective understanding about the meaning of competence for the Health Advocate role', making the parameters of the research clear.

The respectfulness of the research is indicated throughout this written account. The methods and analysis sections are written in both a sincere and straightforward manner, detailing their decisions with respect to participant recruitment, data collection, data management and interpretation. The authors are transparent about how they engaged in reflexivity throughout the study, clearly articulating their positionality in relation to the study focus and acknowledging the limitations of their study findings. Likewise, the focus of the article is on the participants themselves, who were encouraged to share their stories and experiences, through both visual and narrative texts, in a sensitive and thoughtful way. Given the difficult subject matter, approaching the research in a respectful manner is particularly important.

The authors provide a careful description of their analytical processes, including a detailed overview of their coding practice. The authors not only describe the 'wheres and whys' of the study, but also make clear the rationale for some of their choices, ranging from practical to theoretical. This provides a detailed picture of their research process and allows readers to draw conclusions about the rigour of the research process. The 'Findings' section of the paper provides a persuasive description of the research findings, presenting the account in a well-argued and concise manner.

While we are seeing the research in its final published stage, as a written account, however, we can make inference about the plan and evaluation of the dissemination. This article is published in *Medical Education*, a highly regarded international journal with a high impact factor designed to publish top quality papers concerning all facets of health professional education.

Five research examples of constructivist research traditions

As medical and health professions educators, we often find ourselves with questions we'd like to explore to learn more and understand more fully. In the section that follows, we use an example of a potential health professions education issue which we could explore using the constructivist research approaches. Specifically, we will consider how our issue of interest could be explored using the following methodologies: 1. Narrative; 2. Phenomenology; 3. Grounded theory; 4. Ethnography; and 5. Case study.[1]

We present two examples of constructivist research with each tradition: a hypothetical example and an actual example from the literature. All of the hypothetical examples are related to one area of interest: how medical students manage their feelings of insecurity and uncertainty throughout their undergraduate education. We provide descriptions of how this issue could be framed from each approach to elucidate the scope of methodological approaches that can be used to explore a single issue within constructivist framework. See Table 3.1 for a summary.

1 **Narrative**: this approach to inquiry retells someone's story over a period of time. It explores what the story means and what some of the potential lessons to be learned might be. A narrative research project would often involve interviews and participants sharing stories in text form. Using our example of wanting to understand uncertainty amongst undergraduate medical students, a narrative approach could involve a series of in-depth interviews with medical students focused on their experiences of not feeling certain of their medical knowledge in given situations.

   Bleakley[3] offers a compelling argument for using narrative research in clinical education. He highlights the fact that narrative approaches can illuminate 'hard realities'. As an example, Bleakley[3] highlights Rich and Grey's[31] narrative exploration of the effects of trauma surgery amongst young black survivors of penetrating violence. The researchers were interested in learning about how the meaning and circumstances of violent injury might lead to recurrent injury, which they describe as a disturbingly

Table 3.1 Dimensions for comparing five research traditions in qualitative research (based on Creswell)[1]

Dimension	Narrative	Phenomenology	Grounded Theory	Ethnography	Case Study
Focus	Explores an individual's life story	Describes experiences about a phenomenon	Develops theory (theories) based in data from the field	Describes in-depth cultural and/or social groups	Provides an in-depth analysis of a single bounded case or multiple cases
Data collection	Interviews and documents	Long interviews with approximately 10 people	Interviews with 20–30 individuals to 'saturation'	Observations and interviews over an extended time	Multiple sources – documents, records, interviews, observations, etc.
Data analysis	Stories Epiphanies Historical content	Statements Meanings Meaning themes General description of the experience	Open coding Axial coding Selective coding Conditional matrix	Description Analysis Interpretation	Description Themes Assertions
Narrative form	Detailed description of an individual's life	Description of the 'essence' of an experience	Theory or theoretical model	Description of cultural behaviour	In-depth description of a bounded case

common reoccurrence and note that there is much to learn beyond numbers. This clinician-led programme of research included the recruitment of participants while they were still in hospital, offering them the opportunity to tell their story using broad, conversational questions like 'Tell me what happened to you' and 'How has your getting hurt affected your family?'

2 **Phenomenology**: the goal of phenomenological research is to describe participants' experiences in a specific context in order to understand a phenomenon. For example, given our interest in uncertainty, we could explore the experience of feeling uncertain for medical students with backgrounds from non-scientific disciplines. To explore this, a phenomenologist can use an interview to gather the participants' descriptions of their experience, or the participants' written or oral self-report, or even their aesthetic expressions (i.e., written reflections, poetry.)

An example of a phenomenological study from the health professions education literature is Helmich and colleagues'[32] study of first-year medical students and their experiences navigating the clinical workplace as both a learner and future professional. The research team conducted individual in-depth interviews with medical students entering the clinical workplace for the first time since beginning medical training. The aim was to understand their experiences thus far and the impact these formative experiences were having on their professional identity formation. The researchers began each interview by asking: 'What is it like to be a medical student on the ward?' with some probes. This high-level open-type question allowed for participants to describe their experiences within the clinical environment candidly, in their own words. Interviews were transcribed and participants narratives were analysed using a hermeneutic phenomenology approach. The findings are presented thematically with longer individual narratives included to further situate the interpretations made by the research team.

3 **Grounded theory**: this type of qualitative approach iteratively investigates a process, action or interaction. The ultimate goal is to develop a theory. As an example, a grounded theory research project might explore feeling uncertain in the clinical clerkship. The researcher might conduct interviews with students and preliminary analysis of interviews may suggest a theme of 'uncertainty' and this theme could be refined by interviewing participants who are at various points in their clinical clerkship, who might offer different perspectives on what it means to be uncertain. Analysis of the subsequent phase of data collection will lead to further adaptations of the data collection process to refine and complicate the emerging theory of uncertainty.

Weurlander and colleagues'[33] work exploring medical students' experiences navigating emotionally challenging situations is an example of a rigorous grounded theory study in a health professions education context. These researchers intended to develop a theoretical explanation of a social phenomenon — in this case, how students handle and navigate emotionally difficult encounters within the clinical learning environment – that was grounded, or based, in naturalistic data. The data was obtained through focus group interviews with medical students at different stages in their medical training. The grounded theory approach allowed the researchers to build theory about the many factors, which are more than just clinical, that influence a medical trainee's professional development and future practice as a physician.

4 **Ethnography**: arising from early cultural anthropology, ethnography is the process of developing an in-depth description of a group done by becoming 'immersed' in their culture through observation and other means of data collection (see also chapter by Kitto and colleagues). An ethnographic study may look at the culture of a particular teaching site (i.e., a specific clinical ward). The researcher would use multiple data collection approaches, one of which would necessarily be observation, in order to build a rich and nuanced understanding of the formal and informal teaching practices that occur in that ward. The researcher would look for (i.e., observe) examples of practices during which a medical student might feel uncertain, and proceed to explore these in more detail through interviews.

An example of an ethnographic study from the health professions education literature is MacLeod and colleagues' study of medical education distributed by videoconferencing.[34] The research team spent many hours observing people teaching and learning using cameras, screens and microphones, analysing policies and curriculum documents, and interviewing students, technical staff and teachers with the goal of understanding the complexities of technologically enabled learning. Their ethnographic approach helped to illuminate the fact that the often-taken aspects of delivering a distributed medical education curriculum, things like relationships, hierarchy, power, leadership, education, experience and responsibility, weighed heavily in the complex process of educational decision making.

5 **Case study**: case study involves exploring episodic events within a definable framework bounded by time and setting. The selection of an appropriate case to explore is of central concern. Case study research often focuses on questions of 'how'. An example of a case study may be exploring how a student makes use of available resources to find information when they are feeling uncertain about a case presentation. The researcher must systematically collect and manage multiple sources of data about practices of information locating and resource appraisal, in formats that can be referenced and sorted so that multiple lines of inquiry and patterns can be explored.

Crowe and colleagues[35] discuss the benefits of case study research in the context of medical research, highlighting that the approach allows in-depth explorations of complex issues in real-life settings. They highlight Pearson *et al.*'s[36] work, which uses case study as a mechanism to understand how students from various health professions learn about patient safety. This group of researchers reviewed course documents/materials related to patient safety from education programmes within a number of different health professions. They then interviewed representatives of each of those professions. Following this, case studies were developed and explored with participants from various professions to explore the underlying organisational cultures to which students and new professionals are exposed.

While each tradition offers different methodological approaches and analytical processes, when approached within a constructivist worldview, each of these approaches share interpretive epistemological and ontological viewpoints. Specifically, the 'investigator and the object of investigation are . . . interactively linked so that the findings are literally created as the investigation proceeds'[37] (p. 207). The epistemological and ontological positions adopted in constructivist research thus differ from those in which the researcher's role is to discover the truth that lies within the object of investigation, in which reality is believed to exist autonomously outside of any consciousness[37] (such as post-positivism, see Cleland chapter). Constructivist approaches challenge the assumption that data are objective 'facts' that exist in the world as well as the position that a researcher has the job of 'discovering' these data and the related theories they might imply. Rather, as Charmaz[38] describes, a constructivist approach 'sheds notions of a neutral observer and value-free expert. Not only does that mean that researchers must examine rather than erase how their privileges and preconceptions may shape the analysis, but it also means that their values shape the very facts that they can identify' (p. 13). Further, constructivists might actually consider more traditional, objectivist approaches problematic, because these approaches 'may not challenge their fundamental assumptions about the world, ways of knowing it, or actions in it'[38] (p. 238).

Keeping in mind notions of relativism (no objective truth exists), transactionalism (truth is co-constructed) and subjectivism (the world is unpredictable) which we discussed above, research conducted from a constructivist worldview and framed as Narrative, Phenomenological, Grounded Theory, Ethnographic or Case Study, despite their individual approaches to data collection and analysis, would have several common themes.

1. Constructivist research produces 'multiple constructed realities that can be studied holistically; inquiry into these multiple realities will inevitably diverge (each inquiry raises more questions than it answers)'[37] (p. 37).
2. People should be the primary data collection instrument[31] since it is difficult to imagine non-human entities (i.e., tools) that could interact with participants in such a way that their multiple constructed realities could be explored.
3. The research should take place in a natural setting related to the issue to be explored as 'the knower and the known are inseparable'[37] (p. 37) and their 'realities are wholes that cannot be understood in isolation from their contexts'[37] (p. 39).
4. 'Every act of observation influences what is seen'[37] (p. 39), which reinforces the position that the researcher must be the primary data-gathering instrument in order to understand, respond and describe the interactions taking place within the research setting.
5. Each research participant has her or his own point of view and set of experiences; therefore, the research is focused on identifying the nuanced meaning of these multiple points of view in order to produce a collaborative account from the multiple realities that exist. This means that the research participants are, in effect, co-producers in the research process.

Methods commonly used within constructivist research approaches

As a form of naturalistic inquiry, constructivist research should be conducted in a natural setting, since context is essential to the process of constructing meaning. We highlight herein three such methods that allow naturalistic inquiry: interviews, observation and document analysis.

Interviews

There are no facts, only interpretations.

(Friedrich Nietzsche)

Traditionally, the interview has been considered a vehicle by which the knowledge of the interviewee was passed on to the interviewer.[39] The two distinct parties barely interacted except by means of a structured interrogation. Within a constructivist theoretical frame, however, the interview is considered a conversation with multiple purposes, the format of which is constructed as the interview progresses.

Constructivist notions of subjectivity have focused on important considerations regarding the concepts of the self and individualism, which influence the way researchers think about the process of interviewing. Research participants are not considered uncontaminated and passive holders of knowledge about facts, feelings, experiences and demographic characteristics. Likewise, research interviewers have a role larger than simply posing questions and facilitating appropriate responses. Within a constructivist approach, interviews are conducted from a perspective that acknowledges the subjectivities of both the participants and the researcher, considering the participant an active contributor and a co-constructor of knowledge – more than a 'fountain of facts'.

From this perspective, a participant cannot 'contaminate' the data that she or he is helping to construct. Rather, the subject is always building knowledge before, during and after occupying the role of the research participant.[40]

The subjectivity of the research participant and their related experience are in a process of continuous assembly and modification, therefore, the 'truth' of interview responses cannot be determined in terms of whether the responses provided by the participant correspond with a supposedly objective 'vessel of answers'. Within a constructivist approach, the value of data from interviews is hence not only in their meaning but also, critically, in identifying the range of meanings and ideas put forth by participants.[34]

While collecting data through the traditional face-to-face interview continues to be the method most often employed when conducting constructivist research, it is important to highlight the rise in methodological innovation taking place across medicine and health professions education. There continues to be increased demand for and utilisation of research methods that move beyond more traditional data collection approaches. For instance, visual methods such as photo-elicitation, rich pictures and point of view interviewing are generating popularity across health professions education research.[41–44] Such methods have proven useful in prompting participants to think about and characterise their experiences in unique and novel ways and as Liedenberg[45] explains, 'the act of interpreting an image creates a slower and more critically reflective space within the researcher process' (p. 4). Furthermore, there has been heightened exploration by qualitative researchers into the affordances of adapting in-person methods to align with the realities of living in a digital word and, more recently, within the context of the COVID-19 pandemic and urgent calls to conduct 'sustainable science'.[46–48]

***Observation*:**

> *There is no more difficult art to acquire than the art of observation.*
>
> (Sir William Osler)

A constructivist researcher may choose to engage in research observations in order to learn more about a specific scenario in a natural setting. The researcher would observe and collect a set of field notes. While this sounds relatively straightforward, it is in fact an iterative process during which the focus of, methods for, and ideas about our observations might change.

Conceptualising field notes as inert texts designed to accurately describe what was observed falls within the realm of positivism and assumes that there is a single 'accurate' observation. From a constructivist perspective, there is no one correct or true account to be described. Field notes are not truths, but descriptions of social life and social discourse which reduce the complexities of social phenomena into written accounts that are then analysed.

Related to the concept of subjectivity, it is important for researchers to document their own activities, context and emotional responses as they are conducting observations, as these factors influence the process of observing and the manner in which they choose to record the lives of others. It is common practice, therefore, for constructivist researchers to maintain a research journal documenting reflections on the observations of the day.

In a constructivist approach, however, drawing a distinction between field note data and personal reaction is misleading as accounts are necessarily transactional (developed as a result of interaction of meanings and events), and relativist (reflecting multiple realities). While the researcher can certainly separate what they say and do from what they observe, this separation would misrepresent constructivist inquiry in several ways.

First, this separation treats data as 'objective information' that has a fixed meaning independent of *how* that information was elicited or established and by whom. In this way the [researcher's] own actions, including [her or] his 'personal feelings and reactions' are viewed as independent of and unrelated to the events and happenings involving others that constitute 'findings' or 'observations' when written down in field notes. Second, this separation assumes that 'subjective' reactions and perceptions can and should be controlled by being segregated from 'objective,' impersonal records. And finally, such control is thought to be essential because personal and emotional experiences are devalued, comprising 'contaminants' of objective data rather than avenues of insight into significant processes in the setting[49] (pp. 11–12).

Constructivists hold that including personal reflections enhances interpretive and analytic processes, by encouraging a new, but situated, appreciation and understanding of the events being observed. For that reason, rather than attempting to account for, and limit, strong reactions to particular events, a constructivist researcher would consider these reactions as key points of analysis.

Document Analysis

> *[H]ere I sit and govern [Scotland] with my pen: I write and it is done.*
>
> (King James VI (Scotland) and James I (England))

As the above quote illustrates, people 'do' things with, through, because of, and in spite of documents. If a researcher is seeking to construct an account of a particular phenomenon, it is their role, then to understand how relevant documents influence the scenario being studied. Atkinson and Coffey[50] have argued that 'documentary materials should be regarded as data in their own right. They often enshrine a distinctively documentary version of social reality' (p. 59).

Collecting and reviewing important documents that constitute a component of the natural environment is a particularly useful exercise. Within any social organisation, documents do not stand alone. Documents are, in a sense 'living things' that can be 'produced and manipulated, used or consumed, and as things that can act back on their creators – very much as Dr. Frankenstein's monster sought to act back on his creator'[51] (p. 77). As Foucault[52] argued, the organisation of artefacts, like documents, offers insight into basic elements of culture.

Constructivists take documentary sources into account as they are sources of information about the issues being studied. Whether curriculum documents, accreditation standards, programme websites, or lists of competencies, documents are important components that offer unique insights.

The role of the researcher within the constructivist paradigm

Those who espouse a constructivist approach to research appreciate the requirement that the researcher operates from a position of reflexivity. What do we mean by reflexivity?

From a constructivist position, knowledge is socially and culturally constructed and it is therefore necessary for a researcher to acknowledge, and take into account, the many assumptions and views that influence the research process and its related products. Relatedly, reflexivity is not a mechanism to help researchers eliminate their subjectivity(ies), but rather it is intended to support researchers in using, and making sense of their own 'personal interpretive framework consciously as the basis for developing new understandings'[53] (p. 94).The practices of reflexive inquiry address the ways in which meaning is made through research practice and, as Ruby acknowledged, 'being reflexive in doing research is part of being honest and ethically mature in research practice' (p. 154).[54] Positions of neutrality and objectivity, within a constructivist worldview, are considered problematic, and have even been described as 'obscene' and 'dishonest'.[54]

What does reflexivity look like in practice? Take, as an example, a research interview. Alex and Hammarstrom[55] remind us that within the context of an interview, issues of power are a central consideration. An interview does not occur in isolation; both the interviewer and the interviewee act, speak, respond and interact in particular ways in accordance with their perception of the other and her or his associated power. This might result, for example, in an interviewer choosing to focus on particular aspects of the interview while overlooking, or minimising, other aspects. In addition, issues of age, gender, social class, ethnicity, etc. may also influence the dynamic of the interview. Thus, within a constructivist framework, it is important to be conscious of power hierarchies and take into account how those dynamics influence interactions within the context of the interview. 'Despite the best intentions, the interview situation may be experienced as, and may in fact be, a form of abuse. Practicing reflexivity can be one way to minimise such experiences in interview situations'[55] (p. 170). For these and other reasons, reflexivity should be practised throughout all stages of the research process.

The actual practice of reflexivity requires a conscious effort. A constructivist researcher practising reflexively would think critically about the following four elements according to Alvesson and Skoldberg[56] captured in Table 3.2.

Table 3.2 Four elements of constructivist reflexive research practice (from[42]/SAGE Publications)

Element	Researcher Activity
Interaction with empirical material	Take the empirical into account. This includes concrete matters such as transcripts of interviews, written field notes and other relevant materials.
Interpretation	Pays particular attention to, and thinks critically about, the ways in which they make sense of, and interpret, data and construct meaning.
Critical interpretation	Be tuned into social issues, including important issues such as ideology, power and social issues.
Reflection on text production and language use	Think critically about questions of 'ownership'. Who owns the knowledge that is being constructed? Who has the authority? Who determines which voices are heard?

A reflexive researcher would attempt to be explicit in addressing the concerns above in an effort to identify viewpoints that might influence her or his interpretations and analysis. Being unequivocal in such a manner involves actually stating what has been a focus, what has been minimised, and what may have been left out altogether.

Approaches to ensure quality and rigour of research

Approaches to ensuring quality of research exist in the constructivist paradigm and have been described by several authors.[57,58] As researchers in the field of health professions education, we may be most familiar with the criteria utilised for judging the quality of more quantitative methodologies, arising from the positivist paradigm (see Cleland's chapter). Lincoln and Guba[2] and Guba and Lincoln[37] proposed different terms and criteria to assess the quality of constructivist research: *trustworthiness* and *authenticity*. These are explained below.

Trustworthiness criteria

Four elements of trustworthiness have been described:

Credibility: this criterion asks the questions: does the account of reality provided by the researcher have credibility? Has the research been conducted using accepted practices and is it accepted by others? Is the interpretation of the researcher endorsed by participants in the research? Credibility is considered as broadly analogous to the criterion of internal validity in the positivist paradigm.

Researchers in the constructivist paradigm use two main approaches to ensure the credibility of their findings. The first is member checking, also called respondent validation, in which the researcher returns the findings to the participants, who judge whether it reflects their understanding of and is congruent with the process as they experienced it. The second approach is through triangulation. Triangulation means taking different perspectives on a particular object, event or phenomenon. This helps to ensure that multiple views are presented, and that a major oversight has not occurred. It may also involve more than one method; for example, interviews might be combined with observation.

Transferability: the transferability criterion asks the question: can the findings of this study be useful in other contexts that are similar, but that differ in some ways? The comparable criterion in positivist research is external validity or generalisability. While constructivist researchers are often reluctant to suggest that their findings may apply across contexts beyond what they have studied, certain forms of constructivist research – for example, constructivist grounded theory – have the goal of developing a theoretical explanation of the processes and relations that may explain their findings in a coherent way. Results of studies such as these may often have utility across contexts, where similar situations exist. Transferability relates to the researcher's ability to provide rich detail, so that a reader can assess the extent to which the conclusions drawn in the study setting can transfer to another setting.

Dependability: dependability in constructivist research is analogous to the reliability criterion in positivist research. While conventional notions of reliability assume that a degree of stability is present in research settings, qualitative researchers assume that real world settings are dynamic and changeable and that replication is not achievable.[58] Judgements of the dependability of research findings consider the extent to which the research process was carried out in a manner which may be reviewed or audited by another. For example, an 'audit trail' is established which clearly describes how recruitment occurred, what questions were asked of the participants, how the analysis was conducted. The interpretations drawn from the analysis, and their relationship to the data, are also part of establishing dependability. The researcher attempts to distinguish between the instability that is part of the research context, and that which is introduced by the process itself.

Confirmability: Confirmability is the extent to which the researcher makes clear their personal relationship to the research and the findings, and the contribution that any personal views may have made to the research. Research conducted in the constructivist paradigm can never be construed as objective. However, researchers should provide enough detail of how they collected and analysed their data that readers can see how their conclusions might reasonably have been reached.[58]

Authenticity criteria

Authenticity criteria assess the fairness of research within the constructivist domain.[2,37,59] They focus on whether the research increases our awareness (ontological authenticity), educates us (educative authenticity), inspires change (catalytic authenticity) and empowers stakeholders (tactical authenticity).

Table 3.3 briefly summarises these criteria.

King and Horrocks[58] describe what they have labelled 'procedures for assessing quality'. They argue that whatever criteria are utilised to assess quality in constructivist research, they must be consistent with the researcher's philosophical and methodological position. They describe four main approaches: independent coders and expert panels, respondent feedback, triangulation and the provision of thick description and audit trails. Although these have been mentioned above, a more detailed description may be helpful.

Independent coding and expert panels: some form of independent coding is frequently used as a quality check. The aim of doing so is not to prove reliability (as might be the case in quantitative approaches), but rather to assist researchers to reflect critically on the thematic structure they have developed and the coding decisions they have taken. It helps the researchers to be alerted to alternative understandings of the data. Having data coded by multiple people can also help to encourage reflectivity on the interpretations being made. A commonly used

Table 3.3 A summary of quality and authenticity criteria in constructivist research

Criteria	Questions Asked
Credibility	Does the researchers' account of reality have credibility? Has the research been appropriately conducted?
Transferability	Can the findings of this study be useful in other contexts?
Dependability	Was the research conducted in a way that others could replicate?
Confirmability	Has the researcher clearly presented his or relationship to the research?
Authenticity	Has the research been conducted fairly? Does it increase our awareness, educate us, inspire change or empower stakeholders?

approach is what King and Horrocks[58] describe as 'code-defining'. In this approach members of a research team carry out analysis independently, and then meet to compare and discuss the coding that each has produced. An agreed-upon coding structure may then guide further analysis. In some cases, an expert panel of persons with detailed knowledge of aspects of the research is assembled to scrutinise the results. However, selection of individuals with the appropriate expertise is a challenge to doing this effectively.

Respondent feedback: the process of 'respondent feedback', sometimes referred to as member-validation or member-checking, includes taking the analysis back to the participants, to ask how well the interpretation fits with their experience. This is sometimes seen as an ethical obligation, to ensure that participants' voices are well heard. Some concerns have been expressed about this process, as it is possible that either participants may deny an interpretation that engenders discomfort or, alternatively, agree with an interpretation because they do not wish to disagree with the researcher. Use of this process requires that participants are provided an explanation of the analysis which is clear and accessible and which they can assess.

Triangulation: triangulation refers to using multiple methods of data collection, or multiple sources of data, for example, data from both teachers and learners to study a particular phenomenon. Denzin[60] proposed the following approaches: data and methodological triangulation; more than one type of qualitative data, or a mixture of qualitative and quantitative methods; investigator triangulation, in which data are collected by different researchers whose different perspectives are purposively selected; and theoretical triangulation, where different theoretical models are used to make sense of the data. As King and Horrocks[44] note, both qualitatively and quantitatively oriented researchers question whether different methods and worldviews can ever be successfully integrated (see chapters by Cleland, and McMillan).

Thick description and audit trails: thick description refers to researchers providing detailed descriptions of what they study and the context in which they study it. This helps readers to judge whether the interpretation presented is consistent with what has been described. Thick description helps readers to understand how researchers reached their conclusions from the data available, and how the analysis was developed. Lastly, it provides the reader a basis to determine the transferability of the findings to another context. Audit trails involve maintaining careful records of all aspects of the research, especially any changes that occur as the project is conducted; this documentation contributes to judgement of the rigour of the research.

Important points and common pitfalls

No research approach is without its slippery spots and challenges: we present five common pitfalls and important points to keep in mind, when working in the constructivist or indeed any research approach.

Language 'slippage' between paradigms: for those of us working in the health professions, the language of the positivist paradigm – validity, generalisability, subjects, etc. – is familiar. Yet, constructivism and positivism are very different approaches; relatedly, the language of each paradigm is also unique and representative of its associated theoretical underpinnings. For example, constructivists use terms like research 'participants' rather than 'subjects'. This terminology reflects the fact the people who take part in constructivist research are actually participating in co-constructing meaning. Another example is the word 'hypothesis'. Constructivist research is inductive and aims to understand phenomena within particular contexts. The research findings are bound to particular contexts and are not generalisable. Constructivist research therefore does not aim to 'test' and/or 'prove' a researcher's hypothesis.

The question determines the methods: within a positivist theoretical frame, particular methodologies are recognised as 'gold-standards' (i.e., randomised controlled trials) and are therefore desirable (see Cleland). Within a constructivist paradigm, there are no gold-standard methodological approaches. The focus, rather, is on developing a well-conceptualised research question/objective and selecting a methodology that will best support the rigorous exploration of that question/objective.

Role of the literature: researchers operating in the positivist paradigm use the literature with a very specific purpose in mind: to develop a hypothesis based on previous published research. Positivist researchers want to be able to develop a knowledge base in order to develop a testable hypothesis and benefit from methodological insights published by colleagues in similar fields. In contrast, the literature serves a different purpose for those operating within a constructivist paradigm. Constructivist researchers require a familiarity with previous relevant research in order to develop their questions and fine-tune research plans so as not to duplicate already existing research. However, constructivists must remain open to emerging ideas and must be careful to not be overly persuaded by existing literature rather than what they are seeing in their own data.

Time commitment: constructivist research is complex and we encourage those considering constructivist approaches to allocate a significant amount of time to complete their research project. It is iterative in nature, which means that the process can become time-consuming. Rigorous constructivist research also requires the authentic involvement of participants, which can be logistically complex. Further, multiple methodological approaches mean that there are often large amounts of data generated, which, in turn, leads to complex analytical processes. Constructivist approaches, therefore, lead to rich insights and understandings, but they can be very time intensive.

Reflexivity: given that constructivist research focuses on the social construction of the world, it is of central importance for a researcher to take into account, and acknowledge, the ways in which her or his understandings of the world, including the research process, the data and the resulting analysis, have been shaped (see chapter by McMillan). Reflexivity is a central tenant of constructivism. It is not intended to be a form of 'confessional writing'; rather, it is meant to be a rigorous form of self-assessment designed to illuminate the theory and practice gap. Therefore, reflexivity is considered not an optional strategy, but a moral obligation of the researcher.

Conclusion

Constructivist approaches to research offer a rich and varied way to build knowledge and understanding of peoples' experience in the world. In using these approaches, researchers are guided by different traditions within constructivist research, and by important considerations of methodology.

In this chapter, we have presented constructivism as a philosophy, and situated constructivist theories of learning and constructivist approaches to research within that worldview. As we noted earlier, we believe that alignment between theoretical frameworks and concepts, and research approaches, is critically important. If we understand the foundations of the constructivist paradigm, and how it gives rise to theories of learning and approaches to research, our questions can more effectively lead to new understandings that can have beneficial effects for teaching, learning and research.

Practice points

- Constructivist research is naturalistic. This means that it takes place in natural settings and uses naturalistic methods (for example, interviewing, observation, document analysis).
- Constructivist research includes a dialogue between the researcher and the research participants in order to collaboratively construct meaning.
- High-quality constructivist research includes:
  - a carefully considered research question;
  - a demonstration that the research was conducted respectfully;
  - a reflexive researcher;
  - a persuasive and well-argued account of the research;
  - a plan and evaluation for the dissemination of results.

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4 Widening access to medicine: using mid-range theory to extend knowledge and understanding

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> *At the interview for medical school that I went to, most of the other students were middle class . . . Well, I don't know if they were middle class. They came across to me as middle class. But sometimes it feels like they have links that I don't. They've been to all these different things; they've met all these different people. Sometimes it feels like medicine is like this game, where if you have links to enough people, you have an advantage. Because you can get work experience with this person or you can get an advantage in that way . . . it does make a difference who you know* (Focus group participant, inner city London school, p. 12 interview 3).[1]

In this chapter, our goal is to illustrate how a previously under-theorised field of health professions research has evolved over time by engaging with theory and more rigorous research designs and methods. Our topic areas are that of widening participation and widening access to medicine; in other words, increasing the diversity of medical students. The aims of the chapter are to provide insight into this area of research but, more generally, to use it as a vehicle to reflect on how research within a particular field shifts over time, and what can be learned from the past. Throughout the chapter, we provide examples to illustrate key points.

Increasing diversity in medical schools

Across the world, just like the quotation above illustrates, many young people with the academic and personal attributes to successfully study medicine and become doctors experience disadvantages associated with sociodemographic factors such as ethnicity, minority group membership or low income.[1] These disadvantages lead to under-participation in medicine and higher education more generally. The reasons for this are often multifaceted, interconnected within a myriad of wider, complex structural and societal issues including ethnic minority inequalities,[2] parental education,[3] personal aspirations, schooling and educational attainment,[4,5] family and peer influences and expectations[6] and lack of insight or insider knowledge.[2,3]

Widening Participation (WP) seeks to ensure those students entering tertiary education, and in this case medical school, represent the general population from which they come.[7] WP highlights equality of opportunity and relates to improving social mobility, which can be defined as breaking the transmission of disadvantage from one generation to the next. When a society is mobile, individuals have more opportunities for progressing in terms of income or occupation.

Governments have attempted to widen participation to education and medicine via macrolevel (national) policies, the aim of which are to reduce discrepancies between the rates of participation of different demographic groups of students in higher education generally[8] and medical education specifically.[9,10] These WP policies are then enacted by universities and medical schools via the development and implementation of Widening Access (WA) processes and tools.[11–13] WA focuses on the equity or fairness of the selection processes that act as a gateway to higher education. This may refer to specific selection policies that increase the matriculation of certain unrepresented groups.

The precise nature of these WA processes and tools varies across different countries, but may include quota systems,[14] outreach programmes,[15,16] access courses,[17,18] particular use of selection tools[19] and the use of contextual data.[11] Moreover, the focal groups for initiatives also vary, and can include: racial groups,[20,21] indigenous populations such as Aboriginal and Torres Strait Islanders in Australia,[22] rural communities[23] and lower socioeconomic groups.[24,25] Yet, despite this activity and government investment and directives, medicine remains dominated by certain societal groups, and students from other backgrounds remain under-represented in

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medicine worldwide,[12,13,26,27] suggesting these policies are not wholly effective.

Note that WP and WA are the terms which are commonplace in the context of the UK. The term non-traditional, when used in the context of medical students, refers to those students whose gender, race, ethnicity, culture, socioeconomic status or disability sets them apart from the main cohort of medical students, highlighting their under-representation, and increasing diversity sets to remedy this. In other countries, it is more common to use language such as under-represented minorities rather than non-traditional students, and to talk more about inclusion, rather than widening access. You will see all these terms used in this chapter.

Why is it so important to overcome these obstacles and recruit more individuals from non-traditional backgrounds into medicine? One reason is social justice and to ensure through social mobility that any individual with the requisite ability and commitment has the opportunity to access the career of his or her choice, regardless of background, gender or ethnicity.[28] In medicine, WA is also increasingly linked to the promotion of social accountability through its potential to create a more diverse workforce with an improved understanding of deprived communities and an increased desire to work in under-served specialties and locations.[29,30,31,32]

This latter argument is based in the premise that increased diversity within the health professions will improve healthcare outcomes, in that 'like will treat like' with evidence indicating that students who train in more diverse medical schools appear to gain a greater understanding of other people from different sociocultural backgrounds, and this increases their ability to provide healthcare to people with backgrounds different from their own.[15,33,34] Although increasing minority representation in medicine has been identified as an opportunity to both improve clinical care and reduce healthcare disparities, these outcomes are dependent on such students, once qualified, choosing to practise in areas of diversity and deprivation.[35–37]

This short introduction to widening access research, policy and practice illustrates the complexity of the issues, and suggests that assumptions cannot be made that what works in one context, with one focal group, will be transferable to other contexts and groups. We argue that WA research needs to be theoretically framed to ensure studies in the field have greater impact on admissions policies and practice.

We have started by orienting readers to the subject area of WA to medicine. We continue by explicitly linking to one of the overall aims of this book: to introduce many different theories which are applicable to a broad range of health professions education research (HPER) questions. This aim is partially in response to longstanding concerns about HPER lacking an explicit theoretical basis.[38–41] This is changing, as is apparent from the many studies cited throughout this and other chapters. However, the extent to which researchers engage with theory varies across different research areas within health professions education: some areas are more theory-driven or theory-informed than others (referred to as the 'patchy map' by Bolander-Laksov and colleagues, p. 7).[42]

We examine how theory has been used over time in our particular area of interest, that of WA/WP to medicine and increasing the diversity of medical students. First, this requires an explanation of what we mean by theory. Then we will examine how theory has been used in WA/WP research in the distant and more recent past, before considering fruitful future directions.

There is nothing as practical as a good theory[43]

Reeves and colleagues[44] define theory as: 'an organized, coherent, and systematic articulation of a set of issues that are communicated as a meaningful whole'. By developing concepts and explicating their interrelationships, theory can explain how and why a phenomenon occurs.[45] In general, and as explained in the opening chapter of this book, theories in quantitative research are drawn from the natural sciences and are used to generate predictions about the relation between two or more different variables. In contrast, in qualitative research, a theory is a conceptual tool useful in making sense of a complex social reality. It is with the latter that we now focus.

In social sciences and qualitative research, theories differ by the level of abstraction at which they explain social phenomena. There are micro-theories that pertain to specific interventions or operate at a programme or personal level; theories whose application is restricted to a certain subset of social phenomena relevant to a particular range of contexts (middle or mid-range theories); and theories which develop overall explanations, or meta-narratives, for a discipline or body of knowledge, commonly referred to as grand theories.[46]

Social constructivism, positivism and criticalism, introduced earlier in this book (see chapters by McMillan, and MacLeod, Burm and Mann), are examples of grand theories. Grand theories act as organising frameworks for knowledge development or as foundations for mid-range theory development. They do not usually provide specific rules that can be applied to particular situations and are difficult to operationalise because they are so abstract.[46] However, they provide guidance and a language for empirical enquiry and reveal assumptions and worldviews (see McMillan's chapter) that would otherwise remain under-articulated.

In contrast to grand theory, the purpose of a mid-range theory is not to attempt to explain everything about a general subject (e.g., how the world works). Instead, mid-range theories are abstract enough to allow for generalisations but close enough to observed data to be incorporated into propositions that can be empirically validated. This enhances the transferability of outcomes. For example, constructivism (a grand theory) reflects a set of beliefs about the world and how it can be understood, but to operationalise this, researchers use certain (mid-range) theories and various methodological approaches to study of human phenomena based on constructivist beliefs. Mid-range theories thus act as a bridge between grand theory and empirical findings, as illustrated in Figure 4.1.[47] (see also Figure 3.1 in MacLeod, Burm and Mann's chapter).

Merton[48] argues that middle-range theories have always been the principal material of science since the time of Plato. Indeed, quoting Plato, Bacon[49] writes, 'and Plato in his Theaetetus, notest well: "That particulars are infinite, and the higher generalities give no sufficient direction"; and that the pith of all sciences, which maketh the artsman differ from the inexpert, is in the middle propositions, which in every particular knowledge are taken from tradition and experience.' Indeed, most of the theories introduced in this book are mid-range theories.

So, when people in the field call for health professions education research (HPER) to be better theorised, 'they are asking researchers to position their work within some explicit theoretical framework, be able to justify how and why they did so, and use insights derived from the framework to help interpret empirical observations'[42] (p. 2). Using a coherent combination of grand and mid-range theory is a way of ensuring findings are generalisable or transferable beyond the conditions in which individual studies were conducted. There is also another level of theory. Minor theories can refer to theories generated about a specific interaction or aspect of an initiative or programme, which together may contribute to developing mid-range theories.

To this end, a variety of theories can be used to help design a research question, guide the selection of relevant data, interpret data and offer explanations of the underlying causes or influences of the observed phenomena as explained by Bordage quoting Popper (1959, p. 59)[50,51]: 'theories are nets cast to catch what we call "the world": to rationalize, to explain, and to master it'.

We would like to make one last point here. The terms grand-, mid- and minor theory refer to the theory(ies) used. However, there is also terminology which refers to the object under study rather than the tool used to study it.[52] Micro-level refers to actions, ideas and experiences on the level of the individual, within a small group, or a specific initiative or location. Meso-level refers to practice, guidance or shared understandings which take place within larger groups like communities, institutions or geographic regions. Macro-level tends to refer to larger structures like national policies, and the broader culture and context. It is prudent to think of these levels, or scales of analysis, as relational networks rather than stratified categories[53] and mid-range theories can be useful in drawing vertical linkages between them.[52]

Theoretical trends in widening access research

To illustrate these insights, we draw here on our knowledge and experience of research on this topic to present a scientific story using a simple framework. Hung *et al*. (2019)[54] used the analogy of waves to

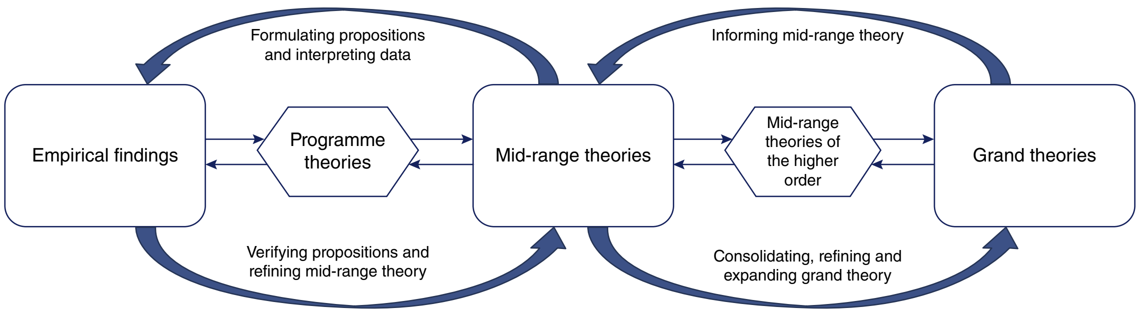

Figure 4.1 Bridging role of mid-range theory in the circle of enquiry (Kislov *et al*.)[47]

describe the maturation of research in a field (their focus was problem-based learning). Such a process, or graduation of thinking, also provides a suitable framework for presenting the trends over time in WA/WP research, thus showing how this field has matured in respect of use of theory, and where gaps remain. Note that, just like waves in the sea, the waves of WA/WP research are not identical in length or distance. Sometimes it is difficult to see when one finishes, and another starts. However, the following three waves represent, in essence, different research agendas and maturing use of theory, laying the foundation for future work in the field.

The first wave: descriptive and local

The first wave of WA research was in the early to mid-2000s. Studies were mostly positioned in Cook *et al*.'s[55] category of description studies: highlighting WA initiatives as innovations and detailing who applies or 'gets in' to medicine but lacking clear outcomes or scientific rigour.

A qualitative synthesis of published studies reporting UK medical school WA/WP initiatives published before 2008 illustrates the nature of much research at this time.[56] The eight studies identified focused on reaching out and helping potential applicants from under-represented groups using various approaches. These included in-reach activities where pre-applicants are invited to activities based at the medical school/university campus and outreach activities are where medical school staff/students go out to the educational institutions of the pre-applicants. These studies also looked only at the proximal challenge to be addressed (e.g., increasing the number of WA applicants to the specific medical school).

The studies were not cumulative, but rather (repetitive) local and atheoretical evaluations of local initiatives. The foremost question was: does it (our initiative to widen access) work? And indicators of 'working' were mostly limited to participant satisfaction with their in-reach or outreach experience, and whether it had encouraged them to apply for medicine. Wider questions, such as exploring institutional/relational aspects of the high school or medical school environment or culture that may affect participant experiences and learning were rarely on the research agenda.[57–60]

The few qualitative studies which did look at broader questions, such as trying to understand the barriers to medicine from the perspective of potential applicants from under-represented groups[61,62] tended to have more robust methodologies than the norm. However, the use of theory remained weak and hence the empirical evidence from these studies was not positioned in such a way to enable transferability, or theoretical generalisability; that is, to move beyond description and interpretation, to reach explanation. Nevertheless, the better examples of such studies were critical in paving the way for later research.[63]

At the same time, quantitative studies looking at the association between sociodemographic factors, such as ethnicity, gender and socioeconomic status, and outcomes were beginning to emerge. Many of these studies were local (single site), reporting observational research such as who was accepted onto particular types of programme[64] or examining the association between sociodemographic background and local indicators of performance (usually performance on medical school examinations).[65] There was a sense, in the UK literature at least, of research merely identifying bland facts – such as students from certain backgrounds perform less well at medical school – without considering the complexity of the issue, leading to (we would argue) ambivalence towards the principle of widening access to medicine. Studies concluded with veiled warnings such as made by Lumb and Vail (p. 1002) 'our results carry no suggestion that, other things being equal, widening access to medical school for mature students and those from less affluent backgrounds would result in poorer performance'.[66]

We would also argue that studies at this time had little impact on practice or policy. Despite significant investment and engagement in widening access to medicine in many countries, the number of applications to medicine from those in under-represented groups did not rise substantially, and nor did the proportion of medical students from under-represented groups. For example, in 2010/11, only 7% of successful medical school applicants in the UK were from the lowest socio-economic groups compared to about 45% of the working population. This demonstrated no improvement from 2002/3.[28,67] Arguably, as Eva and Lingard (p. 753) reason, the early studies raised awareness but they were not sufficiently strong 'to warrant change of opinion or practice or theory'.[68]

The second wave: outcomes and a little process

Research in the field progressed. The next few years (roughly late 2000s to 2018) saw the establishment of longitudinal, multi-site, robust quantitative studies with clear outcomes, using more sophisticated analyses[69] (see Patterson *et al*.[70] for an overview of this body of evidence). Many of these studies were facilitated by the establishment of large national data sets linking sociodemographic admissions data with later performance data (e.g., within the UK[71], Australia[72,73] and Canada[74]).

At this time, papers sometimes took opposing positions: for example, debating the utility of aptitude tests in respect of increasing diversity and predicting success at medical school.[65] These debates indicated that much research in the field was still firmly in the justification 'does it work?' phase of research (in other words, is one way of selecting better than another in respect of WA?). However, there was a shift towards clarification questions, as described in Cook *et al*.'s framework,[55] with more studies focusing on discrete components of selection and admissions processes in respect to the associations between specific processes or structures, applicant socio-demographics and the association of both these factors with later performance.[32,72,75]

Alongside an increase in both quality and volume of quantitative studies came more credible qualitative studies, those which were explicitly aligned in terms of epistemology, ontology and methodology, and which used theoretical perspectives to get a better understanding of widening access to medicine. However, theory-driven studies were still an exception rather than the norm with notable high-quality studies coming from a very small group of qualitative researchers worldwide.[76,77]

We present an example of wave 2 research in Box 4.1.

The use of the mid-range theory of policy enactment illustrated that how WA/WP policy processes play out varies according to contextual dimensions. It also provided insight into dimensions of context and how they inter-related across different medical schools. The detailed understanding which emerged from the use of theory illuminated what might be open to change, and how best to direct change. This was instrumental in later work that examined how UK medical schools use contextual analysis in making offers to students from disadvantaged backgrounds, and how best to facilitate a fair, consistent approach to widening access to medicine.[82]

BOX 4.1 Taking context seriously: explaining widening access policy enactments in UK medical schools. Based on[78]

A high-impact government report highlighted that the impact of policies to increase the diversity of medical students in the UK diffed by subgroup. Following the publication of this report,[79] Cleland *et al*. hypothesised that individual medical schools interpret and put into practice widening access/participation policy very differently. Their aim was to examine the reasons for this diversity of approaches, and they did so using the theoretical lens of policy enactment.[80,81] This mid-range theory was developed for the wider field of education and so Cleland *et al*. imported it to health professions education (specifically medical education) to illuminate the complex processes by which individual medical schools put macro-level policy decisions into micro-level practice without explicit guidance as to how to do so. For example, in terms of enacting WA policy, medical schools must interpret policy, drawing on their own culture, within the limitations and possibilities of their context, such as available resource. In other words, context is core to how government-dictated (macro) WA policy is implemented 'on the ground' (at a meso- and/or micro-level).

Aligned with social constructivism (grand theory) and using a qualitative methodology (individual interviews) they found that admissions Deans and staff from 24 UK medical schools held very different positions in relation to the interpretation and translation of WP policy. These positions were influenced by a number of contextual factors, including: geographical locality and positioning of the medical school; the expectations of the university and other key stakeholders, and resources. The latter were subtle and referred to resources for medical selection processes rather than for WP per se. The data revealed that the political goal of WP (diversifying the medical school student body) and medical education's goal of producing the best doctors may sometimes conflict. Interestingly, given the first wave of WA research, it was clear from the data that, generally, medical schools tended to focus their available WP resources on developing and rolling out WP activities, but not evaluating the impact of these activities. Study participants talked about the WA activities of their school but did not know if these had actually had any impact on their student population.

The third wave: starting to recognise complexity

The most recent and third wave of research into WA/WP continued in the spirit of clarification research but also saw an increased use of more nuanced theoretical frameworks in the qualitative studies, and more sophisticated questions in the quantitative ones. The field moved on from examining the issue mainly from the perspective of applicants to also considering the structural barriers to WA/WP, as well as acknowledging that there was not a 'level playing field' in terms of preparing for medical school. This explored the nuances of 'how and why' negotiating the admissions process for applicants from URMs/disadvantaged groups may be challenging. There was recognition of the complex and intertwining network of factors that may contribute to an applicant's disadvantage and how these challenges might be addressed. Longitudinal, multi-site and rigorous quantitative studies with clear outcomes using sophisticated analyses were becoming more established.[74,83]

To further illustrate the maturation of the field we now give three examples of wave 3 research. Our examples are qualitative, to illustrate how the use of theory in WA/WP research has become more explicit over time, with scholars making clear the assumptions and principles contained in the theoretical frameworks they use in their research projects.

Example 1: Revised Bourdieusian thinking: Old dog, new trick

Alexander *et al*. (2019)[84] revisited a topic first studied in wave 1 of WA/WP research: that of aspiring to study medicine. Literature published in the early 2000s suggested that, in the UK at least, individuals from non-traditional groups may not consider, or aspire to, medicine because of sociocultural barriers and instead perceived medicine as 'not for the likes of me'.[61] Since then, the UK higher education landscape has undergone significant change, with an increased emphasis on student choice and widening access (WA) initiatives. Thus, the authors looked anew at the perceptions of medicine held by school pupils from non-traditional backgrounds to assess whether sociocultural factors remain a major barrier to medicine.

This was a qualitative interview study which employed a social constructionist world view and used focus groups plus a task-based activity to explore the perceptions of medicine held by school pupils from non-traditional backgrounds. Initial data analysis was inductive (data-driven). Identified themes were then considered through the conceptual lens of a 'reflexive habitus'[85] a mid-range theory adapted from the work of Pierre Bourdieu.[86]

Bourdieu's theory of social capital has been, we argue, over-used in WA/WP research and his concept of habitus has been critiqued as limited and outdated.[87,88] However, by using the more nuanced concept of a 'reflexive habitus', the research provided a deeper understanding of the applicants' perspectives. The use of theory elucidated that they not only perceived that their sociocultural differences did not deter them from aspiring to, or pursuing, the career of their choice but some considered their 'different' background as a strength. Overall, the findings suggested that a key mantra of WA initiatives – that anyone with the ability and desire should have the opportunity to access medicine, regardless of his or her background – had been successfully integrated into the collective consciousness of pupils from backgrounds underrepresented in medicine. The study's findings demonstrate the importance of ensuring that research, and subsequently medical school practice, keeps pace with political and societal change to focus WP/WA initiatives on the barriers of the present, rather than on understandings of the past.

This wave 3 study also challenges the rigidity of the habitus as conceived by some socioculturalists, introducing afresh the concept of agency and how, in this case, applicants from non-traditional backgrounds can not only perceive and negotiate any mismatch between their habitus and the habitus required for a specific field, but also reflexively decide how to retain aspects of their primary habitus.

Example 2: A complex problem

'Wicked problems' are complex in nature, have innumerable causes associated with multiple social environments and actors with unpredictable behaviour and outcomes, and are difficult to define or even resolve. Cleland, Hanson and Patterson[89] took the frameworks of complexity theory and wicked problems to look at selection and widening access (WA) from a fresh angle, to make recommendations for future research, policy and practice. This was an example of borrowing mid-range theory from another discipline (wicked problem theory was originally developed in the field of social planning) to shift the focus of research in the field from an erroneous search for a simple solution to thinking differently about how problems associated with selection and widening access could be tackled.[90]

The use of this combination of theories as a lens to review the literature provided a way to acknowledge subtleties and complexities rather than overlooking them, to think about process not just outcome, and learn from apparent failures. For example, one of the ten properties of a wicked problem is: every wicked problem can be considered to be a symptom of another problem. Attaining the required grades remains the first hurdle in medical school admissions in most contexts. However, educational attainment is linked to systemic and social factors: worldwide, students in higher socioeconomic groups outperform students in lower groups in school exit examinations.

Another property is that: every wicked problem is essentially unique. Cleland and colleagues concluded that medical school selection is context dependent. Different countries and localities have different needs, priorities and processes for selecting medical students. Yet at the same time medical schools within individual countries differ significantly in their selection policies, aims and objectives.[76,77,91] The wicked problem framework positions selection and widening access to medicine as a multi-causal, complex, dynamic, social problem and foregrounds stakeholders' views and context as being highly relevant.

Drawing further on the theory, they proposed that wicked problems require wicked solutions. Framing medical school selection as a complex wicked problem shifts thinking from finding an overly 'narrow' solution[68] to more contextual and receptive thinking. Complexity science and the framework of wickedity shifted thinking and action from a fruitless search for one elusive, objective truth (e.g., the best way to widen access, the fairest way to select) to recognition of the dynamic, multi-level and multi-faceted aspects of medical selection policy, in which managing uncertainty, acknowledging context, and questioning and considering 'issues' associated with medical selection are more likely to lead to productive solutions in the future, especially regarding WA.

Example 3: Foucauldian critical discourse analysis of WP policy

How educational policies, such as those which drive WA/WP to medicine, are enacted has been discussed earlier.[78] For wave 3 studies, unpicking why policies are enacted as they are at a regional or organisational level may include a focus on power structures and norms which shape these at the level of the state,[77] or supra-state level.[30] Coyle *et al*. (2020)[92] approached this phenomenon via a Foucauldian critical discourse analysis (CDA) of WP policies, comparing texts from the UK and Australia published between 2008–2018.

Although this theory and approach has been used to examine messages around medical admissions in Canada[76,77] and the UK,[91] Coyle and colleagues' work is the first CDA comparing policy documents from two contexts to identify and compare international discourses in this research area. A comparative approach is a distinct strength of the study, as it helps make the 'familiar strange'. This is key within a critical approach: findings which are assumed as 'just the way things are' in one context, stand out as odd in another. This promotes in-depth questioning befitting of Wave 3 studies.

Foucauldian discourse analysis is covered in depth elsewhere in this book (see the chapter by Paton and colleagues). In brief, an exploration of discourses offers insight into the power dynamics of a particular time and place, and how these discourses produce and reproduce the social, cultural and institutional structures which give them power.[93,94]

Coyle *et al*.'s analysis[92] revealed that the discourses in UK policy documents foregrounded social mobility as the underpinning force of widening participation in higher and medical education. On the other hand, the Australian policy documents promoted and reinforced the aim of social accountability for equity and workforce diversity. UK policy largely stresses the individual responsibility and the deficit of those from non-traditional backgrounds in a meritocratic system. Responsibility for tackling inequalities is given to universities, medical schools and the professions by the policy documents. In contrast, Australian policy prioritises affirmative action and community values, in efforts towards 'nation building'. Most often the Australian agenda calls the government to action, and to be held responsible for outcomes. By analysing a decade of policy documents, the authors were also able to give insight into how discourses had shifted over time.

This study's findings contribute to the nuanced understandings sought in wave 3 literature by exploring and explaining why WP works as it does in what contexts. The authors do not preference one set of discourses over the other, but rather encourage both countries to reflect on the other's discourses as a lens through which to scrutinise their own policies and histories, and to imagine alternatives for the future.

Wave 4: Looking ahead

Twenty plus years of research has given us a better understanding of widening participation and access to medicine. From investigating questions such as 'Does the summer school offered by my institution increase applications from under-represented groups?' to nuanced work examining changing attitudes and approaches, research in the area has come a long way. However, no field can remain static, and every study leads to more questions, the answers to which will deepen and widen our understanding of how best to increase diversity and widen access to medicine.

The fourth wave of WP/WA research is starting to swell, but what direction should it take? What is topical now that is relevant to WA practice, policy and research? We observe that the global Covid pandemic has thrown into sharp focus inequalities in education, including the under-researched area of how different groups of medical students experience the curriculum. Institutional and structural issues remain under-examined. We also urge researchers to progress work that explores career choice and trajectories of under-represented minorities. Broader issues relating to key stakeholders, e.g., parents, teachers, local communities – and importantly patients – remain under-explored worldwide. We argue that the focus should be on taking appropriate theoretical approaches to both methodological design and interpreting data to address new questions in the field.

Conclusion

Using Hung *et al*.'s framework,[54] we have outlined the significant evolution of widening access research over the last 20 years or so. Studies within what we have termed the first wave of research in this area were largely descriptive, unanalytic and commonly underpowered, Wave 2 studies highlighted more robust methodologies, reporting outcomes from longitudinal studies and/or across multiple sites whilst qualitative studies explored both the student experience of 'getting in' to medical school as well as 'staying in'. The third wave moved us on in terms of theoretical approaches that examined 'what works for who and under what circumstances' ensuring greater generalisability and outcomes robust enough to advise on practice and policy. The use of mid-range theories was crucial to helping researchers in this field make the hidden visible and the implicit explicit, teasing out the inherent complexities of widening access to medicine across contexts.

We conclude that if 'determining whether or not progress is being made in an area of study requires judging whether or not empirically unsupported ideas are being discarded, whether or not the conversations stimulated by the research efforts have changed and whether or not the focus of our research efforts continue to evolve' ([42] p. 295), we can confidently say that widening access research is in a very different place compared to 20 years ago, and is continuing to progress in terms of research question sophistication and use of theory.

Practice points

- Increasing the diversity of medical students remains a global issue highlighting ongoing issues of inequity in education.
- Research in this area has shifted over time from atheoretical, small studies to adopting the use of theory and more rigorous methods.
- As a result, recent studies begin to provide generalisable and transferable findings, helping illuminate what approaches work (outcomes) and how they work (process) in different contexts.
- Advancing knowledge on a topic takes time and a willingness to draw on knowledge and resources from different fields and disciplines.

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5 Developing the research question: setting the course for your research travels

Juanita Bezuidenhout, Champion N. Nyoni, Rhoda Meyer and Susan C. van Schalkwyk

How often have you walked out of a class, left a tutorial or completed a ward round with a group of students and wondered about the extent to which the students had actually grasped what it was that you were hoping to share with them? Or what about having marked an assignment or exam, observed a student during an OSCE, and then been perplexed because the responses given bear no resemblance to what you had discussed with them previously? This type of reflective thinking, prompted by our natural curiosity, is what moves us to start asking questions about our teaching and our students' learning. When we approach these issues in a scholarly manner, building on an existing body of knowledge, we embark on educational research. The key driver in such research activity is the research question which is the focus of this chapter.

In the previous chapter, the role of theory in educational research and the development of theoretical and conceptual frameworks was explored. We now move to the heart of the research process, namely the research question which is the tool that will set the course for your research journey. Once you have decided that your curiosity regarding an interesting phenomenon warrants further investigation, in other words warrants further study, you will embark on an iterative process that leads to the development of a research question. This chapter focuses on such development. In the first section, we unpack the characteristics of the research question as it evolves, including its role and function. Thereafter, we take you through a process of developing a research question of your own.

Developing the research question can be characterised as going through a process of triple distillation. Distillation is defined as 'The action of purifying a liquid by a process of heating and cooling' or 'The extraction of the essential meaning or most important aspects of something'.[1] Through repeated distillation, a distillate becomes more pure and concentrated. Often the liquid is distilled twice, but in rare instances it is distilled thrice, resulting in increased purity and concentration. In each instance, the distillation process ultimately leads to a refined product from which all extraneous and unnecessary information has been removed. Each distillation requires the researcher to work iteratively until the final product emerges. Given our focus in this chapter, we review the distillation process (Figure 5.1) as a metaphor to guide our discussion. In addition, we refer to an actual healthcare professions education (HPE) research project (see Box 5.1) to provide specific and practical examples.

BOX 5.1 Scenario of an actual health professions education research project that will be used as background to provide specific and practical examples of research questions.

A medical faculty in South Africa establishes a rural clinical school (RCS), offering medical students the opportunity to voluntarily move away from the academic hospital to spend their entire final year at a district or regional hospital (year-long longitudinal rural clerkship). This intervention requires changes to the curriculum and results in different teaching and learning experiences for students and clinicians at the distributed site. Numerous questions immediately come to mind. Has the intervention been effective? How have the students experienced the rural platform? What have been the outcomes in terms of student learning? How does this compare with rural clerkships elsewhere? How has service delivery been affected? Why do students decide to take up the rural elective? And so forth. These are the sorts of questions that serve as catalysts for educational research.

By the end of this chapter you will be able to do the following:

- Identify the principles of a 'good' research question.

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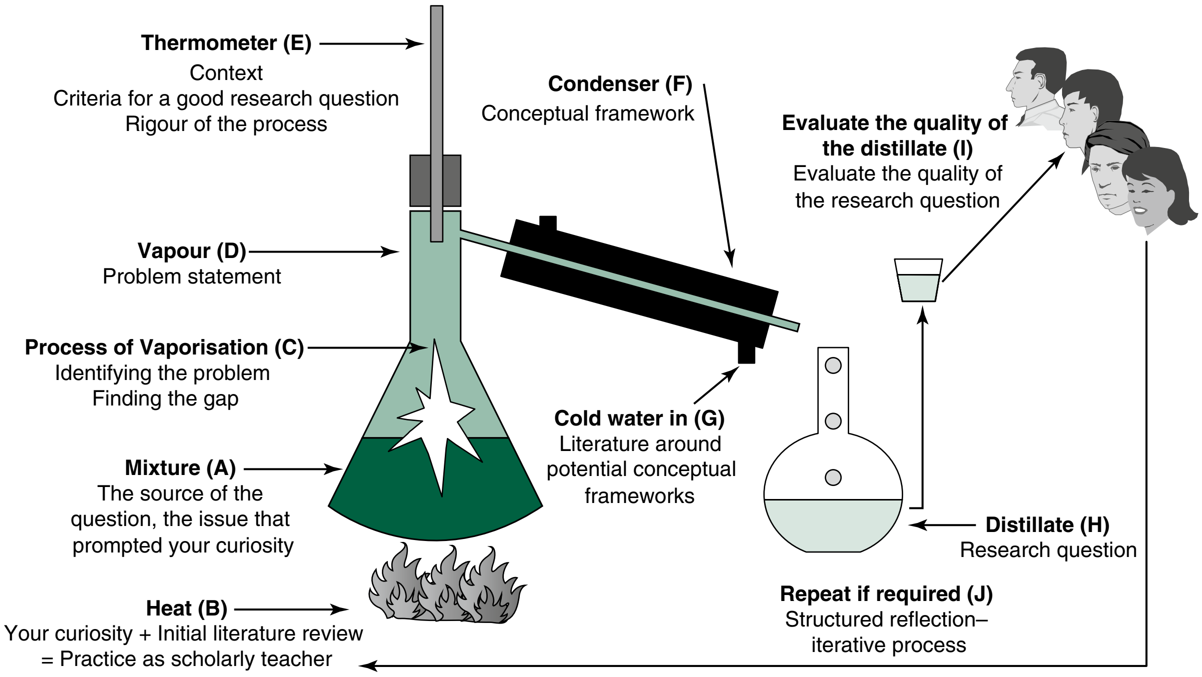

Figure 5.1 The purpose of distillation is to separate a specific liquid, the distillate (H), from a mixture (A) of liquids/s and other ingredients. This mixture is heated (B), resulting in series of reactions (C) that will produce a vapour (D). The exact temperature (E) of the process is important, to ensure that only those molecules that must form part of the distillate will vaporise. Impurities and superfluous elements are left behind in the container. The vapour is then guided through a condenser (F) in which cold water is circulated (G). This condenses the vapour, and the distillate (H) can be collected. The distillate then has to be evaluated to ensure its quality (I). If necessary, the process has to be repeated (J). In this illustration, the components of developing a research question are equated to the steps in the distillation process.

- Describe the different types of questions and their implications for and impact on the research process.
- Explain the process of developing a research question.
- Develop your own research question.

Why a research question?

Why is it necessary to have a research question? Is it not sufficient to have a topic or an idea and to develop aims and objectives accordingly? The research question is, however, pivotal to any educational research project and has a particular purpose in the research endeavour – that of providing direction, both in terms of reading relevant literature and in the selection of data collection methods.[2,3] The research question could also be seen as a lens through which one will navigate and explore specific issues.[4,5] In essence, the research question becomes your guide that directs all other activities during the research process and against which decisions with regard to research design, the presentation of results and the way in which the results are interpreted and discussed will be measured.[4,6,7,8] The quality of the research question (Figure 5.1H) determines the quality of the research.

Irrespective of the nature of your research, it is critical that you are interested in the topic.[3,9] Your enthusiasm, particularly when it is aligned with your practice, can spark an interest amongst other potential collaborators. In addition, as you enhance your expertise and understanding of the topic, your stature as someone who sufficiently understands the topic in order to effectively explore it will become established.[9]

The research question under the microscope

As suggested in the opening narrative of this chapter, an important source of questions (Figure 5.1A) in HPE research resides in our practice/activity as teachers, whether it be in the clinical context or focusing on a theoretical issue.[10,11] Your reading of the literature can also prompt a research question. For example, you may have a particular interest in a virtual Objective Structured Clinical Examination (VOSCE) and have recently read about it.[12] However, as you read about this approach, you become aware of the challenges that others have documented when applying VOSCEs and you may question how these challenges manifest in your own context. Another important source of research questions comes from a desire for teachers to determine the extent to which a particular educational approach has been effective, usually in terms of enhancing student learning. HPE is continuously being challenged to adopt innovative approaches that will facilitate transformative learning experiences of our students.[13] Implementing such innovative approaches brings with it a responsibility to be accountable and to produce evidence of the usefulness, or not, of these approaches, and to respond accordingly. When the RCS (see Box 5.1) was implemented, for example, part of the planning made provision for a five-year longitudinal cohort study that would investigate the impact of this unique intervention. Thus your curiosity to find out more is what generates the heat that initiates the distillation process (Figure 5.1B).

Research questions come in many different guises and can have many different objectives (Table 5.1). When starting out in HPE research, one typically will focus on less-complex research questions. However, studies in this field are seldom one dimensional and often address a matrix of 'layered problems'[14] with sub-questions being developed to support an overarching question (see the first example in Table 5.1). It is important to note that different levels of research questions each offer unique contributions to the field.[4]

Table 5.1 The guises and objectives of research questions: in relation to a particular phenomenon or event, the research question is typically used to interrogate an intervention through one of the actions described here

Objective		Example
Describe		*What does the curriculum for the final-year medical students at the RCS look like?*
	Subquestions	*What content is included in the curriculum?* *How often do students attend tutorials?* *What is the mode of engagement between students and lecturers/supervisors?* *How is the assessment conducted?*
Explain		*'Why do students elect to attend the RCS in their final year?'*
Explore		*'How do final-year medical students experience the year-long placement?'*
Investigate		*'What is the potential of the RCS to enhance retention of rural health care practitioners?'*
Predict the outcome		*'Will final year medical students attending the RCS practice their profession in rural areas?'*
Compare/justify		*'How does the performance of final-year medical students at the RCS compare to that of the final-year medical students at the academic hospital?'*

The 'good' research question

What is a 'good' research question? Critically, a research question should have significance and relevance.[15] When the RCS was established, it was the first of its kind in South Africa. In addition, it represented a considerable financial and human resource investment on the part of the university. Determining the impact of such an intervention, therefore, had relevance at both institutional and national levels. Educational research questions should also advance educational theory and practice.[10,16] They should pre-empt any discussion around methods, be focused and offer the potential to uncover the real issues. Good questions are concise, focused and direct, devoid of ambiguity, self-explanatory, unbiased, appropriate, elegant and simple, timely and theoretically rich.[2,7,10,11] They should be clear and examinable – in other words they need to be answerable.[10,17] Addressing a gap in the literature is also a fundamental criterion of a good research question.[10] Ultimately, as mentioned earlier, a good research question is one that piques the interest of the researcher. Together, these criteria serve as the thermometer for the distillation process, carefully measuring the quality of the question being defined (Figure 5.1E).

The structure of the research question thus carries the hallmark of the principles mentioned above. It contains a minimum of three parts and should identify the variables that you, as a researcher, are investigating: an intervention or a specific situation (an independent variable); the outcome, such as the performance, attitudes or behaviour (a dependent variable) and who you are going to study (the population).[18,19] In the case of the RCS study, the implementation of the RCS is the independent variable, the impact of the intervention is the dependent variable and the students and clinicians are the population. When you want to compare two or more interventions, your question will contain four parts, namely the Population; the Intervention; the Control or alternative intervention and the Outcome (PICO Participants, Interventions, Comparisons and Outcomes).[20] In a complex environment, such as education, there are often additional variables that are important, including the moderator and mediator variables. Moderator variables determine what effect the intervention has on different groups, for instance in the RCS study, the intervention might have had a different impact on students from a rural background than on students from an urban background.[21] A mediator variable explains how the intervention works and describes the process by which the intervention achieves its effect. In the case of the RCS, the students started developing a professional identity because they became part of the local community of practice. Moderator and mediator variables are more commonly present in quantitative than qualitative research.[21]

Developing the research question

Despite all the information available on the research question, and notwithstanding what has been written above, many who are new to HPE research find it challenging to develop a research question. We hope your reading thus far has nevertheless sown the seeds of a research question in your mind. In the next few sections, we focus on the evolution of your preliminary question. In this instance, Morrison's notion of the development of research questions in HPE, as being both a science and an art, will be central to our thinking.[22]

Identifying a 'problem'

The issue that has prompted your curiosity (Figure 5.1A) is often labelled the 'problem'.[11] A research problem can, for example, emerge from an investigable hunch; an aspect warranting further investigation, a teaching and learning practice that can be improved, a concern with published research findings that appear at odds with one's lived experience, the translational nature of existing findings, and conceptual or theoretical foci.[7,23]

Identifying a problem (Figure 5.1B+C) can be steered by a series of questions, starting with what is significant to know. This relates to the prevalence and/or seriousness of the issue and the likelihood that the results will be of benefit to a wider audience. Significance also relates to what the research can add to the literature by, for example, investigating a timely, less-studied topic, challenging existing dogma, improving methodologies or exploring a key issue in a different context, such as was the case in the RCS study.[24,25]

Thinking critically about the problem you have identified, expressing it in different ways, and then situating this researchable problem within a theoretical framework become the next steps in the process of developing a research question.[16]

To effectively distill the problem, you must engage with the current literature relating to the topic, especially as your next task is to determine whether there is a gap in the knowledge and what the gap is.[19] How does one identify a gap? Clearly, immersion in the body of knowledge will help define your field of enquiry. If this reviewing of the literature, the detail of which will be covered in a next chapter, does not provide answers to your envisaged research question, or perhaps answers the question, but in a very different context, then you may have identified a gap. At this stage, it would be prudent to revisit the previous chapter, specifically the section regarding your worldview. You have to be aware of how your assumptions about the nature of reality (ontology) and the nature of knowledge (epistemology) will influence how you perform your review of the literature and therefore how you will justify why you believe the gap exists. This will inform the formulation of your research question and the subsequent research design.[26] The RCS study was unique given that the concept of a longitudinal rural clerkship was studied for the first time in an African context. The research therefore sought to address this gap by determining the mechanisms at play in this particular context.

The last question to answer in this section is why the gap in knowledge has not yet been addressed. This often speaks to feasibility and can relate to aspects of research design, such as setting realistic goals and objectives. Challenges in relation to the time frame, resources available, ethical matters as well as data collection and analysis are further issues that can influence feasibility.[9]

With the 'heat' you have generated (Figure 5.1B), you should be able to formulate a problem statement. Clearly identifying the problem will enable you to formulate such a statement – an explanation of the issue that requires investigation – to guide the construction of your research question (Figure 5.1D).[7] Your statement will typically be structured by describing the study's context, for example 'Increasingly medical students are being trained at distributed rural sites . . .', followed by an introduction to the statement of intent, often using a transition such as 'however' or one of its synonyms:[25] '. . . however little is known of how this is implemented in the African context and how it influences the students' clinical learning experiences.' This problem statement is the 'vapour' of your distillation process. It will also inform the purpose of your study, its rationale and intent.[7]

Establishing a conceptual framework

Following on the problem statement, the conceptual framework (Figure 5.1F) sets the stage for the research question that will drive your study and provides the lens through which the study will be investigated.[6] A conceptual framework is your own interpretation of a system of concepts, assumptions, expectations, beliefs and theories that supports and informs your research[27] and it may include a theory, an approach or a model that represents a way of thinking about a problem and helps to explain how complex things work.[26] It will therefore help you frame your problem. A conceptual framework can be constructed in either narrative or graphical form and may include the key elements, concepts, theories and variables that inform your research and the potential relationships between them.[28,29] It can even include your ideas and beliefs about the research. The conceptual framework is therefore a very personal articulation of how you view the phenomena you are studying.[27]

As you have seen in the previous chapters by Cleland and MacMillan, your research will usually be situated in a specific paradigm, for example, positivism, interpretivism or criticalism, although you could combine, with caution and care, aspects of different paradigms.[28] This positioning will help guide the construction of your conceptual framework, the formulation of your research question and the design of your research.

There are four main sources you could draw from when developing your conceptual framework. These include your experiential knowledge, the existing literature (theory and research), exploratory or pilot studies and thought experiments.[27] A conceptual framework will therefore clarify and position your research question within a specific theoretical context and guide you in formulating the question, choosing the variables and interpreting the results. The process of constructing a conceptual framework requires that one consider multiple perspectives before it can be finalised.[28] This can add depth to your study and encourage you to engage with your research on a different level, for example, moving from descriptive or justification studies to more clarificatory work.[30] A strong conceptual framework will also allow future researchers to draw on your study.

In the case of the RCS study (Figure 5.2), the research was positioned within an interpretivist paradigm. The design of the intervention was informed

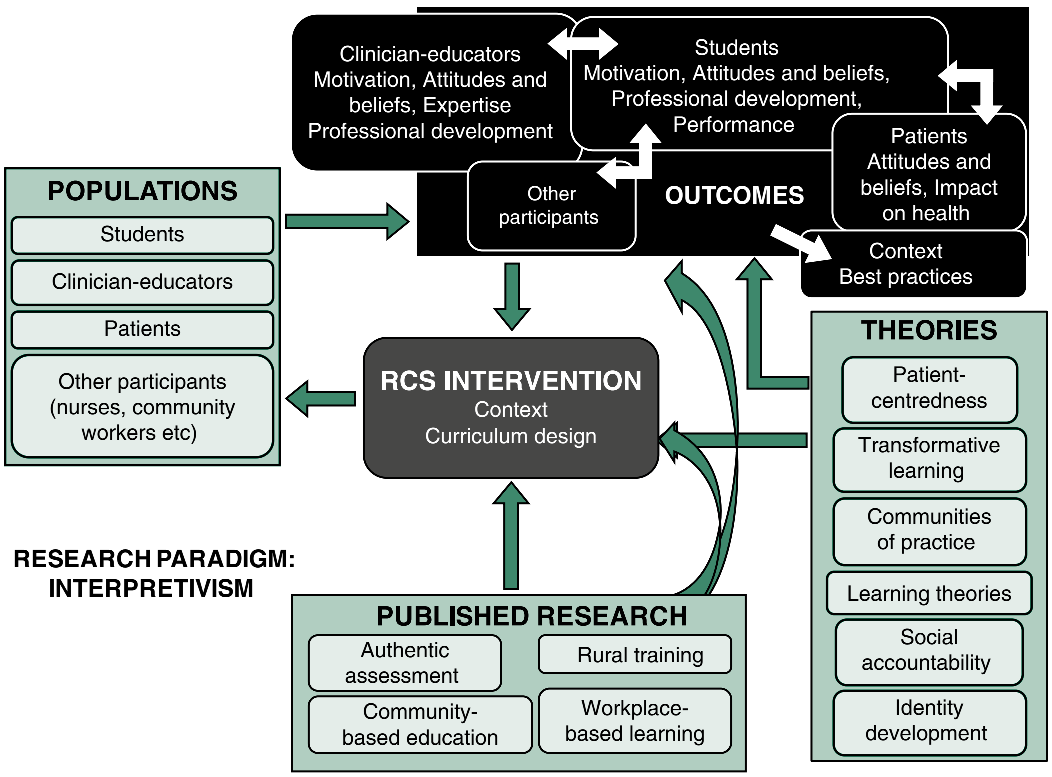

Figure 5.2 A graphic representation of a conceptual framework affords the researcher the opportunity to visualise the various components that contribute to the development of the research question. This example represents a potential conceptual framework for the RCS intervention. The research paradigm, the theories and published research that informed the conceptualisation, the context and the various populations and variables are all represented in this framework

by the philosophical positions of social accountability and patient-centredness, and published research on the impact of similar interventions in other contexts. Theories that played a major role in the development included transformative learning,[31] communities of practice and situated learning[32] and professional identity development[33] – all theories that inform the potential impact of the intervention on the populations studied. Figure 5.2 provides an example of a framework that is based on these different perspectives.

Refining the research question

Let us get back to the research question. As you have seen, the process of delineating a problem statement, developing a conceptual framework and formulating a research question is iterative in nature. Each phase contributes to the distillation process towards refining the research question (Figure 5.1H). In the case of the RCS research, our initial research question was very broad, simply asking whether the intervention had been successful. Through the process of refinement, however, the question became more focused as the key issues that needed to be investigated were discerned.

At this point, therefore, it is time to examine the quality of the choices you have made in developing your question (Figure 5.1I). We previously discussed a range of criteria for good research questions. Examine your question and decide whether it meets these criteria. Engage with others informally, or at conferences and seminars to obtain input as to the value and appropriateness of your research question. Revisit the literature and confirm that your question addresses the gap you initially identified (Figure 5.1J).

Conclusion

At the beginning of this chapter, we argued that the research question is the cornerstone of any research endeavour. We also suggested that the development of a research question is both a science and an art. The science is mirrored in the triple distillation process with each step and each component emphasising the action of refinement until the final product emerges. The art is seen in the iterative application of review, revision and critical reflection that influence the decision making towards scholarship. In the chapters that follow, the focus will be on putting the research question into play and designing a study that will offer a valid response.

Practice points

- Find research questions in aspects of your own practice that are of genuine interest to you.
- Develop a problem statement.
- Identify a conceptual framework.
- Embrace the iterative nature of formulating a research question.
- Critically consider the criteria for good research questions.

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6 Researching technology use in health professions education: questions, theories, approaches

Rachel H. Ellaway

I began my academic career as an education technologist, designing and building computer-based systems and tools to help train tomorrow's doctors. It was the height of the 'e-learning revolution', and it was exciting to be exploring the potential of these new technologies. And yet, I was increasingly aware that there was something amiss in this mad rush. Some tools were used a lot while others were hardly ever used, some teachers and learners were more open or resistant to change than others, and deploying a new tool or system often had unexpected side effects. Moreover, many scholars seemed to be more focused on proselytising on behalf of technology than on behalf of learning or learners. My focus shifted to the impacts of technology use on educational ecologies and the individuals within them. This was a journey through sociologies of educational technologies, psychological domains of affordance and cognitive augmentation, economics and politics of technology use, and new ideas such as digital professionalism. More than two decades later, the issues that researching technology use have raised are still central to my work, even if I now encounter them in other domains. This chapter explores the plural and nuanced world of educational technology research and its implications for health education scholarship in general.

One of the eternal struggles of graduate students, others who are new to the field, and many who have been here for a while, is asking good research questions and organising studies around them. Tools and models for framing research studies, such as Lingard's problem-gap-hook model[1] (see also chapter by Lingard and Driessen) can help focus down on what a study's questions might focus on, but research questions pull everything together in a study and as such they are the core around which everything else is oriented (see Figure 6.1, and chapter by Bezuidenhout and colleagues). Note there are other approaches, for instance starting with a hypothesis and then designing a study to prove or disprove it – I return to this issue later in this chapter in considering big data research.

Research questions should be 'FINER' – *feasible* (the question is answerable within the means of the researcher); *interesting* (you or others are interested in the question being answered); *novel* (the question has not already been answered); *ethical* (hopefully self-evident) and *relevant* (the answer can be generalised and is useful).[2] However, defining what makes good research questions around technology use is perhaps easier to outline in terms of negatives rather than positives. Asking questions like 'does technology X work?' or 'is technology X better than some other approach?' are examples of how studies can come off the rails before they even start. Not only is something almost always better than nothing,[3] that the use of a particular type of technology in a particular time and place corresponded with some improvement in learning outcomes (or whatever other measure is used) does not mean that the technology was the causative factor (caution in correlation-causation) nor does it mean that its subsequent use will produce similar effects.[4] After all, there is so much in using technology in health professions education that is circumstantial: pre-existing teacher and learner attitudes, the place of the technology in the learning environment, and infrastructure and institutional policy can make a significant difference to outcomes. We might more productively ask questions that explore the multifactorial circumstantial nature of introducing technology into teaching and learning activities. For instance: what was it about the design, implementation and/or use of the technology that contributed to the outcomes of interest? I will review in turn the broad questions that need to be considered in researching technology in health professions education.

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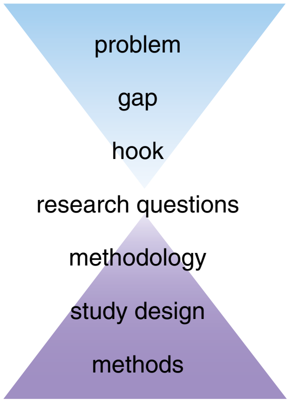

Figure 6.1 A logical flow of designing a study. Taking this approach, you start with a problem-gap-hook statement[1] or some other specification of your study. Next, you formulate research questions. A methodology is then selected to align with the research questions, followed by the study design which outlines the specific methods that will be used. Everything should be aligned (see chapter by Cleland). Based on[1].

What?

Let us start with a deceptively simple question: exactly what do we mean by 'using technology in health professions education'? Indeed, what do we even mean by 'technology'? Taking a dictionary-like perspective, technology is either considered to be the practical application of scientific knowledge, the products of those applications (machines, products, devices), or the practices and knowledge of those who engage in the applied sciences and engineering. In medical and other health professions education, we regularly do all three. In terms of technology as applied science, much of this book is dedicated to linking research to practice and, as such, I would argue that this entire volume is about technologies of one kind or another. In terms of the practices and knowledge of technologists being applied to the problems and needs of health professions education, we might take systems thinking, workflow analyses, and data management as a few areas where there are intersections (or should be) between the two. However, it is technology as systems and devices that is my focus in this chapter. Even then this definition is very broad. Devices such as (paper-based) books, pens and classrooms are clearly technologies and they have long played a central role in mediating health professions education, but when we say 'technology' they are rarely what we mean.

I will therefore follow the zeitgeist in framing technology in this chapter in terms of digital technologies. Although there might be a tendency to think 'the newer and shinier the better', what constitutes 'new' is a somewhat subjective judgement given that digital technologies may still seem new to many health professions teachers and researchers, despite training the first generation of doctors who cannot remember a time without widespread use of digital technology. There is also a complication in the increasingly distinct fields of inquiry related to specific digital technologies such as simulators, robotics, virtual worlds, augmented reality and haptics, not to mention the role of e-health and virtual care in education and training. However, quite what is or is not legitimately part of particular health professions education discourses is less important than identifying and appraising what technologies, from whatever quarters, are materially involved at whatever levels and in whatever ways in training health professionals.

You also need to be clear where the technologies you are interested in start and end as they are often entangled (one technology is dependent on many others) and variant (there are many differences between specific instances and uses). It is insufficient to say we researched the use of an online portfolio, a virtual world or a haptic simulator. It is important to say specifically which makes and versions you explored. For example, if one was interested in social media, could a study into the use of YouTube in 2010 tell you much about the use of Instagram more than a decade later? Part of this is about defining scope; are you interested in a single technology (such as using a particular iPad App) or a group of technologies (such as a variety of Apps that perform similar functions on different devices)? Are you interested in hardware or software, the user experience or the configuration of the learning environment? There is no one right way to research technology in health professions education; rather, whatever approach you do take, you should be clear and precise as to what technology means and what aspects you are interested in the context of your study or other scholarly activity.

Who?

Not everyone uses the same technologies, and not everyone uses the same technologies for the same purposes or in the same ways. Asking a simple question such as 'does PowerPoint work?' would yield different answers depending on whether you were interested in whether PowerPoint helped a teacher to teach, whether a teacher's use of PowerPoint helped their learners, or whether these learners found the PowerPoint slides they downloaded after the teaching event useful. You might even be interested in whether individual uses or the use of PowerPoint in general 'worked' for the programme or profession, or how they performed relative to some other perspective or set of values such as efficiency or economics. There are clearly many different perspectives one might bring to bear.

Answering 'who?' questions therefore involves defining who the subjects of your research are and what it is about them that you are interested in. More specifically, you need to decide who it is you are going to engage, and whether you want to, say, question, observe or track them. Central to this is deciding whether you are more interested in teachers' perspectives, activities or outcomes or those of their learners, or perhaps those of some other stakeholder group. Are you interested in individuals or in groups, and if the latter then in what kinds of aggregations (teams, classes, cohorts etc.)? Or are you more interested in researching whole organisational units such as courses, programmes or institutions or maybe even broader systems levels such as medical education systems, healthcare systems, or whole professions? Whoever your subjects are you will also need to consider their key characteristics and how homogeneous or heterogeneous they are. In any given group not only are some learners (or teachers) going to be more capable or engaged in using technology than others, there will likely be different levels of confidence and competence in, and dispositions towards, using digital technologies.

Where, when, how?

The next questions are about defining in what context(s) the technology is being used. After all, it might make a big difference if, say, a mobile App was being used independently, or in a structured classroom activity or during an exam. Context can be a somewhat nebulous construct, so let me unpack it a little. The first aspect to consider is the activity the technology is being used in; what role does the technology play in that activity, and how does the technology relate to other aspects of the activity. For instance, we might study how technology is used in small group learning activities such as problem-based leaning (PBL). In doing so, we should define the steps in the PBL activity (e.g., problem orientation, group discussion, information gathering, problem-solving and resolution), the different roles that technology can play (such as note taking, bibliographic research, communication and scheduling) and how using technology intersects with other aspects of the activity (such as dependence on finding appropriate evidence). We might also want to know how experienced the learners are in using technology in this kind of activity, what differences in technology use there might be across the group and to what extent technology is encouraged or discouraged by the group moderator. We might even want to know how technology might undermine the PBL process (for instance, laptop screens inhibiting discussion, or the problem being passed down from one year to the next via social media). We might add other questions such as 'with what?' and timing questions such as 'when?' and 'how often?'. We might want to know to what extent participants have autonomy in using a particular technology, can they decline to use it altogether or use an alternative? We might want to know whether the technology mediates activity (such as literature searching) or whether it is used in a more instructional way, something I have previously called *'in loco docentis'*.[5] We might also want to know how the small-group activity and the use of technology in it relates to programme (what level or stage, pursuing what outcomes or competencies and so on). We might want to know about the available infrastructure; technology use may be approached very differently if there is unreliable network access or electricity supply. We might want to know about how technology is used in a particular group activity or across multiple instances of a group activity either in parallel (other groups working on the same activity) or in sequence (how a group changes their approach over time).

Exploring technology use may also consider how the relevant technologies are operated. This may focus on interface and interactivity designs, or it might consider the topologies of use. As an example of the latter, digital devices are typically designed to be used by one person at a time (cellphone, tablet, laptop), while services and other online tools typically serve multiple users simultaneously (although their interactions and data may or may not be shared). How often technology is used may also be important in that an infrequently used technology that nevertheless prevents a serious medical error might be considered of greater importance than one that is used all the time (such as a social media app) but with less significant consequences.

Although the breadth of contextual questions might seem overwhelming, in naturalistic research they are essential. Although conducting research in controlled quasi-experimental settings can allow some contextual variances to be reduced or managed, even then, the experimental context still needs to be described. It is rare to be able to engage truly standardised learners or teachers, let alone activities.

The question of how experimental or naturalistic research should be is beyond the scope of this chapter, but there nevertheless remain questions as to how experimental research can translate to naturalistic settings, and this efficacy–effectiveness divide is as much an issue in technology research as it is in health professions education research in general.[6] Settings, activities, the role of the entity of interest and the entanglement of the entity (or its characteristics or functions of interest) typically need to be factored into acts of inquiry.

Why?

When it comes to the question of 'why?', there are really two 'why?' questions that need to be answered. The first question focuses on why the technology of interest is being used. For instance, research into a tool intended to improve clinical decision-making would likely be approached very differently to a tool intended to monitor learner completion of learning outcomes. Not only does asking 'why?' help to clarify what it is that we need to collect data on and analyse for, it also allows us to consider the unintended uses technology is put to as well as those that are more 'on piste'. For example, student A might use a particular technology because they find it useful in the task at hand, student B does not find it so useful as they undertake the task differently or have different needs, while student C uses the technology because they feel they must whether or not it confers any benefit to them. This raises the voluntarism; if someone is free to decide if and how they use a particular technology, then we might approach our research into its qualities differently to technologies that someone has to use. We should ask, therefore, not only why technology is being used but also whose decision it is to use it. It is also worth noting at this point that there are very few activities in health professions education that can only be carried out using technology. Digital technologies are generally used because they change the rules and quality of action. This might be accelerating the speed and reach of actions and interactions, expanding the scale and systematicity of data gathering, storage and analysis, or the ability to monitor and track participants.

The 'why use this technology?' question, as with the others, is an important one in framing not just the study design but its potential significance and its potential audience. This brings me to the second 'why?' question, which focuses on why you want to conduct the research. For instance, are you interested in improving the technology or its use? Are you interested in whether it was worth the cost or disruption it may have caused? Are you more interested in whether the technology helped to improve outcomes (and if so how and for whom?) or in the experiences of those using the technology? There are so many different foci and perspectives one might take in framing a technology study that making this clear not only helps to ask the right questions, it also has methodological and analytical implications, and it connects inquiry to its translation to practice.

In summary, asking the right questions in researching technology use in health professions education, as in health professions education as a whole,[7] is one of the most important things you need to do. There are so many frames of inquiry you might employ, so many different units, levels and contexts you might use to orient your research, that seeking the most interesting or germane ones is an essential step in conducting meaningful and rigorous research. Moreover, asking the right questions is not necessarily a one-time task. Depending on the research paradigm and context, questions may change and develop through an act of inquiry, particularly in areas of uncertainty. Either way, attend to your questions!

Theorising technology use

I now turn to the question of the role of theory in such acts. Although it has been defined many ways, I find the following definition of theory useful:

> *a set of interrelated constructs, definitions and propositions that presents a systematic view of phenomena by specifying relations among variables, with the purpose of explaining and predicting the phenomena.*[8]

Theory focuses on a particular kind or class of phenomena understood in a certain way. That there are a great many theories of learning, teaching and technology use reflects this tangential perspective. Theory is developed from empirical observation and analysis, and it also guides observation and analysis; as Kant is supposed to have observed, 'theory without experience is empty, but experience without theory is blind'. Although in any given study there might be one theory or group of theories around which it is organised, there will be multiple theories at play not least because there are typically parallel theories that reflect what we are investigating, how that investigation should be undertaken and to what end. Indeed, different theories can inform every stage of the research process. These broad points are illustrated in Figure 6.2.

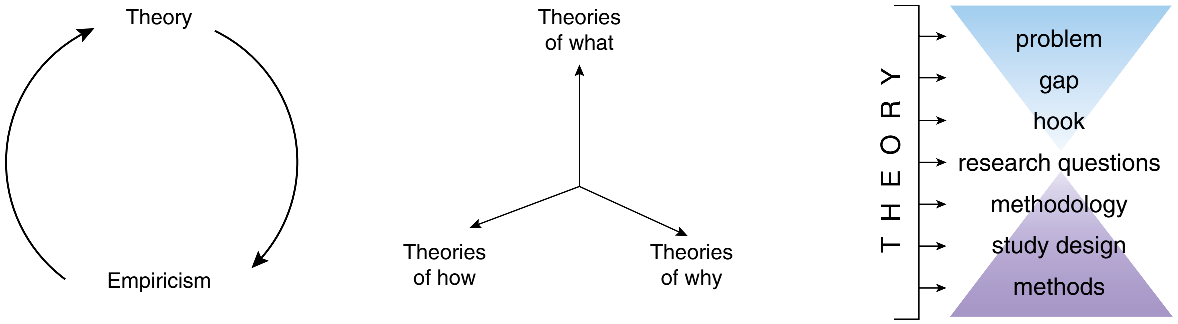

Figure 6.2 Three axioms of using theory in research. Left: Theory and empiricism are inescapably linked, empiricism is needed to develop theory, theory is needed to guide empiricism. Centre: Theories are not all the same, some are about what is being researched (subjects, constructs), some about how research is conducted (methodology and method), and some about why it is being conducted (rigour, values, ethics). Right: Theory can inform every step of the research process. Varpio and Ellaway[9] and Crotty.[10]

Let me next outline several theories that have proved useful in education technology research. Firstly, cognitive theories reflect a position that however technologies are used, it is the impact of that use on thought, reasoning, and memory that matters. Learning outcomes (however defined) are often the focus from a cognitive perspective, although there are others. For instance, some cognitive theories can reflect how technologies are designed and used, such as Mayer's multi-media learning principles (the cognitive impacts of different technology interface designs)[11] and cognitive load theory (sorting necessary and redundant demands on cognitive capacity) (see chapter by Szulewski and colleagues).[12] Other cognitive theories consider a more radical cyborg perspective where technology can function as part of a cognitive process, for instance using technology to support memory, wayfinding, searching or decision-making.[13]

Another commonly used body of theory focuses on the mediative and morphogenetic nature of technology, how it shapes, directs and alters what we do and what we might do, and the spaces within which activities take place. Examples include scaffolding theories that model how learners' supports change,[14] affordance theories that can be used to model how technologies define the range of available actions,[15] and dependency theories that model how some kinds of actions or abilities depend on others.[16] Sociomaterialist theories can also provide a mediative lens in that they model how technologies direct and shape the activities in which they are used[17] (see also chapter by Ajjawi and colleagues). Engeström's activity theory framework places mediation at its apex while noting the links between community, rules, division of labour and the subjects, objects and outcomes of the activity (see chapter by Johnston and Reid).[18] Other socio-materialist theories stress concepts such as entanglements and assemblages[19] that emphasise how human and non-human agents form both intentional and emergent dependent structures. As an example, one might say that a learner who depends on social media to support their learning becomes entangled with the devices they use and with those individuals with whom they interact. Morphogenic theories, on the other hand, consider why things are the way they are, and to that end focus on issues such as mechanism, variance, precedent, and context.[20]

Normative theories consider the way things should be and how and why they differ from the way they are. There are a great many theories that come under the general category of critical theory that might be applied to technology research, including critiques based on feminist theory, critical race theory (see Razack and colleagues' chapter), (dis)ability theory, and postcolonial theory.[21] Each has its strengths and weaknesses, each its different applications and relevance. There are even digital specific theories such as digital native theory that models engagement and capacity as a generational issue,[22] and digital professionalism theory that translates professionalism to digital environments and contexts.[23]

Other bodies of theory, such as Bandura's social learning theories (that focus on learning from and among others)[24] and constructionist theories (learning through making)[25] may also be useful when there some relevant social or group dimension to the technology use that is being explored (see chapters by Torre and Durning, and MacLeod, Burm and Mann). However, quite what constitutes social may need to be re-thought, not least because technology can seem antisocial when everyone is absorbed in using their own devices even if they are using them to communicate with each other.

In summary, although there are some theories that are perhaps better aligned with researching the use of technology in health professions education, or that tend to be used more often than others, the selection or development of theory should reflect the nature of the phenomenon or at least those aspects of it which are of interest.

Methodologies

The approach to selecting or developing a methodology should reflect your research questions and your theoretical framing of the phenomena of interest. A methodology is a strategic approach to inquiry that outlines what it is you should focus on, and in general terms how you should approach a particular act of inquiry. There is nothing unique about digital technologies in this regard. Whether experimental, survey, realist, phenomenological or some other methodological framing, there are many different methodologies that can be used in technology-related research. Having said that, given the complexities of technology use, trials and experimental designs need to be very reductive to focus in on a single aspect about which some conclusions might be drawn. Realist methodological framings, on the other hand, are rather more expansive and less reductive in exploring what aspects of technology are more or less useful for different people in different contexts.[26] Indeed, given the complexities and practical focus of health professions education, many methodologies in health professions education are multiple (parallel constructs) or mixed (converging constructs) rather than single construct approaches, and this equally applies to researching technology use.

In selecting a methodology, thoughts should be given to the ontological, epistemological and axiological implications and affordances (see chapters by Cleland, and McMillan):

- Ontology is concerned with what things of interest in your research questions exist, and what kind of things they are. For instance, what does 'using' a particular technology mean? Are you interested in actions, reactions, subsequent application, group dynamics, meaning making or some other construct? Being clear about your constructs is a key step in selecting a methodology.
- Epistemology is concerned with what knowledge you need to answer your research questions, what kinds of knowledge can you collect within different methodological frames, and what knowledge do you want to develop or provide? For instance, data based on server logs, observations and user interviews have different epistemological implications. Epistemology is also concerned with the quality and scope of knowledge one might acquire or develop. If you are more interested in broadly generalisable findings, then larger and more inclusive datasets might be needed. Alternatively, you might be interested in explaining what happened in a single specific context, in which case there are different methodological choices to be made.
- Axiology is concerned with what constitutes good research, what value it has (or might have) and what is ethical. For instance, is it appropriate both scientifically and ethically to oblige learners to use a certain technology, or is it more appropriate to observe or discuss their choices of which technologies (including none) they might choose to use? All methodologies have an axiological frame and are often differentiated based on these values; what is appropriate in one methodology (such as participant opinions) may not be appropriate in another.

Whatever methodological position is taken, it is important not to start with a methodology and work backwards, but to fit a methodology to existing questions and theory. However, translating questions to methodology is a point to pause and reflect on the broader purpose and goals of the research you want to conduct. After all, there are many different purposes for research and many ways to approach scholarly inquiry, each of which has its own norms or paradigms. The METRICS model (Figure 6.3)[27] is one way of considering purposes and domains of inquiry, in part to help orient questions, theory and methodology, but also to note that most acts on inquiry involve more than one domain. For instance, you might synthesise what is known, conduct research to test hypotheses, conceptualise findings in terms of theory and then seek to support the translation of your findings to practice. Being clear about the rules and norms for different parts of a study is as important as understanding those of your methodological framing.

Repositioning research from being an umbrella term for all acts of inquiry to one modality among many (one focused on generating and testing hypotheses and theories) can also help to open up alternative approaches to scholarly inquiry. For instance, an innovation study need not be experimental to be scholarly, but it might well use design-based research techniques[28] in exploring new educational possibilities afforded by new technologies. Similarly, evaluation methods provide a wide range of other ways to explore the impacts, effectiveness and efficiencies of educational technologies.[29]

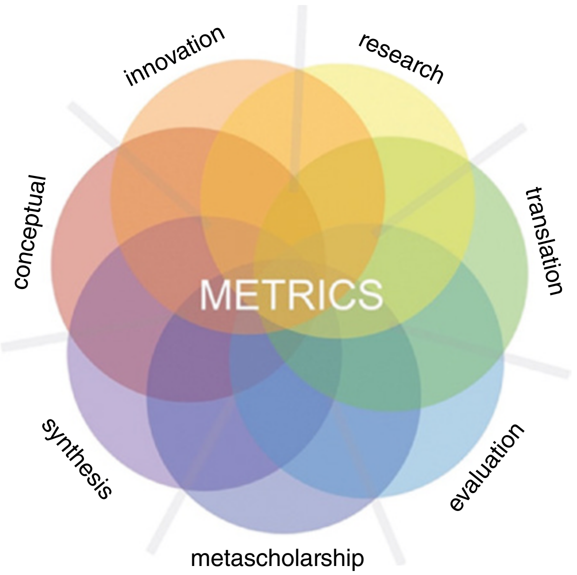

Figure 6.3 The METRICS model of domains and purposes of inquiry.[27]/ PD CC BY SA 4.0 / Ellaway RH et al. Meta scholarship explores how scholarship is conducted and what it generates. Evaluation explores the value of things, typically in support of decision-making (comparative selection, economics, programme evaluation, impacts, accountability). Translation involves moving evidence from other fields/disciplines to health professions education, from one context to another, or from 'bench to bedside'. Research tests and/or generates hypotheses and theories. Innovation explores new things, new ways of acting or seeing, or the results of change. Conceptual focuses on theories, models, frameworks and philosophies. Synthesis focuses on reviews and histories of various kinds.

Study designs and methods

A study design is like a curriculum, it sets out a structured and connected set of methods focused on a common set of goals or outcomes. Study designs should flow from the selected methodology, and they should be complete (all the steps required to successfully complete a study), coherent (each part aligns with every other), feasible (doable within available means) and logical (cumulatively the parts can deliver a successful outcome). There is (or at least there should be) an intimate relationship therefore between methods and study design.

Some methods are common to many methodologies, such as sampling and recruitment, while others are more methodology-specific, such as data collection, data handling, data analysis, synthesis of findings etc. These are well-described elsewhere in this volume and in other research guides. However, while there are few if any digital methodologies (their being largely conceptual rather than practical), there are some digital methods that can be used in research.

The first of these is to use data generated by technology use. Most devices and systems automatically generate logs of their use and this tracking data (assuming the data are accessible) can be used in many ways in research.[30] However, while any action that the technology can detect can be added to the data stream, technology clearly cannot collect data on things it cannot detect. Some thought is required, therefore, to whether records of clicks and key presses equate to useful data about the phenomena of interest. The representativeness of tracking data can be further complicated if participants are aware the data their activities generate is being used for research purposes and their actions become artificial or even reflect attempts to game the system. Data can also be gathered using digital technologies that are specifically designed to support research. This might include biosensors for skin galvanic response, heart rate and temperature, biophysical sensors such as eye-tracking systems,[31] haptic devices and accelerometers for motion detection, and so on. That many of these sensors are built into technologies such as smartphones and smartwatches or can be constructed easily and cheaply using platforms such as Arduino or Raspberry Pi indicates how digital technologies open up new data gathering possibilities.[32] Finally, digital technologies afford many opportunities to observe or interact with subjects, and to record what happens. Indeed, it is rare for digital text, audio, or video not to be the primary medium of data capture and management in contemporary research.

Finally, although the use of big data techniques in education remains a relatively elusive aspiration (in large part because of the small amounts of data we collect and the heterogeneity of this data), data science is a growing area of interest in professional education, particularly where data from clinical, socioeconomic and other domains can be combined with educational data.[33] In some cases, educators do have larger datasets (for instance from admissions and in-programme assessment) while many agencies collect data from across education systems (for instance from licensure examinations or from accreditation cycles) that might be analysed in this way. The other (almost impossibly) large data set that can be drawn on is the Web. Whether it from be medical school websites, social media (at least that which is accessible) or content providers (such as Wikipedia and YouTube), there are unquestionably vast volumes of data that might be used. The question as to whether these data have any real use in health professions education sciences needs to be answered on a case-by-case basis.

A significant departure in the new data science is its focus on pattern searching with a relatively vague hypothesis, at least initially. Once a pattern is identified, hypotheses can be firmed up and confirmational analyses conducted. Returning to Figures 6.1 and 6.2, this is an alternative to the problem-gap-hook-research question initialisation of a research cycle, replacing it with pattern-hypothesis-research question framing. As an emerging area of research that is dependent on many conditions that are not well-represented in contemporary health professions education science (large data, appropriate modelling tools and theories etc.), it is hard to predict what role big data will play in this field going forward.

Conclusion

In this chapter, I have neither listed specific technologies nor outlined specific methodologies or study designs. Using technology in health professions education has so many possible forms and variations, let alone so many perspectives that might be taken on exploring this variety, that the most I might say is that anything is possible. Rather, I have emphasised the logic of asking better questions about technology use, linked this to the use and variety of theory that can be used to frame both subjects and approaches to inquiry, and linked these to selecting methodologies, study designs and methods.

Given that most research today is conducted using digital technologies that allow us to work with our digital data, the medium truly is the message. Asking good questions is not only a matter of robust interrogation of the phenomena we are interested in, it also requires us to think about the impact of digital technologies on the research processes we engage in and the products we generate. Many technologies offer a great deal of convenience and efficiency in conducting research, and yet this may be at the price of the researcher's craft skills and the ability to account for the processes and decisions technologies undertake on our behalf. After all, how many researchers understand the mathematical basis of a Cronbach's alpha, even though they use the test as the basis for the knowledge claims they make? That we seem to be on the threshold of artificial intelligence being able to take on more of the 'burden' of data capture and analysis should also give pause for thought, not least on what trade-offs we already make but also what more we might yield for the sake of an easier life.[34] As researchers, we should always appraise the tools, whether theories or technologies, that we use, to ensure the rigour and accountability of the work we produce.

My last high-level concern is with respect to deep change. Using technology often changes our underlying value systems, beliefs, and social arrangements, albeit in ways that cannot be predicted and that may go unnoticed. Gordon Graham argued that:

> *Technological innovation cannot and should not be regarded merely as an improved means to a pre-selected end, because, while some technology merely modifies, other technology transforms.*[35]

If the presence of technology in health professions education is inevitable and even inescapable, then the meta question that we should really explore is how technology use in general is changing health professions education. This is reflected in Woolgar *et al*.'s maxims of digital technology use:

> *The uptake and use of . . . technologies depend crucially on local social context. The fears and risks associated with new technologies are unevenly socially distributed. Virtual technologies supplement rather than substitute for real activities. The more virtual the more real. The more global the more local.*[36]

It is the macro cyborg question of what we become when digital technology underpins so much of what we do that has yet to be properly addressed and yet lurks in every study we undertake. I argue, therefore, that we need to be more attentive to what research becomes and what we as researchers become in an ambiently digital world.

In closing, I return to the point I made earlier, that all health professions education and health professions education research can be seen as forms of technology (in the wider sense of the term). Of course, it might be argued that this becomes a hopelessly recursive or meta line of argument. However, I would argue that not only is technology use not a discrete phenomenon, its ambient presence within health professions education and health professions education research, with all the dependencies and morphogenic influences this brings, requires a deeper and more critical reading of what technology and technology use are, how they are entangled with everything we do, and how we have changed and continue to change in the face of the ambient use of digital technologies and systems. It is not a coincidence that some of the richest and most powerful corporations and individuals in the world today are in IT. What this means for health professions education today and tomorrow is one of the most important questions we have yet to answer in our field.

Practice points

- Clarity is required over what technologies are involved, who is using them, to what ends, and in what contexts.
- Research questions should be carefully crafted and should inform directions and choices regarding methodologies, study designs, and methods.
- There are no entirely digital research methodologies, but there are many digital research methods.
- There are a great many theoretical orientations to researching technology use in health professions education, each of which has implications for what is researched, how it is researched, and the kinds of evidence that research might generate.
- Technologies are deeply transformative, and researchers should be mindful of what we become, and what health professions education becomes in the context of widespread technology use.

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7 Power analyses: planning, conducting and evaluating education research

R. Brent Stansfield and Larry D. Gruppen

Steve taught a course for several years and his students have found the course material to be difficult. Last summer, he developed a new learning module – readings, exercises and intermittent quizzes – to help his students. He thinks the module is having a positive effect: his current crop of students is performing better than his previous cohorts and he would like to publish a paper demonstrating its effectiveness. He has 35 students' exam performance from last year (without the module) and the current 35 students' exam performance (with the module). He knows he will need to perform an independent samples t-test, but he does not know if he has enough data to publish the results. If it is not enough, he can gather more: he can ask the school administrators for prior years of no-module student performance and he can collect more with-module data in the coming years, but he would rather not delay his publication unnecessarily. How many student records will Steve need for those statistical tests to give him reliable answers?

As discussed in this book (Chapter 1), quantitative research inherently involves statistical analysis of numerical data. Power analysis is an important step in deciding how many subjects or data points are needed in a quantitative study. Power analysis helps ensure your study is planned adequately to find effects such as the impact of an intervention, an educational outcome or the relationship between variables. You may remember from Chapter 1 that quantitative research is planned in detail in advance of a study commencing, and power calculation (for instance, determining the necessary number of subjects) is a critical step in the methodology of any quantitative study. If you are applying for funding for a study, power calculation will be one of the specific methodological points looked for by grant committees, as it will be at the other end of the research process when you write up your study and it is peer-reviewed for publication.

Therefore, why is it important to calculate power? The purpose of power analysis is to focus on the size of your effect, which helps you understand and communicate its practical significance.[1] If a study is 'under-powered', and the results are negative (for example, a randomised control trial that found no difference between the treatment and control groups), then the question will always remain whether the lack of effect was due to insufficient numbers rather than anything to do with the ineffectiveness of the intervention.

Hopefully, this example makes clear the importance of conducting power analyses before you collect or analyse statistical data, then compute and report effect sizes with confidence intervals when publishing your results. Thus, the aims of this chapter are to familiarise you with the basic concepts that underlie power calculation so that you can improve the effectiveness of your own educational research and communicate more clearly the strength of the effects you find.

Going back to the example given at the beginning of this chapter, a *power analysis* gives you the answer by *estimating the number of measurements necessary in order for a statistical test to have a particular chance of finding a study effect of a particular size*. There are four components of a power analysis:

1 the effect size;
2 the probability of Type I error;
3 the probability of Type II error;
4 the sample size.

1 The *effect size* is the strength of the relationship or effect that you are examining in your study measured in statistical units (standard deviations or percentage of total variance). For Steve's learning module study, the effect he is interested in is the difference in exam scores between the intervention group (with-module) and the non-intervention group (no-module). There are several estimates of effect size, and we describe the most common in the following sections. Smaller effect sizes are harder to detect and require more subject measurements in order to be detected.

2 The *probability of a Type I error* is conventionally set at 5% (0.05). This is the probability of

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(incorrectly) finding a statistically significant effect if, in reality, there is no effect. This probability is named *alpha* (α) and it is what we compare the *p*-value of our statistical test to when determining statistical significance. If Steve's learning module is not effective, any *t*-test he uses to test its effectiveness has a 5% chance of giving him a statistically significant finding anyway; this finding would be a false positive, which is called a Type I error.

3 The *probability of a Type II error* is the probability of NOT finding a statistically significant result when the effect you are testing actually DOES exist. This probability is named *beta* (β), and it is the complement of what we call *power* ($1-\beta$). Beta is conventionally set at 20%, which means 80% is considered adequate power. An experiment with β = 20% (0.20) for a given effect size has 80% power for that effect size and therefore an 80% chance of yielding a statistically significant statistical test for that effect if it exists. If Steve's learning module actually improves student performance with a medium effect size (around 0.5 standard deviations) then his *t*-test with 35 students per group gives him 80% power for that effect size. That means that he has a 20% chance of NOT finding a statistically significant effect despite the effectiveness of the module; this finding would be a false negative, which is called a Type II error. The effect is there, but Steve did not find it: if he claims the effect is not there, he has erred.

4 The *sample size* is the number of participants in your study. More participants give you more power. The smaller the effect size, the larger the necessary sample size must be to have adequate power to detect the effect.

These parameters are all related mathematically. Once you define three of these parameters, a power analysis will calculate the value of the fourth. Since the first two of these parameters are typically set by convention (α = 0.05 and β = 0.20), you will usually need to determine or estimate one of the last two yourself. For Steve's learning module study, you already know the sample size: 35 students per group. Therefore, you can take that sample size, set power at 0.80 and alpha at 0.05 and do a power analysis to estimate the smallest effect size you could detect.

Because Steve has a two-group design and wants to run a *t*-test, he can use Cohen's *d* as his effect size estimate. Cohen's *d* is the effect size of the difference between two samples. It is the ratio of the difference between the group means to the within-group standard deviation. Cohen assigned a rule of thumb

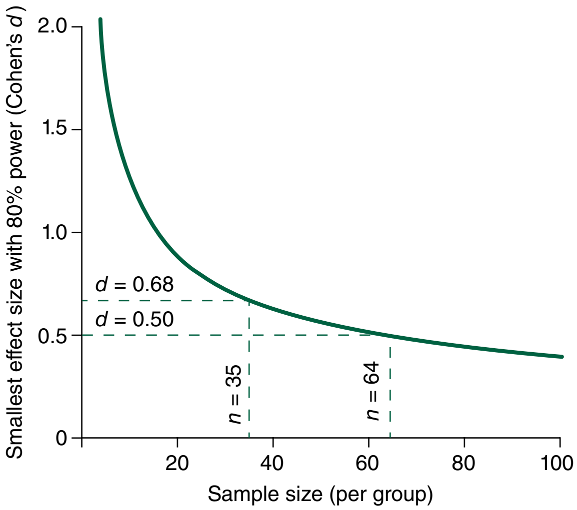

Figure 7.1 Smallest effect size detectable with 80% power for sample sizes up to 100 per group

for interpreting this effect size: a small effect is around d = 0.20, a medium effect is around d = 0.50 and a large effect is around d = 0.80.[2]

The curve in Figure 7.1 shows the smallest effect Steve has 80% power to detect (with α = 0.05) as a function of his sample size (number of students per group). Larger samples allow him to detect smaller effects with that given level of power. Steve can use that chart to see that his sample size of 35 gives him 80% power to detect an effect of d = 0.68.

If he suspects that the real effect size of the impact of his learning module is smaller than that, he can set alpha and power at the same levels (5% and 80%, respectively) and define the smallest effect size he is interested in detecting and then do a power analysis to calculate the minimum number of students in each group he will need: his required *sample size*. Let us say he thinks the real effect size is medium (closer to d = 0.50). He can trace the curve in Figure 7.1 and find he will need 64 students in each group to achieve 80% power. In that case, he should wait another year and test another 35 students with the module and ask his administrators for another year of old non-module test scores.

Let us say that Steve's learning module in reality has a medium-size positive impact on student learning; it improves a classes' mean exam score by half of a standard deviation (d = 0.50). If Steve neglects to conduct a power analysis and simply runs his *t*-test on the easily available data (n = 35 students per group), he will only have 54% power: there will be a 46% chance that his test would be non-significant despite the actual efficacy of his intervention. This Type II error would be tragic: a non-significant result is likely doomed to never be published and Steve may conclude (falsely) that his learning module is ineffective. The power analysis would show Steve that doubling his sample size will greatly reduce the chances of making this error.

Compute and report effect sizes with confidence intervals

Let us fast-forward a year. Steve wisely conducted his power analysis and decided to double his sample size. He now has 70 students in each group. He conducts his t-test and finds that students with the learning module score statistically significantly higher than those without ($p < 0.05$). He looks at the means and standard deviations of the groups and calculates his observed effect size: $d = 0.60$. There is a true effect size – if he could run an infinite number of students with and without his learning module, he would find precisely how much the module improves students' test scores. The results of his study, with only 70 students per group (much smaller than infinity), yields an estimate of that precise amount: his observed effect size has some uncertainty associated with it. This uncertainty comes from numerous factors (age, gender, educational background of the students, random variation in their mood and attention on the day of the test and myriad other factors too many to account for), and if he were to rerun the same analysis using different groups of students, he would certainly get somewhat different effect size estimates. The true effect size is probably not 0.60, but some value somewhat higher or lower than what he observed. Because of this, when reporting effect sizes, we should always report *confidence intervals* around them. Confidence intervals are essential to any report of observed study results.[3] Confidence intervals tell you just how precise is the estimate of a given statistical parameter obtained from a study.

The confidence interval provides us with the range of values of d that are likely to reflect the true effect size. Specifically, the 95% confidence interval around $d = 0.6$ may be as low as 0.4 and as high as 0.8. In other words, any value of the true effect size inside the confidence interval would be more than 5% likely to yield the effect size we observed. It is important to remember that the confidence interval is NOT a region where the true effect size is 95% likely to be. It is instead a range of true effect sizes that make our observed data reasonably plausible. A 95% confidence interval ranging from 0.3 to 0.5 indicates that if the true effect size were anywhere outside that range, there would be less than a 5% chance of a data set yielding the effect size estimate it did.[4]

This example also illustrates the connection between confidence intervals and p-values in statistical testing. In the logic of Null-Hypothesis Significance Testing (NHST) we determine whether observing a d of 0.60 is sufficiently unlikely (probability of 5%) given that the true effect of the intervention is zero (the null hypothesis). If so, we can reject the null hypothesis that the true effect is zero. The confidence interval lets you make that very same judgement by examining whether the null hypothesis (no relationship, difference between two means = 0.0, etc.) is included in the confidence interval. In the case of the 95% confidence interval from −0.1 to 0.7, the null result (0.0) is included in that interval, then a true effect size of zero could plausibly yield our observed results and so you should NOT reject the possibility that the true correlation is zero: your statistical test is not 'statistically significant'. In contrast, the 95% confidence interval of 0.1–0.5 does not contain 0.0; hence, this study would let you conclude that the observed results are unlikely to have occurred ($p < 0.05$) if the true effect size was zero.

Reporting an effect size with a confidence interval in your published research allows your readers to compare your results directly with those of others. Steve's estimated effect size of $d = 0.60$ (95% CI 0.40–0.80) might be larger than his colleague's result, who tried a similar learning module without intermittent quizzes: his colleague may have found $d = 0.45$ (95% CI 0.30–0.60). This information helps researchers generate new hypotheses (for instance, that intermittent quizzes are an important component for learning modules). If Steve and his colleague had merely reported their t-tests and statistical significance, no such comparison could be made and they might not think up the hypothesis of the importance of intermittent quizzes.

Cohen's d is standard for two-group designs like Steve's. It is directly comparable to other effect size measures that are in units of standard deviation. For instance, Steve's colleague might have asked her students how many hours they spent using the learning module and computed Pearson's r to measure the effect. Since r is a standardised, unitless measure, it can be converted into d, so that Steve and his colleague might compare results directly. The conversion is direct: $d = 2r/\mathrm{sqrt}(1-r^2)$.

More complicated study designs require a different type of effect size measure, one that measures the percentage of variance explained by your model. Eta-squared (η^2) is the most common of these. Others you might encounter include omega-squared, *f*-squared and *R*-squared. These are all computed a bit differently, but they are all estimates of effect size that range from 0 (the model explains none of the variance) to 1 (the model explains all of the variance) and all of these can be reported with confidence intervals.

Therefore, how does one report the results of a study that provides more information than the traditional $p < 0.05$? The fundamental recommendation is to report each of the elements identified earlier. Note that:

- Alpha, sample size and power are often provided in the Methods section.
- The effect sizes and confidence intervals are typically reported in the Results section.

The more visible consequence of following these guidelines will be the demise of reporting the observed *p*-values (e.g., $p < 0.0035$ or $p < 0.0001$) and, instead, simply reporting the criterion *p*-value (typically $p < 0.05$ or 0.01) and signify which of the observed results meet that criterion. The second consequence will be the inclusion of effect size measures and associated confidence intervals. By including this information, the reader has a better understanding of the clinical significance and therefore the real-world implications of the effect.

Table 7.1[5] illustrates these practices. The overall *p*-criterion is 0.05. The observed mean values for the outcome measures (types of errors) are reported along with variance measures (standard deviations) and the observed differences in means. The effect sizes are reported as the proportion of variance accounted for in each outcome measure. Confidence intervals provide information on the precision of each of these estimates. The criterion *p*-value (0.05) is provided as a footnote and applies to all the variables in the table.

As an example of how power analysis and confidence intervals help us understand the results of a study, we can look at a published research article, such as the vast majority of published articles, that contains neither. A published study described the efficacy of training physicians in patient-centred communication.[6] They used a short form of the training with which they successfully trained 15 physicians and measured another 15 as a control group. They also used a long form of the training with which they trained 20 physicians with no control group. Each physician was measured twice: shortly before the training (or lack of training for the control group) and a month later. The primary measure was a coding of the patient-centredness of their communication derived from audio tapes of five real patient interactions; the coding generated several scores for the incidence of various patient-centred communication behaviours (asking open-ended questions, psychosocial talk, etc.).

One of their planned comparisons was of the change from pre- to post-training communication scores between the 15 short-training physicians

Table 7.1 An example of reporting effect sizes with 95% confidence intervals

Error	Mean (SD) frequency per student			
	Intervention group (n = 30)	Control group (n = 53)	Mean difference (95% CI)	% variance accounted for (95% CI)
Lack of medical subject headings (MeSH) explosion	0.7 (0.8)	1.3 (1.0)	−0.6 (−1.0, −0.2)*	7.7 (0.9, 18.8)
Missing MeSH terms	0.7 (0.8)	1.2 (0.9)	−0.5 (−0.9, −0.1)*	6.8 (0.3, 18.8)
Lack of appropriate limits	0.8 (0.7)	0.9 (0.5)	−0.1 (−4 0.2) 0.2)	_†
Inappropriate Boolean operator/failure to combine all relevant search concepts appropriately	0.7 (0.7)	0.6 (0.5)	0.1 (−0.2, 0.4)	_†
Failure to search for best evidence	0.4 (0.5)	0.7 (0.5)	−0.3 (−0.5, −0.1)*	7.7 (0.9, 18.8)
Missing one or more concepts	0.6 (0.6)	0.7 (0.5)	−0.1 (−0.3, 0.1)	—†
Inappropriate limits	0.2 (0.4)	0.3 (0.5)	−0.1 (−0.3, 0.1)	—†
Search inefficiency	0.1 (0.3)	0.3 (0.3)	−0.2 (−0.4, −0.1)*	5.5 (0.9, 18.8)
Incorrect search terms	0.1 (0.3)	0.3 (0.4)	−0.2 (−0.4, −0.0)*	3.6 (0.1, 12.90)
Total search errors	4.4 (3.3)	6.2 (2.8)	−1.8 (−0.4, −3.2)*	7.6 (0.4, 20.6)

Types and frequencies of search errors in the post-elective searches of 83 fourth-year medical students in an evidence-based medicine elective. University of Michigan Medical School. Ann Arbor, Michigan, 2001–2003.

* $p < 0.05$, independent *t*-test.

† Percent variance and confidence intervals are not computed for differences that are not statistically significant.

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and the 15 control physicians. They used an independent samples t-test to compare the pre- to post-training change in various communication scores of intervention and control group physicians and reported no statistically significant results. While they did not report a power analysis, their power can be computed: an independent samples t-test with 15 subjects per group has 80% power to detect an effect of $d = 1.06$ or greater. This is a very large effect size, and so we would not expect statistically significant results if the training had only a small or even moderate effect on physicians' communication behaviour. Thus, the negative finding is not surprising and contains little information about what the true effect size might be, other than the fact that it is probably smaller than one standard deviation.

Another of their planned comparisons was to compare all three groups (control, short-training and long-training) on various aspects of patient-centred communication. One of these comparisons found that the 20 long-trained physicians increased their use of open-ended questions (the mean pre- to post-training difference was 4.5) more than the 15 short-trained physicians (mean difference was 3.0) and controls (mean difference was 3.2). This effect, tested by one-way analysis of variance (ANOVA) had a p-value above but close to alpha ($F = 2.8$, $p = 0.068$) and hence was declared non-significant. Using the group means and the sample size, we are able to reverse-engineer the statistic[1] and find that their observed effect size was around eta-squared = 0.106. For percentage-explained effect size measures, this is a moderate-to-large effect and could have been reported as such. Instead, the authors reported the non-significant difference and that 'there was some indication that long-program physicians engaged in more asking of [open-ended] questions'.

The aforementioned patient communication article describes a possibly powerful communications skills training tool, but a power analysis would have informed them that their sample size was too small to find statistical significance for all but very large effect sizes. In light of their low power, they could have reported their observed effect size estimates with their wide confidence intervals in addition to (or instead of) their significance tests to better demonstrate the potential efficacy of the tool. However, they are only able to report very unstable estimates of their tool because of their paucity of data and the 95% confidence intervals for many of their observed estimates include zero – a complete lack of efficacy of their training tool – as a plausible true effect size.

Practicalities and pitfalls

Hopefully, the previous section has demonstrated the importance of power analysis and sample size calculations in any type of quantitative healthcare education research. One question new researchers often ask is whether or not they should or could go ahead with a study without the necessary sample size to be likely to detect an effect. For example, if you need data from 100 people in each arm of a trial to detect an effect but there are only 50 people per arm available to you, is the study still feasible? We would strongly advise against going ahead with such a project. Your results are likely to be inconclusive and uninformative. Moreover, it is unethical to trouble subjects and waste limited resources in the service of collecting insufficient data; this work will very likely not yield fundable projects or publishable results. In such cases, go back to your research question and consider if another type of study design will provide more statistical power with the same sample restrictions.

One way to improve statistical power is to choose a more reliable outcome measure. Remember that the denominator of the effect size is the unexplained variance in the model. A more reliable measure will have less unexplained variance, making the denominator smaller and therefore the effect size larger. This will increase your observed effect size and thus your statistical power for detecting this larger effect. For instance, if the authors of the patient communications article cited earlier had pooled their various measures of different types of patient-centred communication into one more stable estimate of overall patient-centredness, they might have reduced their measurement error and thus increased their observed effect sizes. If they had reduced their residual variance of the one-way ANOVA cited earlier by 10%, their observed effect size would have jumped to eta-squared = 0.116 and would likely have been statistically significant.

[1] To do this, we need to determine the degrees of freedom of the F-test, which are 2 df for the model (the number of groups minus 1) and 47 for the residual (50 subjects minus 1 minus the number of model df).We then determine the mean-square term of the model as a variance of the model parameter estimates (group means iterated by group sample sizes) and use that to determine the mean-square of the residual (since F is the ratio of the model mean-square to the residual mean-square). These mean-square terms are multiplied by the degrees of freedom to determine the sums-of-squares for the model and the residual. Eta-squared is the proportion of the model sum-of-squares to the total sum-of-squares.

If you are comparing across sites (e.g., comparing the impact of tutor training, where the tutors under study work across a number of different campuses), then you may use a particular type of randomised controlled trial to do so: the cluster-randomised trial.[7] These are very common in healthcare research. In this type of quantitative design, the power calculation has to take into account the possible influence of site as well as the qualities of the primary outcome measure.

Conclusion

Finally, you may be relieved to hear that there is plenty of guidance available as to how to plan power analyses. Cohen[2] is the seminal reference. The Internet is a good source of resources and there are many online tools that allow you to choose a statistical test, plug in parameters and solve for the one you want (the necessary number of subjects or the statistical power of a given sample size for a given effect size). As stated by Cleland earlier in this book, statisticians are key colleagues when planning and analysing quantitative research. Seek statistical advice on power calculations and analysis and indeed on all aspects of the research planning early on: this will save much time and angst later in the research process.

Practice points

- Estimating effect size and computing power are important aspects of study design and help avoid Type II error.
- Whether determining an adequate sample size for an estimated effect size or determining the smallest detectable effect size for a given sample size, power analysis informs the researcher about the likelihood of finding statistical significance.
- Reporting the size and confidence interval of an observed effect communicates the strength of the observed effect in a way that is easily comparable with results from other studies.
- Together, power analysis and effect size reporting improve the efficacy of research and the usefulness of the literature for understanding the clinical significance of findings and of comparing findings between studies.

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8 Navigating health professions education research: exploring your researcher identity, research area and community

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'I am a health professions education (HPE) researcher who had a rather oscillating professional career trajectory. I started off as a general practitioner but soon realised that clinical work was not as fulfilling to me as I had hoped. Exploring alternative career paths, I came across HPE, about which I did not know much at that time. To get a flavour of this field, I participated in a certificate programme. The more I delved into HPE principles and practices, the more I found this field interesting. Eventually, I decided to say goodbye to clinical practice and moved to become an educationalist. As a newbie in the field, however, I experienced an identity crisis, and questioned if I was the right fit. I neither had sufficient research experience nor was sure of the area where I should do my research work. Adding fuel to the fire, I could not find sufficient opportunities to develop my research skill set because the field itself was still evolving in my native country. It was at this moment when I decided to invest my efforts in pursuing higher education in HPE. This afforded me opportunities to conduct independent and high-quality research, collaborate with high-profile scholars, and ultimately to publish my scientific work. Higher studies also gave me a sense of direction in which I would like to continue my research journey. To extend my engagement with others in the field, I started networking within the international HPE community using platforms such as social media, international conferences and special interest groups. With consistent efforts, dedication and focus, I honed my research skill set, and all these experiences shaped my professional identity. Together, this helped position myself as a new researcher with a promising career ahead of me in the HPE community.'

As this personal story shows, starting as a researcher in a new field comes with challenges and opportunities. This chapter provides an introduction for those who are considering or who have (just) started to engage in research in the field of education, and specifically, health professions education (HPE). The chapter is structured around three questions:

- Why are *you* doing research?
- Why are you doing *this* research?
- *Where* are you doing research?

Before discussing the relevance of these questions and the elements that we consider of importance when thinking about one's position with regard to these questions, we start with a brief description of health professions education as a field of research.

Simpson suggested that health professions educators are tasked with engaging in educational scholarship in such a way that it can inform our practice and that of our colleagues (current and future), as well as HPE as a discipline.[1] HPE research is part of a complex landscape of people, organisations and governments that have an interest in educating healthcare workers. As Swanwick explains, this is a space in which 'academic journals vie for attention, institutions and professional bodies compete for political leverage, and the wheel of reform and "improvement" revolves faster than, and often independently of, the cycle of evaluation and research'[2] (p. 3). Research in medical education and health professions education more broadly originated in the mid-1950s. Around that time efforts started to systematically study innovation related to HPE in North-American medical schools.[3] Since then, HPE research has grown into a worldwide field of research that includes people with many different backgrounds, including healthcare practitioners, educators, educationalists, psychologists, biomedical scientists, sociologists, anthropologists, linguists, statisticians and librarians. The field is developing globally in diverse directions, in response to different challenges and at various rates.

Researching Medical Education, Second Edition. Edited by Jennifer Cleland and Steven J. Durning.

Research in HPE serves a dual purpose. One is an applied purpose of helping to ensure high-quality education, addressing various educational problems and developing innovations to improve the education of healthcare professionals. The other purpose is to contribute to a collective understanding of a range of challenges and issues society faces when investing in educating health professionals. We could refer to this as middle-range theory-building. Robert Merton, a twentieth-century sociologist, used the term middle-range theory-building to refer to theories that result from the iterative process of research that builds on previous research to give rise to (or refine) conceptual models[4] (the value of mid-range theory is discussed further in the chapter by Nicholson and colleagues). Gradually, over the past 70 years or so, HPE research has developed as a science in its own right by covering the breadth of the spectrum that connects these two purposes. In essence, the science of HPE can be seen as applied theory building. Lynham explains that the role of a researcher in applied theory-building is to be a theorist who can interact with and 'be influenced and informed by both her or his experience of the phenomenon in practice and her or his acquired knowledge/mastery of the phenomenon in theory'[5] (p. 228).

Despite its development in this rich landscape of stakeholders and diverse influences from a variety of scientific domains and with various research experience, HPE research has been critiqued on a number of points. Albert and colleagues interviewed 'influential figures' in the field who stated that 'studies tend to be both redundant and opportunistic and researchers tend to have limited understanding of both theory and methodological practice from the social sciences'[6] (p. 103). Others have critiqued the lack of theory or the inappropriate use of theory in HPE research.[7,8] Regehr argued that the evolution of HPE research would benefit from shedding assumptions associated with traditional physical sciences.[9] Instead of searching for 'proof' that something works, education research should focus on understanding how it works and – instead of striving for simplicity in our educational approach and research explanations – the field of HPE research should aim to represent complexity well.

In summary, HPE research is a relatively young research field that is dynamic, evolving, critical about its own accomplishments, globally diverse and both practical and theoretical. Understanding this is a helpful first step when considering why *you* want to do *this* research within your *context*.

Why are *you* doing research?

At this point, having explored the HPE research landscape, we turn our attention to *you* as a researcher in HPE. Our assumption is that if you are reading this chapter you are, at the very least, interested in asking questions that are of educational relevance, and seeking answers for those questions. Adopting a scholarly approach to our teaching, ensuring that our practice is informed by an existing body of knowledge, is central to providing a meaningful learning experience for our students.[10] However, we may find that simply aligning our teaching with what is argued for in the literature is less than satisfactory. Questions of our own arise and we may wish to find ways to answer them that will be relevant for our particular context. In the opening vignette the author suggests that many who decide to embark on HPE scholarship will often already be established researchers in a particular (health sciences) discipline holding a strong disciplinary identity that is rooted in its particular norms and values, and ways of constructing knowledge.[1,11] Moving into the educational space requires us to take on a different mantle, that of educational scholar, researcher, scientist – thus a new identity which in turn is rooted in a rather different set of norms and values, and where knowledge might be constructed quite differently. This shift is often experienced as challenging by health professionals as they seek to integrate this new identity into their existing identity as clinician or biomedical scientist.[12]

Adopting the educational scholar identity

Identity is a slippery term, and one which cannot be explored in depth within the confines of a few paragraphs. However, in the context of HPE, focusing on the development of a physician identity provides useful insight, emphasising both an individual (cognitive) and a social (relational) dimension.[13] The extent to which we exercise our individual agency in a particular context will, therefore, shape our identity journeys. This suggests a level of intentionality as we move to 'become' researchers in HPE. Social realist Margaret Archer[14] has argued that identity formation occurs through the personification of a particular role and in the context of this discussion, therefore, acknowledging one's role as educational scholar becomes central to this becoming. The social or relational dimension, however, suggests that this intentionality should extend to immersing ourselves and participating actively in this new, initially quite alien, disciplinary space.[15] It should also be noted that the strength of an individual's researcher identity has been highlighted as a key mechanism in enhancing research outputs.[16]

But why is this conversation important, why is it necessary for more of those of us who are responsible for training our students to take on the educational scholar role? It has been argued that scholarship is central to the work that we do as academics in the health professions, and this thinking has strengthened through the years.[17,18] In 2011, Ringsted and colleagues argued that research in HPE is much needed 'to deepen the knowledge and understanding of learning and education . . .' and called for 'a scientific approach to innovating medical education practice'[19] (p. 696). It thus becomes incumbent on each of us to take responsibility for constant scrutiny of the field, of what counts as knowledge, of how we educate and how we might make education better. Research in HPE ought to deepen our knowledge and understanding, grow the field and strengthen the theoretical premises upon which our thinking and practice rests. Consciously adopting the identity of an educational scholar is necessary to enable us to 'put our hands on hips' such that we have something meaningful to contribute.[20]

Crossing identity borders

Considering all of what has been discussed thus far, what has catalysed your journey into the HPE research arena and what goals have you set yourself for doing so? To what extent have you embraced an HPE researcher identity as part of this move? Or perhaps you still feel rooted in your primary, disciplinary space? If the latter is your context, then it is likely that moving into HPE research will require you to negotiate paradigmatic borders, as hinted at earlier. While this does not mean that you have to 'sacrifice' one identity to adopt another, it does mean that you will have to deal with complexity, and some cognitive dissonance as you grapple with a new canon, a different body of knowledge. You may need to shed, or at least bracket, long-held assumptions associated with the physical or natural sciences. You will need to acquire a new discourse (predominantly that of the social sciences), grow your understanding of the lay of the land, and grasp the ways of being that characterise HPE research. Deciding about the extent of your commitment to this new field will be important. Some who embark on HPE research look to do so from both sides of the border. This can prove to be demanding, but it can also be a generative and exciting experience as you bring a wealth of knowledge and expertise from your primary discipline into the educational space and engage with educational experts. In that role it will be important that your peripheral participation, on the border, can be regarded as legitimate, particularly if you are hoping to publish and influence thinking.[21] On the other hand, you may wish to journey further, as did the author in the vignette at the start of the chapter. Perhaps you hope to acquire an educational qualification, move from peripheral participation to taking up full citizenship in this new environment. This will require a fair bit of acculturation, 'understanding the enterprise well enough to be able to contribute to it . . . being able to engage with the community and be trusted as a partner . . . to have access to [a shared] repertoire and be able to use it appropriately'[22] (p. 239).

Embarking on scholarly endeavours within the field of HPE is important if we are to enhance our educational practices and grow the field. Research, however, is not easy. Kahn and colleagues[23] (p. 49) describe research as comprising 'work to extend the boundaries of what is known or possible . . . a form of activity that is inherently challenging'. It is careful work requiring diligence and persistence. However, with a clear purpose, a willingness to be open to new ideas and different ways of thinking, your work can not only build the body of knowledge, it can also seek to disrupt it, challenge prevailing ideas and take the science forward.

Why are you doing *this* research?

To take the science forward, a second set of questions to consider when entering HPE research revolves around the focus and relevance of your research: what are you studying and why this particular topic? Focusing your research in a specific direction is naturally connected with your researcher identity. Who you are influences what you study and how you study it. When searching for your topic area, therefore, it is helpful to reflect on the experiences that shaped you into becoming a HPE researcher. Below, we discuss different starting points in a search for focus, which relate to who you are as a researcher. We then connect this with the concept of relevance.

Starting from a practical problem

As noted earlier in this book by Bezuidenhout and colleagues, many studies in HPE originate from problems that are experienced or observed in educational or healthcare practice, particularly by researchers who simultaneously hold teaching or clinical positions. As a clinical teacher, for example, you may observe certain challenges that residents experience when they transition from undergraduate medical education to residency, which sparks your interest to further investigate these challenges, with the ultimate goal of optimising both learning and healthcare during the transition period. Or, as a teacher in a cross-border curriculum partnership, you may notice that the curriculum materials and educational approach that were developed in the partner's setting are not easily applicable in your own setting. This leads you to question how these materials and approaches can be contextualised to better fit with your setting.

In both examples, a problem that exists in practice serves as a starting point for research. To find an appropriate focus of study, however, more is required. Teunissen noted that 'scientific research requires adding a piece of knowledge or insight to issues that transcend local problems that may have led to the research. One's context should not be viewed as the reason for a study but as the practice in which a study can be conducted'[24] (p. 70). In both examples above, a next step is exploring what is already known about these topics. When familiarising yourself with the literature, key questions to keep in mind are: what is already known about my local problem? How is my local problem similar to and different from the research settings in previous studies? What could my local context add to this body of literature? What are the dominant conversations and debates about this topic area in the literature? In order to position your research within the scientific field, it is helpful, as Lingard proposed, to view the literature as a conversation about a topic, and consequently, to consider how your own research can contribute to this conversation.[25] What makes your research relevant to others?

Exploring the literature around a certain topic area can appear overwhelming, particularly for novice researchers, as 'the possibility of "getting lost" is looming'[24] (p. 70). Moreover, as HPE research is a 'vibrant multidisciplinary and paradigmatically eclectic domain where scholars bring their varied disciplinary traditions and vocabularies to the research endeavor [. . .] HPE researchers must read broadly to select the theory that can best inform their research into a particular phenomenon'[26] (p. 989–990). As Teunissen argued, 'recognising that there are many potentially relevant concepts surrounding one's topic of research is both necessary and confusing'[24] (p. 70). According to Teunissen, key preconditions to achieve scientific development are safety and freedom: feeling safe within your team to ask critical and crucial questions about your topic, and to challenge assumptions; and feeling free within your context to explore 'hunches' and new concepts, and subsequently choose from the multiple frameworks, theories and lines of reasoning that could underpin your study. It takes 'trust in your struggle'.[24]

Starting from a paradigm or methodology

Although all research addresses a problem in one way or another, not all research in HPE originates from a researcher's practical experiences as an educator or health professional. Some HPE researchers strongly identify with a particular research approach that serves as the starting point for their investigations, which potentially enables them to shed new light on conversations and debates in the field. This may be particularly applicable to researchers who do not have a teaching or clinical position in the field, and who bring a particular paradigm or methodological approach from their original scientific discipline outside HPE, such as sociology, psychology or engineering. Rather than focusing their research career on one topic area, they may take their paradigmatic or methodological lens as a focus to investigate a wide variety of topics within HPE. Evidently, regardless of the starting point, for each research project the research problem would need to be explored in the literature in similar ways as described earlier.

A paradigm – synonyms being worldview or philosophical stance as discussed by Cleland and McMillan earlier in this book – 'consists of the concepts, practices and language that define a particular approach to science'[27] (p. 687). Researchers that identify with a particular paradigm see the world in a particular way and approach their research topics through this lens. For example, critical theory is a paradigm that aims to make social structure visible through analysing power relations.[28] When researching the topic of transitions in medical education, researchers using a critical theory lens might, for instance, focus on making visible the social structure in the clinical setting, including relations of power and hierarchy, that contribute to challenges experienced by residents. In the example of cross-border curriculum partnerships, critical theorists might focus on the dominance of one partner over the other, and the unintended consequences for students, staff and other stakeholders within the partnership.

Some researchers might identify more specifically with a particular methodological approach, rather than a paradigm in general. For example, you may have specialised in ethnographic research methods, and apply this to all your investigations. In the example of transitions in medical education, you would then observe and shadow residents who are going through their transition period. In the case of cross-border partnerships, you would immerse yourself in the partnership settings to observe and experience the issues at play. Importantly, regardless of your starting point, in order to conduct rigorous research all researchers need to ultimately align their paradigm, methodology and research problem.

Exploring scientific, societal, strategic and personal relevance

Considerations of what you want to study, and why you wish to do so, are inextricably linked with the concept of relevance. Whether your research journey starts from a practical problem, a paradigmatic lens, or something else entirely, in all cases you need to 'hook' readers to your story by convincing them that your particular study is needed[25] (see also the chapter by Lingard and Driessen later in this book). Also named the 'so what' factor, the 'hook' is about presenting a strong argument of why and to whom your study is relevant.[25,29]

Relevance does not have the same meaning for everyone. The same research question (see chapter by Bezuidenhout and colleagues) can have varying degrees and types of relevance for different groups and individuals within different contexts. Hughes Miller and colleagues argued that "[r]elevance is situated in time and place – it depends on the political, sociocultural, historical, technological, and perhaps even epistemological context'[29] (p. Si). In light of the dual purpose of HPE research – applied and theory-building – the distinction between scientific relevance and societal relevance that is often made in the scientific world in general, suits our field naturally. Scientific relevance generally refers to the quality of the study and its contribution to scientific literature and theory, whereas societal relevance refers to the study's potential to impact the field in practice. Evaluation standards for scientific institutions increasingly reflect a high regard for research that is of societal relevance, and even more specifically, societal impact. When searching for your research focus, key questions to ask yourself regarding its relevance and impact are: what is the potential contribution of my study to theory and practice? To whom will my research results be interesting and relevant? And why? In what ways can these target groups be involved in and informed about the research results, so that the knowledge gained can be used in the future?

The relevance of your research can serve as a strong motivation to engage in research. Hughes Miller and colleagues noted that 'particularly when exploring issues of social or societal relevance, researchers develop true passion for an issue'[29] (p. Sii). However, they warn that 'while passion can drive the desire to research certain topics, one's stance as a researcher must remain critical and open to all perspectives and findings'[29] (p. Sii). This may be even more important when you engage in research that is relevant to you personally; for example, because you are directly involved in the phenomenon (e.g., as a teacher, leader, or other direct stakeholder) and the potential impact of the findings on your immediate community. Practicing reflexivity is a key attribute of rigorous research,[30] especially in relation to the personal relevance of your study.

Over a period of time, and related to personal relevance, your strategic involvement in research is another aspect that can guide your search for focus. Building a research career requires strategic decision-making about what projects to participate in and what to decline. While there are certainly HPE researchers who identify a particular area of focus early on and carry it through their research careers[31] – i.e., a programmatic approach – many research projects reach us in more opportunistic ways, for example through collaboration requests. Regehr used the metaphor of 'islands and archipelagos' to describe his own approach to research, which 'has tended to blur the boundaries between programmatic and opportunistic research'[31] (p. 367). While studies that come to you in rather opportunistic ways might be viewed as individual 'islands', you can shape these to collectively look like an archipelago that is connected by 'a conceptual and methodological landmass that sits under the water on which each of the islands are built'[31] (p. 368). In other words, by bringing a consistent set of conceptual and/or methodological lenses to the research work that you do, you can create a programme of research that moves beyond one specific topic area, yet still shows consistency and focus. When determining the focus of an individual study, therefore, consider what the strategic relevance of this project might be for your overarching research programme and career: how does it connect to the archipelago that you are building?

Where are you doing research?

Once you have decided to embark upon the role of a HPE researcher and you have identified the focus of your research, the next important step is to determine the research environment in which you wish to build your research career. A critical evaluation of your research environment is important as it is one of the most influential predictors of the rigour, quality and productivity of your research work.[16] Therefore, while planning your studies, ask yourself: what is the context where you want to conduct your research? What are the contextual support systems available to facilitate the research in your chosen area? What are the barriers that can hinder your research work and how can you overcome these barriers? Understanding your research environment and its associated facilitators and barriers will help you do research in a more systematic, organised and practical manner.

Understanding your research environment

Research cannot be done in isolation; it needs resources and support systems that are usually afforded by your research environment. In this context, environment refers to 'shared values, assumptions, beliefs, rituals and other forms of behavior whose central focus is the acceptance and recognition of research practice and output as a valued, worthwhile and pre-eminent activity'[32] (p. 2). An ideal research environment encourages independent scientific enquiries in pursuit of truth(s) and understanding, which can potentially result in knowledge with a practical impact on society.[33] Ajjawi and colleagues[16] propose that a research environment is a complex, dynamic and multi-factorial entity that is influenced by several individual and organisational factors. At individual level, a researcher's knowledge, skills, attitudes, behaviours and internal motivation are key predictors of research outcomes.[34,35] At institutional level, leadership support, capacity building activities, collaboration opportunities, peer support, infrastructure, funding opportunities, reward/incentive programmes and institutional vision, policy and strategy for research are among the key factors that can influence both the research processes and the outcomes.[16,33,35] When these individual and organisational factors, either alone or in combination, act as barriers, they result in decreased research engagement, reduced productivity and poor quality of research.

As an emerging HPE researcher, you are likely to experience these factors in your career, either as facilitators or barriers. A question that begs an answer is if these contextual factors act as a barrier, how would you manoeuver through these challenges? We propose two broad interventions that can help you overcome these contextual barriers. These are: participating in professional development and building your research community. Below we discuss them individually and help you understand how they can be useful to you in your research career.

Participating in professional development

Professional development – or: faculty development – refers to the set of activities or events that aim at advancing the knowledge, skills and attitudes of the educators in a particular academic domain.[36] Professional development occurs through both formal (e.g., workshops, certification courses, degree programmes) and informal (e.g., peer-assisted learning, mentoring, work-based learning, communities of practice) activities and engagements, and at both individual and group levels. In addition to positively influencing scholarship competency, professional development has also been found useful in shaping the professional identity of the researchers by strengthening their sense of confidence, credibility and self-efficacy.[37,38] Professional development activities designed to advance researchers' skills and expertise lead to a culture of 'extended researcher professionality' cultivated by analytical and reflective practices. Researchers then do not just focus on the topic under investigation but also pay close attention to the research processes. They constantly strive to find and address inadequacies within their research work so that they can meaningfully contribute to scientific knowledge.[12,33] Considering the promising results of professional development activities documented in the literature, we urge you, as an emerging HPE researcher, to make use of these activities within and beyond your institution to grow your understanding of research and engagement in it, and gain confidence to become an effective and methodical researcher.

Building your research community

As mentioned in the opening narrative, it is quite possible that you will come across some challenges and limitations (e.g., lack of peer support, expert guidance, mentoring) during your research career that could lead to a sense of isolation, demotivation and frustration. In such instances, building a collaborative and supportive community of researchers might be valuable for advancing your research goals. A research community is a group of scholars with diverse educational backgrounds, personalities and experiences who share common academic interests and collectively reflect upon values, norms and conceptions of a certain research domain.[39] A research community that is built on professionalism, mutual trust and respect provides the necessary support and sense of belonging to a researcher to make identity transitions and to develop their research capacity, confidence and self-esteem.[40] A research community, however, should be built with care as it demands commitment, time and perseverance. There are different networking strategies that can be used to develop your own research community. Some of the most common networking platforms include social media, national and international conferences, academic research societies and associations and special interest groups.

Digital social media are currently among the most powerful informal networking platforms that can be used to reach out to national and international research communities. Social media platforms such as Twitter, LinkedIn and Facebook are becoming increasingly popular information exchange media amongst the HPE community where scholars broadcast their publications, reach out to recruit study participants, engage in scholarly discussions and critique others' scholarly work. Some studies even suggest that these social media platforms can assist in scholars' digital identity formation and in building communities of practice.[41–43] Research is a creative and spontaneous process, and the connections that facilitate this process should develop naturally. Consequently, research networks developed through informal digital socialisation are often found to be deeper and more sustainable than formal encounters.[44] Proponents of digital social scholarship are also of the view that scholarly use of social media platforms can expand the reach and impact of scholarship and can foster the development of transparent, efficient, effective and equitable scholarship processes.[43]

Another powerful networking activity is participating in national and international conferences. There are many international conferences organised by world-renowned medical education societies and organisations (e.g., the Association for Medical Education in Europe (AMEE), the Association for the Study of Medical Education (ASME)) where scholars from around the globe participate, present their work and engage in scholarly conversations. These conferences offer an ideal platform to develop a broad research network by approaching national and international scholars from cross-disciplinary and multi-disciplinary backgrounds. Conferences are also a useful medium to immerse yourself in the latest scholarship trends as well as receive limelight from the research community by presenting your own research work. We encourage you, as an HPE researcher, to make use of these platforms to develop a vibrant, diverse and productive research community to overcome contextual barriers and to successfully achieve your research goals.

Interrelated questions and intentional answers

The personal story at the start of this chapter is based on the actual experiences of an HPE researcher. In this story, we can recognise the researcher is grappling with the three questions that formed the basis of this chapter. Moreover, we can see how the questions are interrelated. The researcher in this story moved into HPE research because she felt her professional identity did not match with her clinical work environment. In her newly chosen field, she had to negotiate a new identity; initially, one that combined her clinical and research work, and later on, one that was situated in a fulltime HPE research career. This newly embraced identity led her to intentionally explore a new scholarly community by engaging in a degree programme and participating in networking opportunities at national and international level. This furthermore guided her choices about which topic area to investigate and how to define the relevance of her research work. In turn, that added to her professional identity formation and her community building.

As emphasised in this chapter, HPE research careers come in many different shapes and sizes. It is likely that you recognise some of the experiences in the vignette, yet it is even more likely that your experiences differ in other aspects. For example, unlike the researcher in this story, we argued that many HPE researchers continue to 'live on both sides of the border', requiring them to sustainably integrate their educational scholar identity with their clinical or biomedical identity. Or, unlike the researcher in this story who had to struggle hard to access resources to develop her research skills, you may be fortunate to be placed in a well-facilitated and well-funded research environment. Regardless of your context and your journey into this field, however, you are likely to experience challenges as well as opportunities. If you approach your familiarisation and engagement with the field of HPE with intentionality, some of these challenges might be mitigated, and in that process, opportunities might be created or amplified. One way of being intentional is to ask yourself the three interrelated questions as described in this chapter, revolving around who you are as a researcher, what you want to investigate and what your research context and community look like. We hope that seeking connections and alignment in your answers to these questions may support your successful establishment as an HPE researcher.

Practice points

- Health professions education (HPE) research is a relatively young research field that includes researchers with many different backgrounds and is dynamic, evolving, globally diverse and both practical and theoretical.
- To position yourself within and contribute to HPE research, it is important to be intentional about your researcher identity, your topic area and your research community.
- Moving from a clinical or biomedical discipline into the educational space requires taking on a new identity – that of educational scholar – which is rooted in a rather different set of norms and values.
- Considerations of what you want to study, and why you wish to do so, are inextricably linked with the concept of relevance, which includes scientific, societal, strategic and personal relevance.
- Understanding your research environment and its associated facilitators and barriers will help you do research in a more systematic, organised and practical manner.

Recommended reading

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Lingard, L., & Watling, C. (2021) *Story, not Study. 30 Brief Lessons to Inspire Health Researchers as Writers*. Cham, Switzerland: Springer Nature.

A helpful series to further discover paradigms in medical education is the 'Philosophy of Science' series in the journal Academic Medicine. The introductory paper to the series is:

Varpio, L. & MacLeod, A. (2020) Philosophy of science series: harnessing the multidisciplinary edge effect by exploring paradigms, ontologies, epistemologies, axiologies, and methodologies. *Academic Medicine*, **95**, 686–689.

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9 How to tell compelling scientific stories: tips for artful use of the research manuscript and presentation genres

Lorelei Lingard and Erik Driessen

'It's none of their business that you have to learn to write. Let them think you were born that way.'

Ernest Hemingway[1]

Why do researchers communicate their work to others? Certainly there are the pressures of academia, which demand peer-reviewed presentations and publications as symbolic evidence of scholarship. But more importantly, researchers communicate their work because knowledge-building is a social and rhetorical act: that is, an act of sharing ideas, of argument and persuasion to come to agreement about what is known. In order to move our field of knowledge forward, we need to talk with one another about what we have learned: we need to report our insights, question one another's methods, argue the relevance and application of emerging ideas and extend our insights by building on one another's efforts. Scientific knowledge advances not only through systematic procedures, careful analysis and thoughtful contemplation of results, but also through social – and rhetorical – acts of knowledge creation. This is why researchers communicate their work to others. And, therefore, no researcher can afford to treat lightly the issues of effective research writing and presentation.

In framing dissemination as a social and rhetorical act, we draw attention to the role of genres in research writing and presentation.[1] Following rhetorical genre theory, we use the term 'genre' to mean more than mere structure.[2,3] While structure is important, it is shaped by three other dimensions of genre: purpose, audience and occasion.

To communicate effectively, a researcher needs to understand all four aspects of the genre in which she is participating: What is the required structure? Who is the intended audience, and what are their shared values and generic expectations? What is the genre's purpose? And what is the occasion in which this genre is an appropriate communication strategy? In summary, genre is how we recognise and construct types of communication actions within types of communicative situations. It is how we create a shared sense of order, and accomplish shared goals.[2,4]

Writers and presenters tend to focus almost exclusively on the structural dimensions of genre. They worry about which sections/headings are required in their PowerPoint presentation, or about the word limit for their paper. However, a simple comparative example will serve to illustrate why all four dimensions of genre are necessary for effective communication. Imagine that you want to communicate about your last research study to your colleagues in a national conference presentation, your extended family at Thanksgiving dinner, and your vice-dean in the elevator. In the occasion of the conference presentation, your purpose is to offer, in the allotted time, a detailed explanation of the means and outcomes of your research for the purpose of incremental knowledge-building with an audience of disciplinary peers. In the occasion of Thanksgiving dinner, your purpose is to tell an anecdote in conversational language that your family (who, we will imagine, does not share your disciplinary expertise) will find engaging and relevant, and to tell it in a manner that will not last until dessert (and, in our family cultures, that isn't too self-aggrandising). In the third occasion, your purpose is to report a research highlight in accessible but still formal language that will signal your work's importance and recognition before the elevator door opens. The first occasion demands the generic structure of introduction, methods, results and discussion to satisfy the expectations of the audience; in the other two occasions, this generic structure would be a serious

[1] Arnold Samuelson (1984) *With Hemingway: A Year in Key West and Cuba*. New York: Random House.

Researching Medical Education, Second Edition. Edited by Jennifer Cleland and Steven J. Durning.

rhetorical faux pas. What this example illustrates is that, notwithstanding our tendency to privilege structure when we are writing papers or preparing talks, structure is only one part of effective dissemination, and it is dictated by purpose, occasion and audience. Therefore, this chapter offers tips that will keep you attuned to all four features of written and oral research dissemination genres. The chapter will also briefly discuss the possibilities that social media offer for communicating science.

Writing up

This section provides advice about five key aspects of research writing: Entering the conversation, Mapping the gap, Telling the story and Crafting the language (see Box 9.1).

BOX 9.1 Key principles for approaching research writing as a social & rhetorical act

Join a conversation
Identify a problem
Nod to the known
Map the gap
Have a hook
Tell a story
Craft with care

Entering the conversation

The first thing to remember about writing up is that you are not writing up a *study*. You are writing up a *story* that emerges from the results of a study.[5] This is a critical rhetorical shift: it turns the act of writing a paper from being a descriptive report of something *you did* as a researcher, to being a persuasive story about something in the reader's world. Remember: nobody cares about your research study *per se* (sad, but true). But they may care about your story *if* you can convince them that it is relevant to a salient problem in their world, and enter the scholarly conversation that is currently going on about that problem. For this reason, the first question a writer should ask herself is 'what problem in the world is this paper about?'

The second question a writer should ask herself is 'where is the scholarly conversation about this problem taking place?' These questions guide your selection of journal audience, your situation of the work within the literature and your organisation of results and discussion. It is very useful to start thinking about journals not as bound collections of papers but as social contexts for scholarly conversations about shared problems. From this perspective, getting your paper accepted is at least in part a matter of signalling that you offer a relevant and logical 'conversational turn' in an ongoing discussion about a shared problem. And so, you need to select a journal not (only) for its impact factor, but (also) for alignment between the problem you are writing about and the problems its community cares about.

Once you have selected the conversation you are joining, and found journals in which this conversation is taking place, positioning your conversational turn as relevant requires an understanding of the journal's values. Do they value work with international dimensions? Do they privilege work that engages in theory-building? Do they prefer work with relevance to more than one educational context, or work that addresses the policy dimensions of a problem? Exploring the values of the journal can help you articulate the problem your story explores in ways that will resonate with its audience. In the example in Figure 9.1, the authors gathered information about the journal's values by communicating with the editor and reading papers the journal had published on similar topics, and then set up their introduction to reflect these values: relevance to patient outcomes, newsworthiness, scientific top quality and journalistic style.

The conversation metaphor can also usefully guide your sense of the purpose of the literature review that often opens a paper. You are not aiming for an exhaustive romp through all that has been

Whether or not 'experience' means 'making the same mistakes with increasing confidence over an impressive number of years'depends on how self-analytical and critical you are. When you speak of your students needing to be 'more reflective' you mean that they should let their future behaviour be guided by systematic and critical evaluation and analysis of actions and beliefs and the assumptions that underlie them. All UK doctors are now expected to make reflection a critical foundation of their lifelong learningon the assumption that patients will benefit. This emphasis on reflective learning in medical education is relatively new, and certainly no hard evidence exists yet that patients benefit directly from doctors' reflective learning.However, evidence suggests that reflection could help students to learn from their experiences.

Excerpted from: Driessen, E.W., Tartwijk, J. & Dornan, T. (2008) The self-critical doctor: helping students become more reflective. *British Medical Journal*, **336**, 827–830.

Figure 9.1 Signalling the journal's values

Many have characterised the clinical activities related to non-acute patients as possessing limited educational value, naming these activities 'clinical service' or, more pejoratively, 'scutwork'. These terms refer to tasks that are necessary for patient care but are not educationally valuable, or are repeated more often than necessary for education purposes. In a published commentary, one internal medicine resident labelled clinical service tasks as 'non-educational, non-physician level scut'(p. 13). Residents spend a significant amount of their time (approximately 25 %) on service activities. If these activities are truly non-educational, this is time which may be reallocated to improve education. However, there is disagreement over whether or not particular tasks have educational value, with experienced physicians arguing that this service or 'scut' work is essential to developing clinical acumen and practising the art of healing. For instance, activities such as talking to families, often considered non-educational by residents, provide an opportunity for teaching 'patient care, professionalism, and communication skills'(p. s17). Disagreements over whether an activity is perceived as educational or non-educational suggest that there may be opportunities to realise different types of learning from these tasks, depending on the environment in which they are encountered.

Excerpted from: Vanstone, M., Goldszmidt, M., Weijer, C., Watling, C. & Lingard, L. (2013) Resigned Professionalism? Non-acute inpatients and resident education.*Advances in Health Sciences Education*, **17**(4), 247–255.

Figure 9.2 Literature review as a portrayal of conversational turns

said on a topic; you are mapping the highpoints of the conversation before your contribution, and arranging them so that your contribution is a natural next step. Think of your literature review not as a dry list of citations, but rather as a means of creating a sort of gravitational pull – the reader should experience a powerful and explicit logic that leads, inescapably, to the point that your paper is poised to share. And search the literature to find actual conversations: commentaries on published papers, editorials, podcasts, often cited papers that get taken up in variable ways in other's work. As much as possible, view the literature as being a record of conversational turns expressing the views of scholars in the field – not *just* as references. As the following second paragraph of an introduction illustrates, you want to signal that people are actively building knowledge in your field, and you are joining them (Figure 9.2).

Many of us are good conversationalists but our wits seem to desert us on the page. Thus, it can be helpful for a writer to imagine herself as part of a social conversation, because it allows him/her to draw on intuitive communication etiquette. In spite of academic writing's unique rhetorical occasion, the basics often still apply. For instance, imagine yourself at a cocktail party with senior researchers in your field. If you wish to join a small group enthusiastically engaged in conversation, you must first eavesdrop, catch the thread of the argument, and then position your contribution to be relevant and timely. You have to choose the right moment and judge your tone, so that your entry is smooth and engaging rather than abrupt and impertinent. You do not want to be that dreaded person whose interruption drags lively conversations off course, or who evangelically holds forth with utter disregard for other positions in the debate. The same is true for research papers submitted to journals, so treat your writing as a conversational turn.

Mapping the gap

We have established that your paper is a conversational turn, telling a story which contributes to the audience's evolving understanding of a problem that matters in their world. To be a compelling conversational turn, then, the paper must establish three things before the introduction ends (and preferably in the first few paragraphs): (a) identify a problem in the world; (b) establish a gap in current knowledge or thinking about the problem; and (c) articulate a hook that convinces readers that this gap is of consequence. Consider the example in Figure 9.3, which quickly lays out the problem, the gap and the hook in the first paragraph:

You might have heard that an introduction must include a 'clear research question' or a 'purpose statement': in fact, these may be two of the 'golden rules' of introductions that you are familiar with. And while of course it might be helpful to do either or both of these things, neither has the rhetorical weight and prominence of the problem, the gap and the hook. You could have a lovely research question about something your audience does not recognise

With the advent of interprofessional care, new questions about leadership and teamwork have arisen. How should responsibility be shared and power differentials mitigated? How has the physician's role changed? How do healthcare teams view these dimensions of their work? Without insight into these issues, we cannot know how best to educate physicians and other clinicians regarding their responsibilities on collaborative teams.

Excerpted from: Lingard, L., Vanstone, M., Durrant, M., Fleming-Carroll, B., Lowe, M., Rashotte, J., Sinclair, L. & Tallett, S. (2012) Conflicting messages: examining the dynamics of leadership on interprofessional teams. *Academic Medicine*, **87**(12), 1762–1767.

Figure 9.3 Laying out the problem, the gap and the hook as a problem that matters. Or you can have a clear purpose statement that sends the work off into directions where there is no gap in knowledge. Do not put your faith in a clear research question or purpose statement to compel the reader's attention. The problem, the gap and the hook are necessary components to establish your story as one that matters.

The three steps of problem, gap and hook are most useful if you remember the premise laid out at the beginning of this chapter: research dissemination is a social and rhetorical act. Your audience will have evolving impressions of what constitutes a problem that matters in the world, and you need to have your finger on the pulse of this evolving social context as you do your literature review. Are you writing about a problem that is inarguably novel (a rare event), one that is actively being worked on, or one that might be perceived by some readers to be already solved? As an example of the latter case, consider the problem of 'professionalism' in medicine. In the late 1990s in medical education research journals, this was a fairly novel problem; today, a researcher with a professionalism story to tell enters a crowded landscape in which much has been said and editors and readers may have developed a sense of ennui, a belief that surely we have figured this problem out by now. As Figure 9.4 shows, the establishment of the gap is a particularly critical step in such a case:

This example acknowledges that much progress has been made exploring professionalism as behaviours and competencies, and that context has been recognised as important, while focusing in on the problem of 'translation of abstracted principles into action' as the gap remaining to be filled.

Similarly, you might identify a problem that resonates with your readers and clearly claim for yourself a gap in current knowledge. However, if the reader does not believe that this gap matters – that is, that filling the gap will change anything – then your story has no 'hook' to draw them in. For instance, I may assert that poor staff communication in nursing homes is a problem that matters in the world, and I may illustrate a gap in our understanding of how shift work contributes to that problem. But if I do not have a hook – such as an argument that the causal relationship between communication breakdowns and medical errors in other settings centres on information handover between shifts – then readers may not see the gap as one worth filling. If that happens, it does not matter how elegantly my study was designed or how robust my results were; without a hook, which I would define as a claim to the significance or relevance of the gap, which draws on our shared values (here, the value of patient safety and error reduction), the story will lack vigour.

Telling the story

As we have said, the best academic papers tell a story, rather than reporting a study. Among the features shared by good stories, recognisable characters and a cohesive plot are critical. A common problem for writers of research stories is that the text can get crowded with an ever-growing list of characters – concepts, theories and keywords. This problem may emerge because many healthcare professional education problems are complex phenomena, requiring the writer to position them within an interdisciplinary set of literatures. When keywords pile up, however, incoherence can set in; that is, readers simply cannot follow the plot because there are too many characters on stage, coming and going, and their relations to one another are not entirely clear. As this explanation suggests, one heuristic for

> Evaluating professionalism has become an important issue for medical educators, with the current trend focusing on observed behaviours and competencies to maximise reliability and validity. Although direct observation is clearly important, assessing behaviours in isolation is insufficient—evaluators must also consider the context in which behaviours occur, any values conflicts that may be present, and the resolution of the situation. It is clear that behaviours themselves are not always transparent indicators of 'professionalism' and that the translation of abstracted principles into action is complex.
>
> Medical students' professionalism is primarily evaluated by faculty attendings, but little is known about how they think students should act. In a recent study, we found that attending physicians often disagree about what students should or should not do in challenging situations. Significant inconsistency existed between and even within individual faculty about what they considered to be appropriate medical student behaviour in a given scenario. In an effort to move beyond the simple analysis of behaviours, some of our other work has examined students' reasoning in the face of professional dilemmas. This research demonstrated that when faced with challenging professional situations, students are motivated to act based not only on the principles of professionalism, but also on the basis of affect (or 'self') issues, or potential implications of their actions. Knowing how students reason through these dilemmas provides important insights into how they make decisions about how to act when faced with these sorts of challenges. However, it is still not clear how faculty would reason through such dilemmas when considering how students should behave.
>
> Excerpted from: Ginsburg, S., Lingard, L., Regehr, G.R. & Underwood, K. (2008) Know when to rock the boat: How faculty rationalize students' behaviours. *Journal of General Internal Medicine*, **23**(7), 942–947.

Figure 9.4 Establishing the gap in a well-studied field

Introduction

Research suggests that inadequate communication is a primary cause of medical errors and that communication among the professions in the operating room (OR) is essential to patient safety. In research on nurse–physician communication in settings such as ORs or ward rounds, nurses persistently report that they are perceived as a passive audience for others, and that they are constrained in what and when they are able to communicate. The communicative constraints on nurses have been analysed in terms of the ways that knowledge and competence are displayed in the 'theatre' of the OR, the continued dominance of biomedical discourse over other types of healthcare discourse, and the disempowered or 'oppressed group' status of nurses. Nurses also report seeing themselves as 'keepers of the peace' whose role is to maintain a calm environment for surgeons to focus on their work, sometimes described as a gendered role or a 'female thing'.

Survey research on team communication in the OR indicates that nurses and anaesthesiologists have less positive perceptions of the effectiveness of their communication compared with surgeons, and are less likely to respond positively to the statement 'I am comfortable intervening in a procedure if I have concerns about what is occurring'. In our own ethnography, leaders of the different professions spoke to us about occasions when something of concern took place in the OR and 'nobody said anything'. Because of their central role in patient safety and advocacy, nurses are often the subject denoted in questions about why no one spoke up.

To date, there has been no research directly examining the speech practices, including silence, that are identified as constrained or problematic. This is understandable given the difficulty of documenting silences in communication and the traditionally marginal role of silence in qualitative research. Using observational data from a multi-year study of interprofessional communication in three hospital ORs, our objective in this paper is to directly examine instances of silence and constraint in communicative exchanges in the OR using a critical ethnography approach.

Excerpted from: Gardezi, F., Lingard, L., Espin, S., Whyte, S., Orser, B., & Baker G.R. (2009) "Why didn't anybody say anything" Silence, power, and communication in the operating room. *Journal of Advanced Nursing*, **65**(7), 1390–1399.

Figure 9.5 Keywords as characters in your story

ensuring coherence in your story is the metaphor of a drama. Treat keywords and ideas as actors in a play. Ask yourself, among all these actors, which has the lead role? Which have supporting roles? In the sample introduction that follows, although there are numbers of keywords – 'communication', 'patient safety', 'operating room teams', 'gender', 'nurses' and 'silence' – the organisation signals that the main character of this story is 'silence', and the other ideas are in service to that (Figure 9.5).

As you write the paper, the lead role(s) should not change; the main character from the introduction should still be featured in the discussion, although you may add new characters as necessary as long as relationships are evident. New characters joining the discussion can productively complicate the plot line, if it is clear to the reader why these characters have appeared. At any time in the text, it should be clear to the reader which ideas are in the front stage of the unfolding drama, and which are in the backstage.

The discussion may be the most difficult part of your research story to write. Why? Because the story's plot line needs a dramatic 'arc' – it needs to go somewhere, to climax, before resolving the questions or tensions and concluding. Many writers resolve without any climax: their discussions summarise, review design limitations, point to future research – but do not take the story of the results anywhere interesting. Writers who overlook the 'so what?' altogether may have falsely assumed that having done a study is reason enough to write a paper. Not so, because, as we have argued, study and story are not the same thing.

Many commentaries on academic writing have argued for the critical importance of the 'so what?' in academic research papers.[6] Why do the results matter? How do they reframe the problem, challenge common assumptions, advance the conversation you are joining? Your results are only part of your contribution to the conversation; your discussion of 'so what?' is the other part. You are telling a story that contributes important insights about a problem in the world that an audience is having a conversation about. One key to explicating the 'so what?' is to think of it as the piece that readers not precisely interested in your study details may still care about. For instance, in the work of one the authors of this chapter (LL), that could mean imagining what someone not interested in operating rooms or team communication practices might find valuable in his/her study of how surgical residents participate in operating room banter. The 'so what?' in such an instance could be that language is the central force in the hidden curriculum; if so, the introduction and discussion of his/her paper will need to engage the conversation about hidden curriculum to propose the central role of language and illustrate *why it matters* that we recognise this role in medical education. As this example suggests, the 'so what?' often reaches past the setting of the particular study you conducted. This is achieved through a process of abstracting, linking and extending – but there is a fine line! Beware of arm-waving or broad over-generalisations that are inappropriate given the nature of your data.

Crafting the language

So far, our advice has been largely conceptual: think of your research paper as joining a scholarly conversation in the field; articulate a problem, gap and hook to gain entry to that conversation; and tell a story with clear characters, a strong plot and an explicit 'so what?' Unfortunately, a writer can follow all of this advice and still produce a weak paper. Why? Because writing is only partly conceptual; it also involves careful attention to the crafting of the language itself.

As Helen Sword has pointed out, academic writing is, unfortunately, not often stylish and compelling; more often it is ensnarled in labyrinthine logic and weighed down by what she calls 'soggy syntax'.[7] In what follows we will briefly consider the main causes of and solutions for these main problems. This chapter does not aim to provide a fulsome guide to the craft of writing; for that, we recommend Lingard and Watling's 2021 book of 30 writing lessons, 13 of which address both basic (e.g., sentence and paragraph structure) and advanced (e.g., modality and voice) grammar issues.[5]

The first problem we have called labyrinthine logic, to reflect the experience of the reader who gets lost in the twists and turns of your argument. This problem is usually related to the problem of too many main characters that get introduced, seemingly at random, throughout the paper without signalling their relationship. This situation can be helped a great deal with effective use of the first sentence of each paragraph, the topic sentence, which signals the paragraph's main idea and links it to the idea immediately preceding. To check whether your topic sentences are doing this job properly, try cutting and pasting your topic sentences into a list. When you read the list, it should lead you through the logical steps of the story. Or, to use another metaphor, you can think of topic sentences as 'signposts', telling the reader where we are going next in the paper, and how that destination relates to where we have been.

The second problem, 'soggy syntax', refers to sentence constructions that bog the reader down rather than carrying him/her swiftly along.[8] Writers often create soggy syntax through their use of the subject position (the agent of the main verb) or the main verb (the source of the action) in simple sentences, or their handling of multiple subject positions and verbs in complex sentences.

The subject position of the sentence is the agent of the action; to use our drama metaphor, it is where you place your main characters. Academic writing loses vigour when the subject position is a nominalisation, otherwise known as an abstraction embodied in a noun phrase. Consider this example: *In the face of both globalisation and interprofessionalism, the conceptualisation of competence in medical education is changing*. Grammatically, there is nothing wrong with this sentence. But it lacks vigour because the noun phrase in the subject position – *the conceptualisation of competence in medical education* – is an abstract idea. Ideas do not make clear, vigorous agents of a verb's action. Of course, academic research writing is full of ideas, so writers need to learn how to handle them without creating cognitive burden for the reader. The sentence could express the same idea more vigorously by editing to: *Globalisation and inter-professionalism change how medical educators conceptualise competence*. The main change here is that the noun phrases are simplified by removing layers of prepositional phrases, *of competence* and *in medical education*. Ideas are still in the subject position – *globalisation and interprofessionalism* – but they are not elaborated with such layers, so they are less likely to bog down the reader.

The revision – *Globalisation and interprofessionalism change how medical educators conceptualise competence* – also addresses the second problem underlying soggy syntax: passive verb constructions. Passive verbs remove the agent of the action so that no one is actually doing anything in a sentence. To illustrate: 'The researchers interviewed medical students' is an active verb construction and it is clear who did the interviewing, whereas 'Medical students were interviewed' is a passive verb construction, which removes the agent of the interviewing (researchers). In the first version of our aforementioned example sentence, the verb phrase *is changing* removes the agent from the subject position and puts it into a prepositional phrase at the end of the sentence: *in the face of both globalisation and interprofessionalism*. The revision puts the agent into the subject position, customarily placed before the verb, which gives the sentence more energy. Now the agents, *Globalisation and interprofessionalism*, are clearly doing the action of *change*.

As a related tip, writers should watch out for iterations of the verb 'to be', which can signal passive constructions: *The study was conducted*; *Findings were identified*. Passive constructions make readers labour to sort out 'who's kicking whom?'[8] Even when used actively – *Globalisation is an important movement* – 'is' does not have much expressive power, nor do other favourites such as 'makes', 'shows' and 'does'. Verbs are where you create action in your prose, so use verbs that act! Usually, the sentence that needs revision already includes, in noun form, the word that would create action if you put it into the verb position, as illustrated by our revision, which changed the noun *conceptualisation* to the verb *conceptualise*.

Finally, soggy syntax can be caused when sentences present the reader with multiple candidates for the main idea – that is, multiple nominalisations. In our original example – *In the face of both globalisation and interprofessionalism, the conceptualisation of competence in medical education is changing* – the prepositional phrase, *In the face of both globalisation and inter-professionalism*, introduces two nominalisations or abstract ideas (globalisation and interprofessionalism) before the reader gets to the main character of the sentence. Remember, the main character is housed in the subject position of the main clause: in this case, it is *the conceptualisation of competence in medical education*. In this case, the poor reader is already faced with three big ideas before the main verb has appeared, and she may be understandably confused about which of these she should focus on as the story's main character. The problem worsens in complex sentences with subordinate clauses, which have two subjects and two verbs, only one of which is the 'main' subject and verb of the sentence. Consider this example: *Although globalisation and interprofessionalism are relatively new concerns, the conceptualisation of competence is changing in the face of them*. In this example, the subordinate clause is the one starting with the subordinate adverb, *Although*. This clause has a subject position slot, filled by *globalisation and interprofessionalism*, and the main clause (the one without a subordinating adverb) has a subject position slot too, which is *the conceptualisation of competence*. The reader may understandably be overwhelmed by the presence of two elaborate nominalisations in the subject position slots of these two clauses. Lessening the sentence's vigour even further, both clauses use a limp 'to be' construction for the verb. Our point here is not that subordination should be avoided in academic writing; it is necessary to establish complex relations between ideas. But writers should consider how subordination can affect the reader's appreciation of the main idea and the main action in the sentence, and use such sentence structure strategically.

Presenting your work

Try to remember the last presentation that you attended as a spectator. The odds are good that this presentation was tedious, and that your thoughts wandered away as the presenter, positioned with his/her back to you, read from PowerPoint slides filled with text and raced the clock through the final batch of slides. Stroll through any convention centre during an international meeting and this, sadly, is the bulk of what you will see.

Why do scientists persist in delivering boring presentations? Because we think that this is what is expected of us. After all, this is how our supervisors delivered their presentations and it is what we see when we go to meetings. 'Rhetorically weak' appears to be how we signal 'scientifically credible'. We are afraid that a more simple and entertaining presentation will contaminate our scientific ethos with an aura of shallowness. And, of course, this fear is compounded by a general human fear of speaking before a group; in fact, it is 'the number one fear among American adults – ranking above the fear of snakes, heights, disease, financial problems or even death'.[9] Most of us stand with leaden feet in front of an audience, abandoning any good intentions to engage the audience the moment we mount the stage. Scientific knowledge, however, is built through publicly sharing our insights so that they can be refined, challenged and elaborated. Therefore, as scientists, we must learn to handle this fear of presenting.

Most of the advice we gave for writing up science also holds true for presenting science. Our central message – you are not presenting a study, but a story arising from your study – is even more important in case of an oral presentation. The concentration span of audiences is limited and often your presentation will be one in a row of many during a long conference day. It is, therefore, essential to grab the audience at the outset of your presentation and to sustain their interest for the duration. The start of your presentation should observe our problem-gap-hook structure: make clear to the audience what problem you are focusing on, what conversation is happening regarding it, and why your contribution today matters to them. Centered on this structure, this section offers a selection of recommendations for both short and long presentations based on our own experiences as presenters and spectators.

Story telling

Besides interesting study data, stories, anecdotes and examples are the basic ingredients of your presentation.[10] Stories help you to connect with your audience. This can be very important, as the story in Figure 9.6 makes clear.

Stories have to be relevant to your core message; only then can they bring to life the abstractions in your presentations. Most presentations of science are highly abstract, full of theories and analyses. Listeners require time and effort to digest abstract messages, and wrapping them up in stories makes

The power of stories

One of the authors of this chapter (ED) was invited to deliver a presentation about – in that time – a fairly new topic: portfolios. Arriving in the meeting room, he experienced a hostile atmosphere and from remarks of the meetings' chair he discovered that the audience – teachers with an interest in medical education – had already decided to disagree with him before he had even said a word. In their view, portfolios sucked, and from their questions and comments it was quite clear that they had no confidence whatsoever in the main messages of the presentation. Completely frustrated with the fact that he had failed to make the presentation about this new topic a success, he thought about how to prevent a disaster to happen on a next occasion. How to persuade a strongly opposed audience to have faith in lessons from the literature? He found the answer in making explicit effort to connect himself as a presenter and the topic (portfolios) with the world of the audience (doctoring and medical education). He would open his next presentation with a personal story about a paediatric surgeon who had performed a complicated operation on his son. The story would on a content-level make tangible the complexity of the profession of doctors and at the same time explain how portfolios can be used to learn and assess this complexity. At a relational level, moreover, the story would connect the presenter with the audience. It was an emotional story with a happy ending, which directly appeals to the audience: most of them would be doctors and many would be parents too. The next time he had the chance to present about portfolios, the presentation was unexpectedly powerful. The story helped to tear down the wall between him and the already disagreeing audience and to gain trust in his words. From that day stories, narratives, examples and anecdotes have become the essential ingredients for his presentations ever since.

Figure 9.6 Storytelling during presentations

them both more palatable and more memorable. Stories place your abstract message in a context and we know that context plays a very influential role in the construction of knowledge.[11]

Kill your darlings

It is easy to understand why most presenters feel that they have too much to tell in too little time. For over a year, you have been working hard on your study, and now you are anxious to share the lessons you learned from the literature review, account for methodological choices you made, explain the results, present your conclusions and offer important recommendations. The trick is to cook all this work down into a 10-minute talk that will not be used for email catch-up time by your audience. Our drama metaphor for writing up is equally valid for presenting. In a 10-minute drama, there is only room for the main characters; therefore, in your short presentation, you must discipline yourself to stick to one, and possibly two, main messages. This means that, besides storytelling, selection is the second main ingredient of an engaging and effective talk. As one of our colleagues puts it, to engage people in your presentation, you should keep it *simple* and keep it *short*; to increase their engagement, you should keep it even *simpler*, and keep it even *shorter*.

This is a difficult thing to accomplish. You want to share what you know, to dazzle with your ideas and insights – in short, to show off your darlings. Instead, though, the adage should be: *kill your darlings*. Include only those messages that help to communicate your main message to your audience, leaving out anything else that does not directly help to convey this main message, regardless of how much you love it. The principles that we discussed in the 'Writing Up' section, together with what you know about the prior knowledge of the audience, should guide your selection.

Using visuals

For most of us, preparing a presentation comes down to drafting a PowerPoint presentation. This likely explains why, for most of us, delivering a presentation comes down to reading out the text on the PowerPoint slides. Whether or not visual aids such as PowerPoint slides help to convey your message depends on the occasion and the generic expectations that occasion sets up in the audience. However, it is safe to say that when PowerPoint produces reading, rather than presenting, it has not helped you engage the audience. So dispense with the slides-as-crutch approach and consider what the slides do for the audience, not what they do for you.

When your audience is relatively small, it may be helpful if you provide handouts that contain, for instance, a summary of the data, which you then discuss during the presentation instead of using a PowerPoint presentation. If you do use visual aids such as PowerPoint slides, then the first thing you need to do is to make sure that these aids visually support your story and messages. For several reasons, slides full of bulleted text, instead of supporting your story, merely obstruct it. First, the structure disembowels a good story, because bullet points lead to abstract overviews instead of detailed narratives. Secondly, a presentation predicated on text-heavy PowerPoint requires an audience to listen and read simultaneously, which can generate extraneous cognitive load (see chapter by Szulewski and colleagues later in this book). This is exacerbated by the fact that your spectators may read your slides more quickly than you talk, impacting your ability to control the timing of the story. Timing is central to a speaker being able to effectively construct a dramatic arc in their story. Good storytellers build climaxes, weave in complications, insert surprises and achieve resolutions, all of which is threatened if the reader jumps ahead.

So use your PowerPoint slides wisely, as aids rather than as spoilers or crutches. We recommend slides with relevant pictures or drawings and with minimal text. And we do not recommend distributing handout versions of your slides before your talk: that is just tempting people to see how the story ends before you have even started. If you intend to give a handout to the audience, it should be something different from a mere printed version of your slides. For instance, it could include a full study synopsis and methodological details that would weigh down your oral story but might be of interest to some listeners. Garr Reynolds' book on the design of PowerPoint presentations is a good guide for making your PowerPoint less text-rich and more visual.[12]

We would not argue that speakers should have their talks memorised, but having the first few slides memorised well helps with presentation jitters, which tend to be worse at the start of the talk. And you should have a memorised script for the closing lines as well; a good talk can be easily ruined when the speaker ends with a limp closer such as 'That's it' or 'I'll take questions now'. The last line should be something memorable and reflective of the main thrust of the story. Similarly, speakers should be familiar enough with their presentation that they can maintain regular eye contact with the audience in order to judge their reactions to the presentation as it unfolds. This means paying attention to how your body is oriented at the podium: make sure that you look at the audience and not at the screen. Before you present, ask if you will have a laptop at the podium. If you do, there is no need to turn your back on the audience. If you do not, then you will need to rehearse your talk until you know where each slide comes in the story, and you can advance without having to look each time and present without reading the text. Think too, about transitions between slides: ideally, the presenter starts talking about what is coming next before the slide appears, helping the listener to make the logical transitions in the story easily.

Presenting virtually

Many scientists have found themselves presenting their work virtually as conferences, research seminars and courses shifted to virtual during the 2020+ Covid-19 pandemic. While the strategies above hold true in the virtual space, some additional considerations are required.[13] After all, the virtual space has profound implications for structure, audience, purpose and occasion, those rhetorical parameters we need to keep in mind if our scientific stories are going to be effective.

A virtual audience may be more diverse (given the increased accessibility of virtual presentations), and more distractable (given the tendency to squeeze virtual lectures into small moments in a regular workday) than an in-person audience. The occasion is also radically different for a virtual conference presentation. Rather than a conference where everyone is in the same city for a few days, immersed in the same ideas and physically inhabiting the same lecture theatres, the virtual occasion is fractured, fluid and unpredictable. The purpose of sharing your scientific story remains the same, but the strategy must evolve to fit these new audience and occasion parameters. This is why the strategy and PowerPoint from an in-person talk will not suffice for a virtual talk. Different length, pace, interactivity and visuals are required.

An engaging virtual talk is shorter in length and faster in pace than its in-person counterpart. Shorten your presentation, from 30 to 20 minutes, for instance, to prevent screen fatigue in your audience. When shortening is not possible, a longer talk can be broken into smaller segments with pauses and intermittent engagement activity. The pacing needs to go more quickly than for an in-person talk: slower speech loses the virtual audience's attention more readily than a faster pace. The pacing for visuals should also be considered: for instance, spending three minutes on one slide while you elaborate a complex argument risks losing the audience's attention. Instead, change the visuals to cue shifts in the story at shorter intervals than you would in an in-person talk. And keep in mind the size of images and fonts: virtual talks are not projected larger than life on a screen, they may appear on the audience members' laptops in a window the size of a deck of cards. Because of this, the mantra that 'less is more' is perhaps even more true in the virtual space.

Your slides aren't the only thing that is smaller in a virtual talk: you may be too! In a Zoom or Webex presentation, your face may be the size of a postage stamp on the viewer's screen; therefore, you cannot rely on some of your usual tricks to connect with your audience. With nonverbal cues like facial expressions and hand gestures miniaturised, you will need other strategies to counterbalance. The tone, volume and cadence of your voice becomes more important when your face is miniaturised.

Additionally, images on your slide can relay attitude or emotion in lieu of facial expressions. And you may also vary between slides on the screen and presenter on the screen: this way, when your face is visible, it is large enough for nonverbal communication to succeed. Finally, consider putting all your efforts into the story, and either deliver it without slides or deliver it orally with expressive slides. The goal is not a hollow 'voiceover' feeling, but a captivating oral storyteller experience, with the audience mesmerised through their ears, rather than their eyes.

Interactivity is essential, but difficult. We encourage you to use any means at your disposal to make your presentation more lively and interactive. Frequently ask questions: both direct and rhetorical questions work well. Use software polling to create live visual representations of audience reaction. Invite comments in the chat, particularly if the group is small enough that you can pause to integrate them into your presentation as they appear. Assign participants to break out rooms for more extended interactivity, and circulate among them to monitor, challenge and engage. With all of these interactivity strategies, a co-host is helpful to support the logistics.

Virtual presentations can be highly effective, but in our experience they require more preparation time than you might expect. It takes time to carefully prepare so that the length, pace, structure, variety, interaction and visuals fit the audience and occasion. We often practise the presentation with a safe and critical colleague. We acknowledge, though, that the time and energy needed for preparation is in sharp contrast with the nothingness afterwards. Most presenters end their talks alone, full of adrenaline in front of an empty screen. This can create a sense of estrangement or disappointment. Consider making a date to discuss your presentation with your co-host, or asking a few audience members beforehand to meet with you afterwards for conversation. Or, if you really want engagement and feedback, consider putting the video and/or/audiorecording of your virtual presentation on social media!

Communicating science on social media

Communicating scientific work on social media is becoming increasingly popular.[14] Blogs, Twitter and Facebook can help to improve the visibility of the scientific work and the researcher. One recent study showed that promotion of academic articles via social media enhanced download and citation rates,[15] and a systematic review described a positive association between traditional bibliometrics and social media metrics (e.g., number of mentions) in health research.[16] Social media offers the opportunity for authors to *push* their work to readers, rather than hoping they will come across it. In particular, Twitter can make academic work broadly accessible across disciplinary boundaries and to the public.[17,18] A recent analysis tracking tweet patterns for articles published in six journals from political science and communication fields found that article citations were positively correlated with tweets about the article.[19]

If you intend to communicate your work via social media, aim for Coherence, Clarity, Integrity and Punch. Coherence applies not only to individual communications, like a tweet to promote your latest publication, but also to your social media profile. The best profile is carefully curated so that followers know what you stand for as a scientist. For instance, we confine our social media contributions to #meded, #writing, #publishing, #qualresearch and related issues. (Well, Lorelei also tweets about her dog, Tucker, but consistently!) Clarity means ensuring that your social media contributions are accurate and easy to understand. Nuance is difficult to express in social media and likely best left to other communication venues. And remember, the social media audience is diverse (and unpredictable), meaning that you need to be plainspoken (and jargon free) to be widely understandable. Safeguard the Integrity of your social media communications by monitoring the tone of your posts and checking others' content before sharing (e.g., explore links and read articles before retweeting). Finally, your social media contributions need Punch. We don't mean hype! Just as in a research manuscript, you want to avoid over-reaching or making unsupportable claims. By Punch, we mean that you have to grab the social media surfer's attention. Both style and strategy can help with this. Your style should match your personality: if you're measured, or plainspoken, or lyrical in real life, your posts should echo this. Strategy includes techniques such as short sentences, clear images, memorable metaphors and apt hashtags to draw the scrolling audience in.

Conclusion

We have used a rhetorical approach to dissemination in this chapter, to get writers and speakers thinking about how to tell a compelling story from their research work. The tips we have laid out arise from our own experience and from the role models we have both sought throughout our scientific careers as writers and presenters. We recommend 'following' the writing and presenting of people whose communication practices you find effective. Be analytical when you read or hear their work: how did they structure their paper? What makes their style so effective? What separates them from other presenters? If you need help finding speaker role models to follow, a good source of excellent presenters in action is the TED (Technology, Education and Design) website (www.ted.com/talks). We also suggest looking for role models outside your research community: scientists from other disciplines, or authors writing in non-research genres can also inspire your academic communication.

Practice points

- Think of your paper or presentation as a contribution to a scholarly conversation.
- In your opening, aim to identify the problem, map the gap and articulate the hook.
- Tell a story with clear characters and compelling plot arc.
- Craft the written language to carry the reader smoothly through the story.
- Keep the story simple for brief presentations and use visuals strategically.
- Adapt your storytelling strategies to increase engagement in virtual presentations.
- Use social media thoughtfully to push your work into relevant conversations within your field, in adjacent fields and in the public space.

Recommended reading

Writing up
1 Sword, H. (2012) *Stylish Academic Writing*. Cambridge, MA: Harvard University Press.
2 Glasman-Deal, H. (2010) *Science Research Writing for Non-Native Speakers of English*. London: Imperial College Press.

Presenting
3 www.ted.com/talks.
4 Heath, C. & Heath, D. (2007) *Made to Stick: Why Some Ideas Survive and Others Die*. New York, NY: Random House.
5 Reynolds, G. (2012) *Presentation Zen: Simple Ideas on Presentation Design and Delivery*, 2nd edn. Berkeley, CA: New Riders.

Social media
6 http://socialnetworkingforscientists.wikispaces.com/General.
7 http://superfund.oregonstate.edu/apha-roundtable-communication-strategies#.U6vzNI1_sRV.

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4 Bazerman, C. (1988) *Shaping Written Knowledge: The Genre and Activity of the Experimental Article in Science*. Madison, WI: University of Wisconsin Press.
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15 Botting, N., Dipper, L.T. & Hilari, K. (2016) The effect of social media promotion on academic article uptake. *Journal of the Association for Information Science and Technology*, **68**, 795–800.
16 Bardus, M., El Rassi, R., Chahrour, M., *et al*. (2020). The use of social media to increase the impact of health research: systematic review. *Journal of Medical Internet Research*, **22**, e15607.
17 Fitzgerald, R.T. and Radmanesh, A. (2015) Social Media and Research Visibility. *American Journal of Neuroradiology*, **36**, 637.
18 Lupia, A. (2013) Communicating science in politicized environments. *Proceedings of the National Academy of Sciences*, **110**, (Supplement 3), 14048–14054.
19 Klar, S., Krupnikov, Y., Ryan, J.B., *et al*. (2020). Using social media to promote academic research: Identifying the benefits of Twitter for sharing academic work. *PLoS ONE*, **15**, e0229446.

PART II

Methodologies and methods for health professions education research

10 What is known already: reviewing evidence in health professions education

Morris Gordon

A few years ago, I was on the ward and a respected colleague posed a question to the medical team regarding asthma therapy. She specifically asked me and said: 'as you are the expert in evidence, can you tell us what to do?' This question caught me off guard. On reflection, I think it was asked without prejudice and from a place of true enquiry. However, it forced me to analyse what those of us interested in evidence offer and indeed what the field of evidence synthesis offers.

This contrasts with my own experiences working on the team setting up a new medical school over the last decade. Every decision we needed to consider, we turned to the evidence in medical education. I was the one asking the experts! The task involved with considering the exponentially growing body of high-quality research was nearly insurmountable. The factors that needed to be considered were complex. But how do you compare two research studies where methodology is not the only variable, but the primary educational element itself can also vary greatly? These challenges exist for the practising teacher as much as for researchers and require understanding of techniques to review, appraise and synthesise evidence.

The focus of this chapter is to introduce the core principles, or methodological pillars, to be considered when performing, and indeed reading, reviews of an existing body of literature. These core principles are based on how often they are seen as areas of concern in reviews and how important they are to the overall completion of a review in a manner that is as scholarly rigorous as any other methodology discussed in this text. These are:

- devising a clear and answerable question;
- selecting the best review tradition and synthesis approach to answer the question;
- searching for evidence (during planning and reviewing);
- quality of evidence;
- when to use specific review traditions.

These stages are interrelated and, to a great extent, iterative at the point of planning and preparing to carry out a review, as shall become clear later in this chapter.

Introduction

Health professions education generally, and medical education specifically as a field of scholarly investigation, has long had to defend itself against the accusations of poor quality,[1] often from a medical profession that is grounded in a hierarchical view of research that posits the randomised controlled trial (RCT) as the unquestionable 'gold standard'. Ironically, while the CONSORT statement for guiding the reporting of randomised trials was first released in 1996, after 25 years there are ongoing objective measures showing the vast majority of clinical medicine publications are still failing to report in a way that can justify the assigning of the 'gold standard' designation.[2] Similarly, there is a range of research in health professions education, from poor to high quality work across all methodological categories. There is also the issue of a rich tapestry of research methodologies being used by scholars from ideologically polarised backgrounds to answer the same question.[3] Finally, the information explosion of the last 25 years has led to a wealth of research that has compounded the challenges by leading to thousands of irrelevant studies captured by any search, the 'fool's gold of the digital age'.[4]

Given all this activity, how does one separate the 'wheat from the chaff'? How do you identify then examine existing literature in a way which is useful? There are different ways of approaching literature reviews, and which approach you take will depend on the nature of both the literature and your question. However, there are some basic core

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principles which should underlie every review approach. In this chapter, I introduce some of the common approaches to literature reviewing, and then discuss further the basic core principles which should underlie all evidence synthesis.

Evidence-based and best evidence

Reviews of evidence to inform future study and practise have long existed within scholarly fields of study. The clinical medicine field, faced with challenges described above, responded by developing the field of evidence-based medicine, defined as 'the conscientious, explicit and judicial use of current evidence in making decisions about the care of individual patients'.[5] Mirroring this, Harden and colleagues began the best evidence medical education (BEME) collaboration in 1999[6] as an effort to move the use of anecdotal information in medical education to the use of evidence synthesis through systematic review. Both approaches facilitate the use of previous research to inform future study and practice.

Both evidence-based medicine and evidence-based health professions education require the use of methods that are scholarly rigorous and separate from eminence-based works. It must be stressed that this is not to suggest that traditional reviews of research or evidence or not of high quality. (Indeed, I recognise the irony that this very text is an eminence-based digest on the issues of evidence-based health professions education.) Rather, as with all approaches, they have different characteristics, and their utility depends on the specific context and goals of primarily the writer.

'Systematic review' vs reviews that are 'systematic'

The approaches that this chapter discusses are what I would label as reviews that are 'systematic' ('systematic' reviews). They are 'systematic' because they offer transparent methodologies that can be replicated and employ methods to ensure the evidence included and the synthesis of the evidence is rigorous and represents more than the views of a single author.

This is not the same as the 'systematic review', which is the specific methodological approach that is the cornerstone of evidence-based medicine and most notably used by organisations such as the Cochrane Collaboration.

Cochrane is a charitable collaborative with currently over 30 000 contributors across the globe. The approach the Cochrane Collaboration has developed over the last 25 years is focused on summarising the findings around tightly focused questions, to build a meaningful knowledge base about health interventions and on randomised controlled trials (https://www.cochranelibrary.com/). Cochrane combines the methodologies needed to find, appraise and synthesise such studies with approaches to support rigour and transparency, such as prospective protocol preparation and the use of external information specialists to peer review search strategies. A Cochrane review is a very particular beast, a very specific and routinised approach to reviewing, and one which only considers certain types of studies for inclusion, and reporting or synthesising findings. Given this, a common criticism of Cochrane reviews was the lack of findings due to low quality evidence in the field or topic under review. However, this is changing with the use of techniques such as GRADE[7] that identify the certainty of negative results, so reviews should always be informative.

Table 10.1 summarises the difference between traditional reviews, 'systematic reviews' and reviews that are 'systematic'. Core to note are not just the areas of divergence, but also those of convergence. 'Systematic' reviews in education are not a single category, but a broad suite of options. A narrative synthesis, realist review or scoping review are all options that can offer diverse forms of synthesis and share many methodological pillars that separate them from traditional review of evidence. These different approaches to reviewing existing literature are discussed further later in this chapter. First, however, I focus on the methodological pillars which are core to all reviews that are 'systematic'.

The methodological pillars of 'systematic' reviews in health professions education

1. What are we asking?

Core to any evidence-based health professions education project is the research question that needs to be answered. When peer reviewing review articles, I have found the following are common terms used when defining questions:

- We will explore . . .
- We will summarise . . .
- We will map . . .
- We will synthesise . . .

Table 10.1 Comparing traditional reviews, 'systematic reviews'and 'systematic' reviews

Methodology	Traditional review e.g., textbooks, expert guides	'Systematic review' e.g., Cochrane reviews	'Systematic' review e.g., BEME reviews, scoping reviews
Question scope	Broad or not defined	Well defined and often narrow scope	Well defined, scope defined by context
Question types	Not defined	'whether'	'whether', 'what' or 'why / how'
Project plan or protocol	Not produced	Encouraged a priori	Encouraged a priori
Searches for evidence	Informal, not transparent, studies selected by author as they see fit	Highly protocolised and a priori production, transparent, all evidence gathered as per the plan	A priori planning, scope for revision, transparent, all evidence gathered as per the plan
Extraction of evidence	To suite authors goals, informal, not transparent	Done in duplicate, disagreement solved by reaching consensus	Often done in duplicate, disagreement solved by reaching consensus
Synthesis methods	Critique by author, informal	Narrative and often statistical techniques, meta-analysis	As defined by the methodology of review chosen, with all methods possible
Implications of the reviews for research	Usually match the views of the author and often pre-defined	Match the questions posed in the review, often precise	Match the questions posed in the review, can be broad or narrow depending on the review methodology

While on the surface these terms seem entirely acceptable, they are proxies for actual answerable questions. For example, 'mapping', 'exploring', 'summarising' and so on tell me nothing of what educational landscape the author(s) are examining. To expand, when considering Table 10.1, it is reasonable to assert that if researchers plan a review that 'seeks to explore views of students', such questions could only be appropriately deployed as part of a traditional review that seeks to 'explore/ summarise/map/synthesis evidence of student views on an issue'. On the other hand, a 'systematic review' or 'systematic' review question should be specific and informative. There are some well-known formats and processes which facilitate this.

PICO

Core to the 'systematic review' tradition is the use of a PICO format to design a question (Participants, Intervention, Comparison and Outcomes). This very simple tool can and should be applied to any topic. If one were planning a review of simulation teaching for personal protective equipment use, PICO would ask us to consider which participants (learner groups), what forms of interventions (all, face to face, virtual, in which settings, countries, etc.), any key comparison (no intervention, an alternative form of established teaching) and what specific outcomes are of interest (learner satisfaction, changes in their knowledge, performance of the skill in the workplace, etc). This short exercise allows the researcher to take a concept and very quickly start to develop parameters of interest that not only support searching for evidence in an efficient manner, but transparency and 'systematicity' of the approach.

The acronym CAPS can also be used to further test and refine a PICO question within education (Current state of knowledge, Area of interest, Potential impact and Suggestions from experts).[8] If we take the previous example, the review team would consider what current works and previous reviews have found in relation to educational knowledge in this area, refine the area of interest based on this (for example, to explore a new area not previously investigated), consider what the impact of such questions would be for the reader and so the potential utility of the review, and finally reach out to key writers in this field to ask for support or advice.

Consideration of CAPS can refine the PICO question and in turn the PICO question can inform the investigation needed to inform CAPS in an iterative and symbiotic planning process. But a health professions education 'systematic' review author may need to produce a more meaningful set of questions and specific objectives than these tools can offer. As such, PICO and CAPS can be thought of as a first step of a potentially complex phase of planning a health professions education review.

Classifying the existing literature

The next step is to consider the nature of the literature. Cook *et al*.[9] proposed a simple but useful framework for classifying the purpose of existing published medical education research into three categories: description, justification and clarification (see also chapter by Nicholson *et al*. elsewhere in this book). Description includes 'what' questions which are focused on observation, the first step of the scientific method. Justification is next, considering studies that seek to find 'whether' a given intervention has impact. The final category is that of clarification studies. These are often far more complex studies by definition as they seek to answer 'how or why' observations that lead to impact occur. This often involves using existing theories or frameworks to predict the outcomes of studies, and in doing so testing these predictions.

There is a final framework that I would propose is considered at the question and planning phases of a review. Pondering what and how evidence should be captured, appraised and synthesised to answer the emerging questions will lead the reviewer to align with, whether by choice or by utility, a given research paradigm. Burniss *et al*.[10] outlined four major paradigms, or worldviews, and the methodological questions that underpin the development of knowledge within them (see also MacLeod, Burm and Mann, McMillan, and Cleland's chapters in this book). Aligning paradigm, question and the nature of the primary studies (as per Cook *et al*.'s categories above), a review team can both produce high quality questions and identify the most appropriate review tradition for their question, as shown in Table 10.2.

Stop and think

It is useful here to stop and think using the following exercise. Reflect on the latest issues of your health professions education journal of choice. There is likely to be a review included in an issue. Consider the elements discussed in this section of the chapter, ending in Tables 10.1 and 10.2. Try to see if you can derive, if not explicitly state, the PICO for the review. Does the background inform CAPS so the PICO question can be contextualised? Then assess whether the given review could be defined as 'systematic' from the perspective of just its purpose, questions and implications of the conclusions made.

This exercise highlights that without getting bogged down in any discussions of methodology, quality or synthesis, a review can be considered by its most basic purpose as a tool to answer a question of the primary research landscape. This digest also offers the researcher a tool to support planning of any review project. Table 10.2 can also be employed as part of the iterative planning process of any review project.

2. Selecting the evidence

Within the journey of performing a review, selection of evidence is perhaps the core factor most consistently performed across all review approaches. There are huge numbers of resources to guide the design of Boolean searches and the use of technological tools to support these. More and more institutions also now have learning technologists and librarians who can contribute their skills to help design optimal searches. There are two key steps which must be considered at the stage of selecting the evidence: the role of the pilot search and checking decisions. There is also a third aspect to consider: reporting, or extracting, sufficient educational content and descriptions to contextualise the review. It is only after these steps have been carried out that one can assess the quality of the primary studies (the evidence).

The pilot search

The role of the pilot search is pivotal. This is not just a piloting of a search strategy but an opportunity to pilot the very questions of the review. In fact, the pilot search can, and should, be iterative, viewed as a companion to the planning of questions. At the time of question development, a pilot search will help the reviewer refine the question and consider other elements such as scope, context and impacts of interest. The pilot search also informs the choice of review approach – paradoxically, a certain level of knowledge of the very evidence you seek to review is needed to inform decisions about which specific review approach (e.g., scoping, realist, 'systematic review') is appropriate for the review. This is discussed more at the end of the chapter when the use of these review traditions is presented. As such, the pilot search may be best placed within the planning phases twice, at both the question writing and search planning phase.

The pilot search should also inform the viability of a review. This could be as simple as finding that little to no evidence exists – thus making it difficult to justify the need for a review. It can also inform the resource planning of a project. Certain review areas will be more complex and difficult to perform searches for, most notably where nomenclature is ill-defined or country specific.[11] Educational areas of focus where terminology is not standardised can force the production of search strategies that have poor sensitivity or specificity. This can lead to a very high citation count for the search for a very poor yield of potentially relevant studies. If review teams

Table 10.2 The four major paradigms (see also chapters by MacLeod, Burm and Mann, and those of MacMillan, and Cleland in this book), the methodological questions and the review traditions that are best placed for each

	Post-positivism	Interpretivism	Critical Theory	Pragmatism
What's the nature of reality? (Ontology)	Reality is a constant but is never fully apprehended.	Reality is subjective and there are multiple lenses that can be used to view and understand reality.	Reality may be objective but is continually informed and indeed changed by structures of social, political, cultural, economic and gender factors	Reality is socially and experientially based, and is constantly renegotiated, debated and interpreted based on the new unpredictable situations.
What's the nature of knowledge? (Epistemology)	Objective but is not necessarily fully accessible, and thus knowledge is based on a hypothesis that has not been falsified.	Subjective, and thus there is no one ultimate or 'correct' way of knowing.	Knowledge is co-constructed between individuals/groups, is based on values, mediated by power relations, and therefore is continuously under revision.	Knowledge is constructed from objective and subjective points of view. Findings are the means, change is the underlying aim.
What's the nature of approach to research? (Methodology)	Verification / Falsification Testing if hypothesis can be disproved.	Interpretation/construction Using inductive process to gather diverse interpretations of a broad field.	Transformation Comparing and contrasting findings, implications and applications to refine existing, or derive new, theory.	Design Combing approaches in iterative and participatory fashion to address current matter or need, offering new perspectives on an issue.
Review questions[9]	Whether (Justification) What (Description)	What (Description) How and why (Clarification)	How and why (Clarification)	What (Description) How and why (Clarification) Whether (Justification)
Review tradition	'Systematic Review' with/ without meta-analysis	Scoping review	Critical realist review	BEME review Narrative review Rapid review State-of-the-art review Focused 'systematic' review
Implications from review findings	A given 'widget' works in the research setting, magnitude of effect, longevity, can consider cost.	Charting of a large or rapidly emerging evidence base clearly defines: • gaps • core findings • areas for future 'systematic' review.	Proposes an appropriate framework or theory to define 'what works, for whom in what context'.	Can answer a diverse range of questions with contextual utility (need for rapid findings, focused for a given context, within a consensus area of need).

are advanced in their process when they face this barrier, they can become bogged down in a long and difficult screening phase that may have been completely avoidable without any impact on the quality of the review itself. This screening phase can be a step which significantly impacts, if not fatally damages, many reviews: piloting a search can offer a chance to change direction or strategy in some circumstances.

EXAMPLE 10.1 Non-technical skills training

I am currently planning an update of a previous review investigating the use of interventions to target non-technical skills in medical education a decade since my last review.[12] Just using the same search terms, the number of results has increased tenfold in the last decade. When I review the first 200 results, I can see a lot of studies that are not relevant. I am clear how I am defining this particular type of teaching. However, authors of research are either not as clear, or use a different framework and nomenclature. My particular challenge is therefore to balance the capture of only studies that self-identify as addressing this area (which limits citation numbers) with a wider search that allows the review team to identify studies that meet our own definition, even if they don't self-identify that way. The pilot search identifies these issues as being not just linked to the size, scope and therefore resources needed to perform the review, but allows us to refine the very scope of our questions in the form of our own PICO and CAPS.

Checking decisions

The second topic under study selection is the use of methods to independently check decisions. The most common method is to make selections in duplicate (i.e., dual independent review of search results by two reviewers), known to increase the number of relevant studies identified for use in a 'systematic review',[13] but some teams will run Delphi style processes[14] for all selection decisions to ensure consensus and identify and solve disagreement.

Inevitably this stage of independent checking/making selections in duplicate uncovers areas of clear divergence between reviewers, even where a team has set out very specific exclusion and inclusion criteria. This divergence can be related to the relative hawkish or dovish tendencies of reviewers in considering papers. However, it often reflects the more core issue of the underlying epistemological pillar(s) of the review itself (see Table 10.2). Without this process to ensure the nature of knowledge selected truly reflects the educational 'truth', often teams will end up with a specific individual's version of this truth (as per a traditional review, see Table 10.1). As this limits all further phases of the review, the stage of independent checking, coupled with productive and reflective team discussions on papers where reviewers disagree, is essential to any review process. This stage, or process, also offers the chance to refine the research question and the pilot searching strategy.

Reporting of content

Regardless of the specific questions that a researcher performing a review wishes to answer, describing the primary studies on which they are reporting should be provided as a form of quality assurance. This helps readers understand the complexity of interventions in health professions education, assessment and curriculum.[15] Yet this information is often sadly lacking.[16] For example, a seminal study by Hoffman *et al*.[17] identified that in non-pharmacological trials in healthcare, two thirds of studies did not describe the intervention in sufficient detail. Similarly, in a review of 200 papers reporting on e-learning methods, only two of these papers clearly described the e-learning deployed.[18] As a final example, an analysis of poster presentations at a major international medical education meeting found similar issues, with the majority also not describing the intervention in sufficient detail to replicate.[16]

An example of a Cochrane review is pertinent. If I propose we discuss a review of the use of antenatal oral corticosteroids to prevent premature infant mortality, study quality is obviously key. But all readers, regardless of their biomedical background, can recognise the intervention as a defined and understood factor. We could, of course, have discussions of brand, route of delivery or even dose, but we can define what a corticosteroid is and be quite confident that when we discuss this, the global community can interpret this. This is not the case in health professions education reviews. A particular teaching, assessment or curriculum approach is not so easily or well defined. Even if well-understood approaches are the focus, there is such a diverse range of interventions that description and definition of the quantity itself are core.

Description can be rudimentary, using basic characteristics such as the teaching methods used, or they can provide detailed analysis of the interventions they describe, with full lists of learning outcomes, theoretical underpinning of pedagogy deployed, resources, costs, etc. If a review is describing a single homogenous intervention, such as an internationally recognised life support training programme, it is possible that a description is not needed. But this is rare: most interventions are local, at best national. Providing a description of the intervention(s) can offer a surprisingly rich resource for future research and for clinical teachers reading the review, and a deeper understanding of the primary studies. It also allows readers to identify the areas of convergence and indeed divergence in existing works. Table 10.3 gives some examples of what kind of information may be reported to provide a good description of a primary study.

Stop and think

As an exercise, search for a randomised trial of a health professions education intervention. Once you have the study, identify the details of the specific intervention (e.g., OSCE assessment, an approach to widening access, simulation training). Did the review provide sufficient description, or links to access details, of the following aspects of the primary studies: teaching methods, learning outcomes, resources used and/or materials to support replication?

There is no clear consensus on how such descriptions can be described or compared from the perspective of 'quality'. However, we have recently developed an approach which is fit for purpose for reviews in health professions education.[19,20] It uses a Red Amber Green (RAG) scale, similar to the Cochrane risk of bias tool ([21] and see later in this chapter for further discussion), but also covering core elements of interventional reporting. If gaps exist in either method or intervention reporting, it is good practice to contact a study's authors to offer them the opportunity to respond. As already discussed, the information gathered then becomes a key element of the review, both in terms of content to be descriptively synthesised and for quality assessment.

Quality of primary study methods

The other core element of quality is much more familiar and focuses on the methodological quality of the primary studies in the review. Most, if not all, will consist of some form of investigation or evaluation of an educational component. The methods used to achieve this can be diverse, as demonstrated throughout this book. And each method may be deployed well, or badly.

For randomised trials, the Cochrane risk of bias and risk of bias 2.0 tools are seen as the gold standard[21,22,23] (see also Table 10.4). Numerous studies have shown that differences in ratings on these tools correlate with differences in outcomes, suggesting bias does indeed impact the completion (or at least the reporting) of studies.[24] For non-randomised trials, the IROBINS tool is also useful.[25] However, both tools require skill to deploy and most importantly are rarely, if ever, best used to aid decisions on inclusion of specific studies in a review. This is because quality itself is a complex metric. A study may be lacking in one methodological area but excellent for lots of others. Deciding how this compares with a study that is average in all areas is simply not valid. It is also important to note that just because the quality of a study is lower, it does not mean its findings are wrong. Instead, it potentially increases the risk of the findings being problematic, hence the 'risk of bias' tool. Excluding lesser quality studies would therefore in itself be a source of bias within a review process. Instead, rating study methodology can be used to inform synthesis, guide subgroup analysis or simply inform the reader.

Defining quality of methods is a complex area. There is no clear consensus tool but specific tools for the field that have a considerable body of evidence are the MERSQI and the NOS-E[26] (see also Table 10.4). Both systems give a numerical weighting to different topic areas. For example, if a study is completed in a single centre, it will get a lower score than if it is in multiple centres (see Stojan *et al*.[27] for a recent example of use of the MERSQI). However, as the tools assign numerical scoring, it is vital to note that the specific validity and utility of an overall score is questionable at best. Is it justifiable to say two studies with the same score are of equal quality, even though one was a high-quality randomised trial assessing learner satisfaction and the other is a single group post-test study of patient outcomes? My advice is that scoring level comparisons between primary studies are made only within section scoring not in respect of overall scores. Again, these tools, or the resultant score, should not be used to exclude lower quality studies but rather to provide information which can be synthesised and presented to give an indicator of the state of the science for the particular research question/topic.

Specific review traditions

This section briefly introduces some of the main types of 'systematic' reviews, or review approaches which offer transparent methodologies that can be replicated and employ methods to ensure the evidence included and the synthesis of the evidence is rigorous. Those wishing to find out more about 'systematic reviews', and the related techniques of meta-analysis (quantitative synthesis) and narrative syntheses of results in systematic reviews, are directed to the Cochrane Handbook.[28]

Scoping reviews

The scoping review is probably the most rapidly growing review type within the field.[29] Scoping reviews are often seen as ways to chart or map the evidence. They are often employed to answer broad, exploratory research questions and so will often include diverse forms of primary research. The most cited and seminal approach to scoping review was described by Arksey and O'Malley.[30] They laid out a six-step framework:

1 identifying the research question;
2 identifying relevant studies;
3 selecting the studies to be included;
4 charting the data;
5 collating, summarising and reporting results;
6 consultation with stakeholders.

Most of these steps could be applied to any 'systematic' review. However, the unique aspect of the scoping review is the synthesis method in step 4, which indicates the evidence should be 'charted'. This can be achieved through a range of narrative or qualitative methods. Arskey and O'Malley[30] went on to define the core questions such a review should seek to answer. It should identify the scale of the current evidence on the topic to 'map' what exists. It should identify more specific questions that have sufficient evidence to indicate the need for a further 'systematic' review using an alternative methodology. It should summarise key pertinent findings that are apparent within the existing evidence. Finally, it should identify key gaps within the published literature and highlight the need for work in these areas. An example of a recent scoping review I authored is given below.

EXAMPLE 10.2 Medical education developments in response to COVID-19: two scoping reviews

This was not our first attempt to review the literature on this topic. We performed a rapid (high quality, but quickly deployed) review six months after the pandemic began.[19] When we performed pilot searches for an update, we found the evidence base had tripled in size within four months. Most importantly, the range of developments had clear signs of divergence in different teaching areas, investigation of different approaches, to different learners, with different methods. We were not sure whether we should now set out to produce several more focused systematic reviews or update our initial review. We also had a number of areas where we thought we should be seeing research emerging, but this was not apparent.

We therefore chose the scoping approach to chart the literature. We were able to:

- summarise the key developments in this emerging area and the findings of research studies on these developments;
- specify the most appropriate areas for separate reviews;
- identify the areas where research was lacking.[20]

Arskey and O'Malley's[30] work has very much directed scoping review for 15 years, but, as highlighted by Levac *et al.*,[31] Arksey and O'Malley encouraged other authors to refine their framework in order to enhance the methodology, opening the way for up-to-date guidance. Recently, the Preferred Reporting Items for Systematic Reviews and Meta-analysis Extension for Scoping Reviews (PRISMA-ScR) was published.[32] This does offer some guidance, but as with all PRISMA guidance, it is limited when applied to the health professions education context. The previously published STORIES (STructured apprOach to the Reporting In healthcare education of Evidence Synthesis) statement[33] when applied is more likely to guide a high-quality scoping review, even though it is not review-method specific. The STORIES statement identifies the important of asking a clear question, linking the review methods to this question and following this through in the results and discussion. A STORIES extension for scoping, as well as other review methods, is currently under development. Table 10.5 gives some scenarios to consider when, and perhaps when not, scoping may be an appropriate methodology

Scoping is a complex technique. Researchers often select the approach with the appropriate intentions but look to perform a more standard 'systematic' review and therefore could have allied with any other method of reviewing. The disadvantage to scoping is lack of focus on the specific answers to well-defined questions. Rather, it is best seen as defining the 'scope of the evidence' instead of scoping for the 'evidence' itself. This is a subtle, but important, difference, as reviews that are seeking to achieve the latter, but use a scoping methodology, can produce a review that offers little to the reader when the work put in by the team doesn't justify such an outcome.

The core elements of 'systematic' reviewing still exist in the planning, selection and extraction stages of scoping reviews. Therefore, as with all types of review, it is important to pay due scholarly attention to all these elements.

Realist review

In realist reviews, Wong *et al*.[34] use 'realism' to refer to a paradigm that sits between positivism ('there is a real world which we can apprehend directly through observation') and constructivism ('given that all we can know has been interpreted through human senses and the human brain, we cannot know for sure what the nature of reality is'). Realism agrees that there is a real world and that our knowledge of it is processed through the window of individuals. However, realism also argues that we can improve our understandings of reality because the 'real world' constrains the interpretations we can reasonably make of it.[35]

Realist review tries to understand the relationship between context and outcome, through the introduction of 'mechanism' as a linking concept. Realist reviews therefore offer a particular advantage for education because they recognise and embrace the untidy and capricious nature of real-world education and seek to apply theory as a lens to understand it. Realist review is often understood by the moniker that is identifies 'what works, for whom in what context'.[35]

EXAMPLE 10.3 Optimising the delivery of remediation programmes for doctors: a realist review[36]

Price and colleagues considered previous reviews in the field and noted a key text stating 'we cannot delineate precisely what works and why in remedial interventions for medical students and doctors'.[37] Building from this and recognising the complexity around medical performance and remediation, as well as the need to develop theory on how remediation is supposed to work in different contexts, led to the selection of realist review as an approach.

After conducting a realist literature review consistent with RAMESES standards, and through regular engagement with a stakeholder group, the team identified 29 different context – mechanism – outcome examples from the literature (141 papers) that together were used to produce a programme theory of remediation. Motivation and insight were found to be core elements of successful remediation and as such this theory can be used to underpin future developments which achieve change.

Realist review is truly theory driven, offering the potential to expand the knowledge base in policy-relevant areas within health professions education. This can be through the interpretation of success, failure or mixed fortunes of complex interventions with equally complex models of frameworks. However, the quality of such reviews can be difficult to assess.[34] The RAMESES (Realist And Meta-narrative Evidence Syntheses: Evolving Standards) project was completed by Wong *et al*. initially in 2013 and updated with Rameses II in 2017 to address the issues with the execution of such reviews.[34,35] The materials from these projects offer methodological guidance, publication standards and training resources for those seeking to use the realist (and meta-narrative approaches) to 'systematic' review.

Rapid reviews

Rapid review is often used as a method, but in essence it is no more than a reflection of a workplan rather than an actual review tradition. An accepted definition is to 'provide summaries of the literature in a timely and resource-efficient manner by using methods to accelerate or streamline traditional systematic review process'.[38] As such, a team could conceivably use any review tradition or synthesis method and 'rapid' merely describes the balance of streamlined methods versus not reducing quality to a point where the work is flawed. Within health interventional review work, this can be achieved easily, given the positivist alignment of such reviews.[39] However, the concern a researcher or indeed a reviewer of such work must have is: given the complexity of educational research, does 'rapid' simply equate to removing the very elements that added objective scholarly value to the work?

Additionally, 'rapid' should not be led by resource or researcher time, but by the needs of the research community. For example, producing a rapid review of a new health intervention to influence policy is very appropriate. Conversely, producing a rapid review of well-established teaching because of limited researcher time is questionable. A review may be 'rapid' but nothing within the methodology should involve lesser methods or short cuts. Rigour and quality must be maintained.

Within the complex landscape of health education research reviewing, we would normally suggest such a method is used sparingly as the contexts that need it are rare. However, the Covid-19 pandemic of 2020–2022 opened opportunities for justifying rapid reviews, to provide timely guidance for practice in a time of rapid adaptation.[19,20]

Focused reviews

The focused review is another approach that can be misunderstood. It is not a review type that is quick because it needs to be or focused because of constraints of resource or time. It is focused because the question asked is only relevant in a focused area.[40] It is a side effect of this focus that such reviews tend to be smaller, and therefore more rapid, but this is not the goal.

We have employed this method to synthesise evidence in an area that was important, but because the question we asked was by its nature a focused question, the resulting review was less generalisable.[41] This did not reduce its methodological rigour or limit its ability to answer its primary questions. It instead recognised and laid out transparently that this question was a focused one and explained the rationale for this.

If employing rapid or focused review methods, the use of an educational specific reporting guide such as the STORIES statement[33] will ensure that rigour is maintained in the absence of subspecific guidance.

Table 10.3 Types of information which may be reported to describe primary studies within a review.

Content element	Example
Learning objectives and outcomes	The specific objectives of teaching on non-technical skills within medical education.[12]
Primary teaching materials (or examples)	The specific content and example materials of handover teaching deployed in specific scenarios.[41]
Pedagogical approaches	Description of the pivots in teaching produced in response to the COVID pandemic.[42]
Level of integration or involvement of specific review focused elements	Level of patient involvement within the intervention.[43]
Length of programme or breadth of deployment (local, regional, national)	The type of collaboration between healthcare professionals in lower- and middle-income countries.[44]

Table 10.4 Quality assessment tools

Quality of study methodology reporting		Quality of intervention or development reporting	
Randomised controlled trials	Cochrane risk of bias[21] Risk of bias 2.0[23]	Educational interventions	BEME RAG education tool[20,42]
Non-randomised trials	I-ROBINS[24]	Assessment interventions	BEME RAG assessment tool[41]
Medical/health professions education studies	MERSQI NOS-E[26]		

Table 10.5 When is a scoping review appropriate, or not

Scenario	Scoping appropriate	Scoping Inappropriate
A review was performed 15 years ago and updated 5 years ago in the area of interprofessional teaching in undergraduate medical and nursing education. The literature has increased.		Scoping is not indicated. The literature is, by definition, mapped. Instead, it may be the authors wish to consider different questions that can move their synthesis forward.[9]
Since the start of the pandemic, medical school admissions has changed globally to embrace remote means.	This is a new problem and potentially the evidence base could include a range of research methods, in different contexts, with different questions being addressed. It is not clear where or what specific systematic review questions are indicated.	
Clinical reasoning is a highly complex are of interest in medical education and a team wish to map the literature on this important topic.		Scoping is not indicated. This is a term that is capriciously employed, a huge evidence base exists and many subspecific reviews in given topics of clinical reasoning have been completed. This is an example when the team need to consider PICO, CAPS and perform pilot searches to identify the specific question they want to answer.

Conclusion

Reviews in education are the backbone of how clinical teachers and researchers access the growing landscape of evidence in the field. There is value in performing all forms of review, but reviews that align with systematic methods to ensure scholarly rigour have a firm place within the tapestry of options available to researchers. Such works can align with an array of traditions and synthesis methods, mirroring the diversity of primary research in the field. Core to all reviews is to ensure a clear set of answerable questions that do not leave readers thinking 'so what'. Such questions should be matched to the review tradition selected. Finally, when using more complex and nuanced techniques, such as scoping or realist review, methodological support can and should be sought to ensure appropriate execution.

Practice points

- Reviews that use systematic methods offer transparent and reproducible scholarly approaches to select, appraise and synthesise evidence on a given educational question, existing as quite distinct and a broader set of methods than the medical tradition of 'systematic reviews'.
- Reviewers can use the tools PICO and CAPS to propose questions, pilot searches to develop them and consideration of appropriate research paradigms to link their questions to relevant review traditions and methods.
- Quality assessment should consider not just the quality of methods in a primary study, but also the quality of reporting of the given educational intervention as distinct but equally important elements of appraisal.
- Specific traditions, such as realist or scoping reviews, have an important role, but all synthesis methods can be deployed in a manner that mirrors the complex and scholarly approaches described throughout this book.

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11 Qualitative research methodologies: embracing methodological borrowing, shifting and importing

Lara Varpio, Maria Athina Martimianakis (Tina) and Maria Mylopoulos

You are familiar with qualitative methods and methodologies. You have read several introductory texts and have carried out some qualitative research projects. While you continue to learn about the intricacies of qualitative research, you no longer consider yourself a novice. Recently, your interest in how trainees deal with uncertainty has led you to question if there is more to understand about this particular learner experience. You want to explore this further and decide that a qualitative study will be required. However, in looking at your setting and reflecting on the body of research already published, you are not sure which qualitative methodology would be best suited to investigating your interests. None of the methodologies commonly used in health professions education seem to perfectly fit your research question and context. You aren't sure what to do. You question to what extent you should bring existing theories to bear on your data collection and analysis. You wonder about the impact of the broader training context on individual experiences. You question whether the results should be used to generate a description of experience, a new model, or a revision of an existing theory. In the end, to develop a strong research design, you realise you will have to develop a qualitative study that flexibly employs qualitative methodologies, while also maintaining appropriate markers of qualitative rigour. But how to do this?

Scholars working in healthcare professions education (HPE) have witnessed the qualitative–quantitative debate move steadily towards resolution.[1] Scholars have agreed that each approach can be usefully applied to different research questions, each offering informative insights to the field.[1,2] The field has acknowledged that these different approaches are just that – simply different.

This truce has been supported by a proliferation of texts articulating the differences between qualitative and quantitative paradigms, epistemologies, ontologies and methodologies[3–5] (see the chapter by McMillan in this book, and additional reading suggestions at the end of this chapter). Qualitative method guides[6–9] are increasingly available in HPE-based publications, helping scholars to effectively participate in and evaluate qualitative scholarship (see Recommended Reading for some resources we find particularly useful).

But as qualitative methodologies and methods are employed with more frequency, the HPE community must continually 'critique our cultural expectations about how it [qualitative research] should be done'[10] (p. S130). Qualitative methodologies and methods are complex structures in-and-of themselves. Each qualitative methodology has its own history of development, involving disputes that influence the methodology's structures and operational techniques. HPE scholars using qualitative methodologies ought not to gloss over these differences-that-make-a-difference because these variations are the underpinnings of effective research designs.

In this chapter, we explore some of the qualitative methodological differences-that-make-a-difference. We do not describe the many qualitative methodologies and methods available to HPE scholars. There are other texts that do so skillfully, and in considerable detail (see Recommended Reading for some suggested manuscripts). Instead, we examine how methodological flexibility can be employed in qualitative studies. We identify and describe three ways in which this flexibility is realised in HPE research: (a) methodological *borrowing*, (b) methodological *shifting* and (c) methodological *importing*. We explore each of these flexibility techniques by analysing its application to a specific qualitative methodology. We examine methodological borrowing in relation to qualitative description. We look at methodological

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shifting as it relates to Grounded Theory (GT). We study methodological importing as it has influenced the use of discourse analysis. We illustrate these flexibility approaches using comparative sets of published HPE research articles to demonstrate the differences-that-make-a-difference. We conduct this analysis neither to praise nor to critique the selected publications; instead, we aim to illustrate the methodological variability that is possible.

Methodological borrowing

In keeping with the established tradition,[11,12] we conceive of the boundaries that divide qualitative methodologies as permeable. As Denzin and Lincoln propose, qualitative research involves engaging with

> *a wide range of interconnected interpretive practices, hoping always to get a better understanding of the subject matter at hand. It is understood, however, that each practice makes the world visible in a different way. Hence there is frequently a commitment to using more than one interpretive practice in any study.*[12] (pp. 3–4).

Given this premise, we propose that it is appropriate to borrow elements of one methodology to inform research conducted using another methodology. For example, a study can engage in qualitative description (a methodology that does not seek to develop theory) and borrow techniques associated with GT (a methodology that seeks to develop theory) such as the constant comparison approach for analysis. This mixing of methodologies is not a marker of poor study design. Quite the opposite – it means that the researcher is drawing intentionally on specific methodologies to construct a study that will answer a specific research question.

For successful methodological borrowing to be achieved, *the borrowing should be done explicitly and intentionally*. Methodological borrowing requires that scholars be skilled with both methodologies – both the primary methodology being used, and the methodology being borrowed from. Such expertise is required so that the scholar can articulate the purpose(s) and extent of the borrowing.

To illustrate the practices of methodological borrowing, we examine how it has been applied to qualitative description. We describe qualitative description as a methodology, and then illustrate how scholars have borrowed from other methodologies to enhance their qualitative description studies (this comparison is provided in Box 11.1). Although these publications illustrate how methodological borrowing can generate different kinds of qualitative description studies, they do not explicitly acknowledge nor describe the purposes of the borrowing. We suggest that researchers should identify, describe, and justify the methodological borrowing used in their research for this methodological flexibility to be appropriately employed.

BOX 11.1 Methodological borrowing in qualitative description studies

Example 1

Gumuchian S.T. *et al*. (2020) Learner handover: Perspectives and recommendations from the front-line. *Perspectives on Medical Education*, **9**, 294–301.

The purpose of this study was to explore clinical supervisors' opinions of, experiences with, and recommendations for implementing learner handover. The data for this research was from a survey-based questionnaire component of 'a larger experimental study' (p. 295). The authors approached analysis of the study's qualitative data using qualitative description. The authors explicitly describe borrowing from experimental methodology, and their descriptions of the methods clearly indicate its influence.

This study's methodological borrowing is evident in its data collection and data analysis approaches. First, all study data were collected via a questionnaire that incorporated both closed-ended questions (generating quantitative data) and open-ended items (generating qualitative data). The authors clearly state working from a post-positivist stance. As Creswell confirms, in post-positivist experiments, 'the researcher collects information on instruments based on measures completed by the participants'[1] (p. 7). Second, the borrowing from experimental methodology is evident in the structures employed in the qualitative analysis process to ensure objectivity and validity. To 'minimize the influence of individual bias' (p. 296), several members of the research team were involved in the data coding processes. This description echoes the post-positivist tradition of critical multiplism,[2] which involves the use of multiple triangulation techniques (including investigator triangulation) to generate undistorted, more objective data interpretations. The researchers also examined the frequency of each code in the qualitative data, computing the percentage of participants who mentioned each code. This enabled the authors to examine the patterns of code use across participants with similar and different positions vis a vis the learner handover event (e.g., being strongly in favour of using learner handover vs those who strongly opposed its use). Here, the authors relied on the post-positivist tradition turning words and/or felt experiences of a phenomenon into a numeric score to support objective data analyses and comparisons.

Example 2

Shepherd, L. *et al*. (2020) Journey into uncertainty: Medical students' experiences and perceptions of failure. *Medical Education*, **54**, 843–850.

The purpose of this study was to examine medical students' perceptions and experiences of failure during undergraduate medical education. It used individual, semi-structured interviews to collect participants' insights about failure in medical school. The authors label the work as a qualitative description study.

The authors explicitly state using thematic analysis 'to identify and describe core themes across all data' (p. 845). As these authors also acknowledge, qualitative description studies often borrow from thematic analysis. This borrowing is common since thematic analysis is a practical means of qualitative data analysis that is 'not bound to a particular paradigmatic orientation; instead, it can be used within post-positivist, constructivist, or critical realist research approaches'[3] (p. 847). In this study, the authors clearly state that they approached the investigation of failures from a constructivist research paradigm (p. 844). The researchers therefore harnessed thematic analysis's ability, when used in a constructivist orientation, to 'emphasize the social, cultural and structure contexts that influence individual experiences'[3] (p. 847). The researchers acted as co-constructors of the data via the interview dialogue to reveal the participants' experiences of failure as socially constructed.

Qualitative description

With paradigmatic roots in naturalistic inquiry,[13,14] qualitative description rests on the premises that all inquiry reflects specific values, that all knowledge is inextricably linked to the contexts in which it was generated, and that all phenomena need to be examined holistically in their natural settings (see Chapters by Cleland; McMillan; Macleod, Burm and Mann earlier in this book). Although it has a long history, interest in qualitative description was most recently renewed by Sandelowski.[11,15]

The purpose of qualitative description is to describe a phenomenon in the common language of the participants, with sufficient detail and nuance to accurately describe the complexity of the phenomenon, but without the interpretive influence of a theoretical framework.[11,15] It generates a description that is 'a comprehensive summary of an event in the everyday terms of those events'[11] (p. 336) and without the shaping power of theoretical interpretations. As Sandelowski summarises, qualitative description emphasises 'readings *of* [data] lines as opposed to *into*, *between*, *over*, or *beyond* [data] lines'[11] (p. 78). The markers of good qualitative description are the precise reporting of events and the un-interpreted reporting of the meanings that participants attributed to those events.[11]

This 'straight' reporting of data does not mean that qualitative description is an atheoretical methodology.[15] Choosing a research question is the start of the interpretive process (see Chapter 3). Similarly, deciding on data collection methods is an interpretive act. Thus, qualitative description involves interpretation just as every research effort does; however, the aim of qualitative description is to describe events in their own terms. These descriptions should not involve the addition of 'spin'[11] that can come from applying an external theory to data analysis.

The dimensions and practices of qualitative description are less regimented than those of many other research methodologies (such as GT). Sandelowski describes qualitative description as resisting simple categorisation and neat delineation of methods-related techniques:

> *Given its various guises and the eclectic combinations of sampling, data collection, and data analysis techniques characterizing it, qualitative description could never be described as any one method that any one person invented.*[15] (p. 78).

Qualitative description does not dictate specific processes for data collection and analysis. It is open to any and all qualitative sampling, data collection and data analysis techniques that will generate the most appropriate means for developing a near-data[11] description of the phenomena being studied. Understandably, then, methodological borrowing is often employed in studies using qualitative description. A scholar can borrow elements or techniques from another methodology to inform their qualitative description data collection and/or analysis processes. In Sandelowski's terms, borrowing would be 'the hues, tones, and textures'[11] (p. 337) from other research methodologies that become 'overtones' to the qualitative description.

Borrowing from different methodologies results in qualitative description studies that look very different from each other. Both the publications described in Box 11.1 generate 'straight', 'near-data' qualitative descriptions, but do so in very different ways.

Methodological shifting

We conceive of each methodology as existing on a *shifting* continuum. As paradigms, ontologies and epistemologies (see chapter by McMillan) change over time, and as methodologies are adopted by different disciplines, methodological traditions shift in accordance with those developments. For instance, Edmund Husserl developed transcendental phenomenology in the early 1900s. Transcendental phenomenology focuses on examining an individual's conscious experiences to uncover the essential meaning of a phenomenon. To accomplish this, the researcher brackets off prior personal knowledge and attitudes. Soon after Husserl, Martin Heidegger proposed a new variation of phenomenology – hermeneutic phenomenology. This tradition posits that it is impossible to separate the individual from the external world. Therefore, the hermeneutic phenomenologist examines personal knowledge and attitudes in relation to a phenomenon instead of bracketing them off. Today, when a scholar engages in phenomenology, he/she must choose which tradition will enable them to best answer his/her research question – transcendental or hermeneutic. Choosing to engage in transcendental phenomenology does *not* mean that a scholar is using an outdated form of phenomenology. Instead, the scholar is choosing an approach from the methodology's shifting continuum. What is required is that the scholar understands how the methodology has shifted so as to choose the appropriate tradition to employ in his/her study.

We use GT to illustrate methodological shifting. First, we describe the continuum of the GT methodology. We then use two publications (see Box 11.2) to showcase the paradigmatic shifts that have occurred within the methodology and the resulting types of work that each tradition of GT affords.

BOX 11.2 Methodological shifting in grounded theory studies

Example 1

Miles, D. A. (2018). Simulation learning and transfer in undergraduate nursing education: A grounded theory study. *Journal of Nursing Education*, **57**, 347–353.

The purpose of this study was to understand 'how simulation learning transfers to the clinical setting in undergraduate, prelicensure nursing education students' (p. 348). This study exemplifies the post-positivist tradition of GT, marked most prominently by the *tabula rasa* approach of the researchers in exploring their phenomenon of interest, and their positioning of the results as representation of a reality.

From the introduction, the rationale for the study is the belief that 'investigation into simulation learning and transfer would offer guidance on the effective integration of simulation learning in nursing education' (p. 348). Accordingly, the data were collected and analysed inductively, with the aim of developing theory grounded in the experiences and perceptions of the participants. The discussion further describes the core category, identified as 'Acting Like a Nurse', and draws connections to existing literature on transfer of learning and simulation education. However, and importantly, the authors do not seek to build on that literature, but rather draw on it to make meaning of the results from the current study. Finally, understanding of the 'basic social process of simulation learning' generated from the results is presented as a situated reality (i.e., within prelicensure nursing programme).

Example 2

Teunissen, Pim W. *et al*. (2021). Contextual Competence: how residents develop competent performance in new settings. *Medical Education*, **55**, 1100–1109.

This study sought to 'understand how trainees entering a new setting develop awareness of specific contextual changes that they need to navigate and learn from' (p. 1100). The authors investigated 'what contextual changes residents need to navigate when entering a new setting and how those contextual changes can impact their ability to learn and contribute to the development of competent performance' (p. 1102). This is a constructivist GT study; accordingly, the authors justified their use of the methodology by establishing the ways in which the study was aimed at further developing understanding of the phenomenon of 'contextual competence', while utilising existing sensitising concepts from the literature.

In the introduction, the authors used conceptual frameworks of competence and capability as well as literature from psychology and nursing education specifically relating to 'contextual competence' to frame the rationale for their research question and data collection approach. Data analysis involved a combination of deductive and inductive analyses to generate themes that were meaningful within the conceptual frameworks identified. Moreover, the particular perspectives of the researchers involved in the data analysis were described in a distinct 'Reflexivity' section to make transparent the lenses that the research team brought to bear on the data. The discussion foregrounds a developing model of contextual competence, which the authors name 'Bate's hierarchy of contextual competence' and makes clear links to existing frameworks and literature, most notably Maslow's theory of motivation. Implications for how to 'nurture and train 'capability' are elaborated as are the ways in which the results support and build on the existing frameworks of competence and capability.

Grounded theory

GT is an inductive methodology aimed at generating substantive theory using qualitative or quantitative data generated from some combination of interviews, observations and text.[16] It is perhaps the best known and the most commonly used qualitative methodology in HPE research. This popularity is likely due to GT's clearly defined data collection and analysis techniques that were originally laid out by Glaser and Strauss.[16] These techniques, which include some borrowed from other qualitative methodologies, were assembled and clearly defined in a step-by-step text that demystified qualitative research.[17] They include an iterative, constant comparative approach to data collection and analysis, theoretical sampling, theoretical saturation and a four-step, inductive coding process culminating in the generation of theory to understand social phenomena. Generally, when assessing the quality of a GT study, researchers determine if these techniques have been employed effectively.

However, rigour is not solely about fulfilling checklists in the 'doing' of qualitative research.[18] Furthermore, multiple traditions of GT methodology have emerged, reflecting shifts in the underlying epistemologies and ontologies guiding the research process.[19] These shifts have resulted in the modification of GT techniques to reflect the paradigms within which they are being enacted. Thus, it is crucial to understand the underlying paradigms of each tradition within the methodology, how the application of techniques reflects that paradigm and what knowledge is being generated as a result. As researchers, we must situate ourselves paradigmatically (i.e., know our own epistemological and ontological position) in order to select the GT tradition that best allows us to explore our phenomena of interest.

GT's origins in the theory of Symbolic Interactionism[20] significantly shaped the methodology's initial epistemological underpinnings and the development of the techniques that guide its use. Symbolic Interactionism posits that people act towards things based on the meaning that those things have for them; and that these meanings are derived from social interaction and are modified through interpretation.[20] To understand social phenomena, we must explore the meanings that people impose on objects, events and behaviours. Accordingly, the first tradition of GT is underpinned by the question 'what is the *basic social process* that underlies the phenomenon of interest?'[16] As such, GT is a post-positivist methodology, aimed at inductive theory generation that is 'grounded and rigorous', reflective of an emergent reality. This orientation is manifested in GT's dictates that the researcher is a *tabula rasa*, and that theory generation is an entirely inductive process of discovery generated through systematic analysis of the data being collected from participants. While there has been debate about the particulars of the systematic analysis (most famously, a schism between Glaser and Strauss centred on the issue of verification and abduction in GT),[21] GT remained relatively entrenched within the post-positivist mode of discovering reality until the more recent development of constructivist GT.[22]

As the name suggests, the constructivist GT tradition, developed most notably by Kathy Charmaz, shifts the methodology from post-positivism to constructivism. Constructivist GT retains many of the techniques of the original GT methodology; however, Charmaz's modifications aim for interpretive understanding and situated knowledge (rather than explicit generalities or sparse explanations – criticisms often levelled at the original GT).

Constructivist GT positions inquiry in its historical, cultural, social, situational and interactional location. And, perhaps most importantly, rather than demanding the researcher begin as a *tabula rasa*, constructivist GT acknowledges the perspectives and positions of the researcher as well as the researched. In these ways, constructivist GT focuses on 'recognizing prior knowledge and theoretical preconceptions and subjecting them to rigorous scrutiny'[23] (p. 402). While there have been critiques,[24] constructivist GT has gained immense popularity, particularly when researchers seek to use the methodology to advance (i.e., refine and elaborate) existing theory, rather than generate new theories to account for social phenomena.[24]

Some researchers, most notably Clarke,[25] have questioned 'how grounded theory is grounded?', suggesting that grounded theorists must move beyond basic social processes and include 'the *situation* broadly conceived'. In doing so, Clarke has shifted the latest GT tradition into post-modernism. This shift that has yet to find a significant foothold in HPE research, but weak footings are common when methodologies are first imported into a field (see description of methodological importing below).

The publications described in Box 11.2 illustrate how HPE scholars have navigated the methodological shifting that has evolved within the GT methodology. The first publication engages in the post-positivist GT tradition, while the second uses the constructivist GT approach.

Methodological importing

In interdisciplinary fields such as HPE, scholars often import methodologies from other disciplines and fields. Methodological importing involves the large-scale transfer of a methodology's concepts and tools from a field where it was developed or frequently used, to a field where the methodology is largely unknown. Such importing is valuable because it provides opportunities for raising new questions, for addressing old problems in new ways, and for generating epistemic debates that may lead to conceptual renewal or innovation. However, methodological importing is *not* a simple process. When uprooting a methodology and importing it to a new field, the foundational conditions that underpinned the approach can be left behind. The ontological and epistemological orientation of the importing field is often different from the one imported from. This means that the rationale for using the methodology and its associated markers of rigour may not be accepted in the new field. The importing field may be unfamiliar with both the content and the type of knowledge generated by the imported methodology in its original field. Therefore, using an imported methodology entails re-negotiating the ontological and epistemological basis for its use in the new discipline. It also entails finding ways to link it to a relevant pre-existing knowledge to construct its utility in the new field.

When a methodology is imported into a field, it often seems incomplete in its methodological articulation. Over time, as the methodology attracts followers and is used more frequently in the new context, a tradition around its use is formed and more context-specific ontological and epistemological roots take shape. For example, in HPE, such a tradition has arguably been generated around GT but has been less well developed around qualitative description. When methodological importing is in its earliest phases, scholars need to engage in considerable descriptive and justification work. For instance, when importing a methodology, the researcher should explicitly explain what markers of rigour should be used to judge the research generated and should be prepared to modify these markers to accommodate the expectations of the importing field.

To illustrate both the challenges and the possibilities of methodological importing, we examine Foucauldian discourse analysis (FDA). We discuss FDA in the context of other forms of discourse analysis and provide an overview of how it has been imported into the HPE field. We discuss some ways in which the FDA methodology has been used in our field, signposting the negotiations that scholars have had to make in order to legitimate FDA as a rigorous approach for understanding and addressing HPE concerns.

Discourse analysis

Discourse analysis is a broad term that encompasses a variety of approaches to the study of language. One way to differentiate between different discourse analysis approaches is to identify what the researcher is hoping to accomplish through the study of language. For example, Hodges *et al.*[26] organise discourse analysis approaches in three categories:

1 Formal linguistic discourse analysis (such as sociolinguistics), which focuses on language use and meanings of text at the level of enunciation (what is being said and how it is being said).

2 Empirical discourse analysis (such as conversation analysis and genre analysis), which focuses on ways in which language and texts construct social practices.

3 Critical discourse analysis (CDA) (such as Foucauldian analysis), is used to study the emergence of systems of meaning (discourses) and their contribution to the constitution of limits of what can be said or done by individuals or organisations.

In this chapter, we briefly discuss the third form of discourse analysis, the CDA, specifically Foucauldian inspired analysis. For a more in-depth dive into the affordances and limitations of CDA please refer to Patton *et al*.'s chapter in this book.

Broadly speaking, discourses are systems of meaning that emerge in a particular context, serve to organise activity and functions and come to be appreciated as 'truth'. Take, for example, the discourse of accountability. This discourse organises people's activities and interactions around processes that hold individuals and institutions accountable to society for their actions (e.g., for the way they conduct their work, the way they operate their business or the way they handle decision making). People take on different roles in enacting or resisting accountability. These roles (or identity constructions) are immediately recognisable and are linked to accountability processes. For instance, when an individual takes on the role of an oncologist, he/she engages with the texts and practices of their professional bodies, of hospitals where they practice, of healthcare teams and of patients. The discourse of accountability is part of these texts and practices. That discourse influences the oncologist's thinking and actions, requiring that he/she recognise and accept being accountable for providing *what the discourse defines* as high-quality, ethical patient care. The discourse of accountability requires the oncologist to act (and even just to *be*) in certain kinds of ways in order to be labelled as a 'good and responsible' oncologist.

Consistent with a constructivist paradigm (see the chapter by Mann and MacLeod), CDA methodologies examine texts to understand how versions of reality, society and identity are produced and reproduced. CDA methodologies seek to understand how these versions of reality, society and identity support the power of specific institutions, practices and conceptions of knowledge. To continue our example, in an accountability culture, individuals who study and create evidence for robust accounting processes gain visibility and are valued for their expertise. The evidence they produce reinforces the dominance of the discourse of accountability. In the process, they may also become implicated in potential unintended effects linked to a culture of accountability, such as overinvestment in surveillance of workers and their work productivity. To illustrate, the oncologist who creates a checklist for safer and more effective chemotherapy treatments will be accorded respect and social capital by his/her professional bodies, hospitals, colleagues and patients. The checklist bolsters the accountability culture of the hospital since there is now a 'standard' to uphold. However, this oncologist might inadvertently also contribute to increased interprofessional tensions because using the checklist requires a new division of labour and care responsibilities in the team.

FDA researchers attend to language, but not to extract the individual meanings that people ascribe to their words. Instead, this methodology focuses on language to distill and describe how drawing on specific narratives about the world affects individuals, their interactions and the spaces within which they function. The goal of FDA is to make visible the processes by which worldviews become uncontested truths and thus methodologically treats the emergence of ideas as relational and contingent. This poses a challenge to scholars, particularly those who have aligned with positivist/post-positivist paradigms (see Chapter 1). Taking up the accountability discourse example yet again, a study using FDA methodology might ask: How did this 'truth' discursively come into being? What is created as a result of this 'truth'? How does the discourse continue to uphold this 'truth'? In other words, discourse analysts would not evaluate the merits of accountability *per se*, but instead examine what happens when valuing accountability dominates a particular space. For example, FDA can illustrate how reproducing the importance of accountability can open up conceptual space for the construction of new concepts (e.g., accountability reporting requirements) and new objects (e.g., performance checklists) or validate certain subject/identity positions (e.g., good documenter) or to study how a commitment to accountability may hide other ways of ensuring high quality, ethical patient care. Tracking the effects of dominant discourses (i.e., competence, evidence-based medicine, patient safety and collaboration) has been an entry point for scholars in HPE that use FDA to challenge the field's taken-for-granted assumptions.[27–35]

FDA does not have a distinct set of methodological techniques associated with it. This has implications for how researchers demonstrate rigour in their work, particularly when they are importing the FDA methodology into an interdisciplinary field that has had little previous experience with the approach. Scholars first introducing the approach will have to make concessions and adjustments in how they justify their theoretical methodological choices and present their findings, setting up future authors to follow their precedent. As the papers mentioned in Box 11.3 demonstrate, while studies using Foucauldian discourse analysis methodology have been published in HPE journals for over a decade, HPE scholars continue to devote considerable space in their publications to establishing methodological credibility. Such is the price of methodological importing.

BOX 11.3 Methodological importing in Foucauldian discourse analysis studies

Example 1

Kellar, J., *et al*. (2020). A historical discourse analysis of pharmacist identity in pharmacy education. *American Journal of Pharmaceutical Education*, **84**, https://doi.org/10.5688/ajpe7864

This study explores professional identity constructions in pharmacy over the last century to better appreciate why some forms of pharmacy practice are perceived to be more relevant than others. Methodologically, the authors used FDA to problematise the idea that there is one perfect professional identity for pharmacists. However, this is an imported methodology as they are writing for an audience and journal that has not previously published research framed using FDA. They thus begin their method section with a brief biographical overview of Foucault and note that Foucault's 'perspectives can be of significant value to framing health professions education research' and cite several texts published within and outside health professions education literature that overview FDA as a methodology, in an effort to allay any concerns the reader may have about an unknown approach. They go on to provide an overview of the core tenets of FDA that they will be applying in their study. They define terms such as power, truth statements, objects, subjects, and outline how each works to enable scholars to move beyond describing what people think pharmacists do, to describing how pharmacists have come to practise the way they do. FDA does not use the term identity. Instead, the term subjectivity is used to reference the roles people take on when they embody dominant discourses. While the authors introduce the appropriate theoretical term, they continue to also use the term identity which is more familiar to the audience they are trying to reach. Having outlined the potential of FDA the scholars move on to detail their methodology for data collection and analysis. They continue educating the reader, by starting off the section on data sources and analysis with what constitutes an 'archive' in the Foucauldian sense, and how one would go about putting together an archive for analysis. Throughout this section the authors continue to cite texts that overview FDA as a methodology, reminding the reader that this method, while unfamiliar to them, is a legitimate approach. Throughout the methodology section the authors ensure that they justify all their choices by linking back to the theory repeatedly. The deliberation and thought process for choosing the archival texts is clearly articulated with the following statements: 'These sources were chosen specifically as they represent key voices, organisations, and publications in pharmacy education, and thus reflect important conversations of the time, but balance size and robustness of included materials' (p. 1253). The authors also employ common and recognisable data analysis approaches used in other more established qualitative methodologies including iterative reading of texts, overview of analysis by multiple analysts to refine analysis and ensure integrity of findings, notetaking and field note construction to document analytical steps and team discussions to 'ensure that the results were comprehensive and clear' (p. 1253). While these are not procedures used by Foucault in his work, such practices have been adopted by scholars in HPE to create legitimacy for the imported methodology. Similarly, in the results section, the authors speak to the volume of texts included in the archive indicating that it was composed of '40 texts, encompassing 500 pages' (p. 1253). Quantifying the archive to demonstrate its power is also not a required part of the methodology. It is more relevant to describe how the selected texts are meaningful in the circulation of discourses and/or their legitimation. However, given that the audience is used to large datasets and positivist approaches to research, the authors deliberately reference the total pages analysed to reinforce the trustworthiness of their dataset. To help the reader visualise the analytical process, and similar to many scholars who employ FDA in HPE, they include two tables to contrast the features of the five dominant discourses of pharmacy identity that have emerged in the past century. Throughout the findings sections, additional information for how the methodology is applied and how to appreciate the results of this research is provided to the reader. They conclude by further building up the usefulness of CDA not only for understanding the important questions related to pharmacy professional identity, so to 'inform needed professional changes moving forward' but also for other professions that are aiming to 'renegotiate professional identities and roles in the future'.

Example 2

Ajjawi R., Olson R.E., |& McNaughton N. (2021) Emotion as reflexive practice: A new discourse for feedback practice and research. *Medical Education*, **56**, 467–586.

The authors of this paper conducted a critical review of the feedback literature published in three leading HPE journals, *Academic Medicine*, *Medical Education* and *Advances in Health Sciences Education*. Their review aimed to answer the following inter-related research questions: 'What are the discourses of emotion in feedback literature and what "work" do they do?' (p. 2) To justify exploring the intersection of emotion and feedback the authors reference a previous study conducted using CDA[30] by Nancy McNaughton that identified three main discourses of emotion operating in the field of HPE more broadly. However, instead of speaking in depth about the findings of the previous study, they cite McNaughton's argument for CDA, namely that 'researching how emotions are "put to work" in the literature makes visible the invisible emotion schemas that reproduce problematic practices'.[30] In other words, the authors use the common practice of situating one's work in previously published literature as an opportunity to reinforce the potential of CDA as a methodology; a common strategy when importing methodologies. They continue by theoretically defining what is a discourse in the Foucauldian sense and providing additional justification for theoretically conceptualising emotions as discourses. These explanations and justifications precede the formal outline of methods. In addition to an outline of their approach for collecting and analysing the texts that make up their archive, the authors also provide a table summarising the identified discourses and how they have been applied specifically in the feedback literature. These scholars also use a table as a visual aid to quickly reinforce the importance of linking truisms to practices. The authors end the paper with an additional aid for extrapolating and applying the results of this research in educational scholarship and practice. The second table is described as a heuristic, a reference tool to quickly appreciate conceptual and paradigmatic differences and overlaps between different ways of conceptualising emotion in healthcare education settings.

Conclusion

In this chapter, we have defined, described and illustrated three ways for flexibly employing qualitative methodologies in HPE scholarship: methodological borrowing, shifting, and importing. Our identification and reporting of these approaches was possible in great part because of our experiences of engaging in reflexive practices as qualitative scholars working in HPE. In our efforts to report qualitative research to the community, we have had to attend to and negotiate with the larger HPE context. While the qualitative–quantitative debate is ending, the influence of HPE's post-positivist roots runs deep. This influence is seen even in this chapter when, for instance, we use the term 'rigour' and not 'trustworthiness'. The influence is similarly felt when journal reviewers ask authors to define and describe 'ethnography', or 'a theme', but do not ask for the same description of 'an experiment' or 'a p value'. We understand the need for linguistic compromises and for explanatory descriptions in our methods sections. Qualitative research methodologies and methods are still newer to the HPE field than quantitative methodologies and methods. Qualitative researchers working in HPE must explain our methodologies and methods to make our ways of contributing to the development of knowledge accessible to the larger community.

But it is equally important that HPE's qualitative scholars critique their own practices and traditions. We hope that methodological borrowing, shifting, and importing provide scholars with ways of thinking about the differences-that-make-a-difference between and within qualitative methodologies. Just as there is room in the HPE domain for mixed methods research – combining both qualitative and quantitative epistemologies, ontologies and methodologies – there is room for qualitative studies that draw from multiple qualitative traditions (be it by borrowing from across multiple methodologies, by selecting from a methodology's shifting traditions, or by importing different methodologies into the field). Furthermore, just as mixed methods researchers must find ways of demonstrating both rigour and trustworthiness, qualitative research that draws on multiple traditions must demonstrate the markers of trustworthiness that are foundational to each methodology.

> **Practice points**
>
> - Methodological flexibility can be employed in qualitative studies to take advantage of the differences-that-make-a-difference between qualitative methodologies.
> - It is appropriate to *explicitly and intentionally* borrow elements of one methodology to inform research conducted using another methodology.
> - Scholars must make an *informed* choice, from along a methodology's shifting continuum, of the tradition that will best answer a specific research question.
> - When importing a methodology into a new field, researchers must *explicitly explain* what markers of rigour should be used to judge the research generated and should be prepared to modify these markers to accommodate the expectations of the importing field.

Recommended reading

Paradigms, ontologies and epistemologies

Varpio, L. & MacLeod, A. (2020) The philosophy of science series: Harnessing the *interdisciplinary edge effect* in health professions education research. *Academic Medicine*, **95**, 686–689.

For brief introductory overviews or summaries:

Bergman, E., de Feijter, J., Framback, J. *et al*. (2012) AM last page: A guide to research paradigms relevant to medical education. *Academic Medicine*, **87**, 545.

For more in-depth explanations:

Howell, K.E. (2013) *An Introduction to the Philosophy of Methodology*. Thousand Oaks, CA: SAGE Publications.

Qualitative methods and methodologies

Ng, S., Baker, L., Cristancho, S., *et al*. (2019) Qualitative research in medical education: methodologies and methods. In: Swanwick, T. (ed.). *Understanding Medical Education: Evidence, Theory and Practice*, 3rd edn. Oxford: Wiley Blackwell, pp.427–442.

For introductory overviews or summaries:

Bourgeault, I., Dingwall, R. & de Vries, R. (eds) *The SAGE Handbook of Qualitative Methods in Health Research*. Thousand Oaks, CA: SAGE Publications

For more in-depth explanations:

Creswell, J. (2013) *Qualitative Inquiry & Research Design: Choosing Among Five Approaches*, 3rd edn. Thousand Oaks, CA: SAGE Publications.

Denzin, N.K. & Lincoln, Y.S. (eds) (2011) *Handbook of Qualitative Research*, 4th edn. Thousand Oaks, CA: SAGE Publications.

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12 Attuning to the social world: ethnography in health professions education research

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Your medical school is in the first few months of the COVID-19 Pandemic. As the undergraduate medical education (UGME) curriculum director (Dr Vax) who also has an active clinical residency teaching load, you have been put in charge of creating a research programme to study the effects of the pandemic on the way in which the undergraduate medical curriculum is re-designed, delivered and evaluated at the beginning, during and at the end phase of this health crisis. Major curriculum delivery modifications are being proposed that are purportedly tailored to meet the anticipated new demands for modified face-to-face teaching and learning in the clinical environment, as well as campus-based blended and fully online modalities. You are interested in not only what students and faculty say about their new situation, changes in attitude, knowledge and how they feel, but also how they adapt behaviourally in real-time to major changes in their teaching and learning environment. Ethnography has been suggested to you by an education researcher and is a qualitative approach that you have had a passing interest in, but you have not had formal training nor any experience in using it. A brief review of the literature suggests there are a variety of ethnographic approaches that might be appropriate to use at different phases of the pandemic. You decide to explore the ethnographic literature in more depth to see which type(s) of ethnography might be useful in supporting the creation of your UGME research programme.

History and context of ethnography

The term ethnography has its origins in nineteenth-century Western anthropology in its use to describe both the methods and descriptive accounts of anthropologists living with a group of people for an extended period of time with the aim of documenting and interpreting their culture and everyday lives.[1–3] As many anthropologists undertook ethnographic field work in colonial lands, these early ethnographies have been problematised for their assumptions and consequences.[4] Over the years the use of ethnography shifted from overseas to local cultures, and scholars from other disciplines, notably sociologists at the University of Chicago, used ethnography to study social groups and patterns of life within their city settings.[1,2]

Seminal ethnographic work during the twentieth century gave rise to a set of characteristics commonly ascribed to ethnography:

1. Data collection takes place in naturally occurring settings with a focus on a single or a few cases.
2. Data collection is relatively long term.
3. Data is gathered from observation, interviewing and the collection of documents and artifacts from the field.
4. Data collection is relatively unstructured with research questions refined and possibly transformed over time.
5. Data analysis centres on interpretation of the meanings, functions, and consequences of human actions and institutional practices with the aim of documenting what actually goes on.[2,3,5]

Attention to these characteristics allows for the development of ‘thick descriptions’ of communities[6] that go beyond how individual members might describe their experiences, perceptions of, and behaviours within, their cultural group collected via qualitative in-depth interviews.[7]

Although ethnography is commonly associated with the above history and features, it is at the same time an ambiguous and contested term given that, over time, it has been taken up in numerous disciplinary contexts and underpinned by varied paradigms. This has given rise to many deliberations about its ontological, epistemological and methodological underpinnings.[5,8] (See also chapters by McMillan, and MacLeod, Burm and Mann earlier in this book.) The diverse nature of ethnography is apparent through the range of adjectives that have been attached to it, such as feminist,

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focused, multi-site, critical, institutional and virtual, amongst many others.[5] The varied and changing landscape of ethnography has also been influenced by a range of factors including, but not limited to, divergent opinions about whether the purpose of ethnography is the production of knowledge or advocacy for change; pressures for social research to demonstrate impact; changes in ethnographic methods such as digital field work and increased reliance on interviews; and institutional factors such as difficulties gaining access to settings and ethics requirements.[2,5,9]

The variability in approaches to ethnography has contributed to debates about the characteristics that are traditionally associated with it.[5,10] As Wolcott[10] noted, none of the core attributes seem indispensable, and satisfying them all does not assure ethnography. However, there is a drive to preserve a commitment to ethnography as a methodology, a range of field methods and the development of a rich account of the social world.[11]

In this commitment to the essence and rigour of ethnography, a few themes can be found. First is that the primary aim of ethnography is to describe and explain the social and cultural organisation of 'everyday life' for a given community. This involves attending to the shared meanings, beliefs, practices, rituals, stories and material artifacts of social life.[11] Second is the inductive nature of ethnography: initial research planning occurs but a flexible approach is used to deal with obstacles and to pursue opportunities.[5] Time and trust-building are important for being attuned to what is taking shape amidst the varied array of interests, actors, stakeholders, infrastructural aspects, technologies, material resources and time pressures.[12] Third is the abductive nature of ethnography – through observation, revision, more observation and further revision, along with reflexivity, research questions are refined over the course of the research process.[5,12,13]

The above definitions, adaptations and deliberations of traditional ethnography are evident in the health professions education field, particularly medical education.[14] Over the past 70 years, scholars from the fields of anthropology and sociology have published ethnographies reflective of the original defining characteristics of ethnography, that have provided insights to the socialisation processes and culture of medical education.[1,15] Examples of seminal studies that continue to influence medical education scholarship include Bosk's[16] ethnography of medical culture and the socialisation of surgical residents with a focus on the concept of medical errors, and Fox's[17] ethnography of the education and socialisation of medical students and the 'training for uncertainty' that they undergo as part of the process of becoming a physician. Over the past couple of decades, this strand of ethnographic work taking place in, and being published within, sociology and anthropology disciplines, has continued to offer descriptions of contemporary issues in medical education including global health and health disparities, efforts to manage emotion rather than become detached from it, and the standardisation of training and its power dynamics.[15] For instance, Murphy's[18] ethnography of medical education and sexuality at an American medical school describes a hidden curriculum of heteronormativity and the ways in which sexuality-related stigma is produced and reproduced through subtle mechanisms.

In this chapter we focus on three contemporary types of ethnographies – focused ethnography, autoethnography and digital ethnography – providing insights into both their common ethnographic features and unique characteristics, and the ways in which they reveal the social and cultural organisation of everyday education practices.

Focused ethnography

As noted above, adaptations, opportunities and challenges occur as ethnography is taken up and interpreted according to disciplinary context. There are a range of factors influencing changes in the use of ethnography over time. In health professions education, we have borne witness to the effects of normative pressure for social research to demonstrate impact; the difficulties in gaining access to settings and ethics requirements; the pressure for academic scholarship outputs that limit feasibility of extensive field work, all in the context of the distribution of health professions learning across settings and situations. These factors have contributed to a number of applied ethnographies in medical education which ultimately are designed with the endpoint of optimising practices, such as how physicians learn to perform technical skills on patients[19] or everyday practices associated with teaching physical skills.[20] This context has resulted in an increase interest in the utility of focused ethnography.

Ethnography labelled as focused or rapid has been a topic of deliberation both within medical education and healthcare research more broadly. These deliberations are about whether focused ethnography offers a useful methodological approach given movements for research to be undertaken in shorter periods of time and for actionable findings in a timely way[21,22] or whether it offers an 'unhelpful elasticity in the label of ethnography'[23] (p. 258). Focused ethnography is based on the premise that the researcher has an intimate knowledge of the field being studied that allows for the focus required, and also that a large amount of work will be done in preparing for, and analysing, data collected in the field. Focused ethnography is characterised by: short-ranged and non-continual field visits; intensive data collection periods involving the use of digital recorders, videos and photo cameras in addition to observations and interviews; a focus on situations, interactions and activities; and collective data collection and analysis.[24]

Although scholars have outlined the utility and rigours of a focused ethnographic approach, there are concerns about its ability to satisfy the essence and rigour of traditional ethnography. There are questions about whether the short duration of focused ethnographic field work allows researchers to achieve the immersion in the setting necessary to understand the nuances of culture and what actually happens in the setting.[23] Others acknowledge the benefits of a more focused form of ethnography, as long as the commitment to the underlying methodology and focus on the social and cultural organisation of everyday life are present.[11]

Focused ethnography in health professions education research

Focused ethnography has received recent attention in the health professions education (HPE) research sphere,[22,25] with a small number of publications explicitly referring to the use of this methodology. For example, Jowsey[26] *et al*.'s ethnography of student experiences of an interprofessional clinical simulation training course and how their experiences informed their workforce readiness, provides an example of a focused ethnography underpinned by a critical ethnographic approach. The lead investigator had contributed to teaching and research for the course for three years prior to undertaking the ethnography; this familiarity informed the time-compressed data collection. The ethnography consisted of four researchers immersed in the research field over a short period of time (four days for each cycle). The researchers observed staff and student participants and carried out short unstructured interviews during course breaks. In addition, during one cycle a film crew of two people brought six cameras to capture different aspects of student experience. Their findings report on the potentially transformative learning opportunity for students to develop their professional identities, but also the anxiety and stress experienced in these interprofessional simulations.

In another study, Steinert and colleagues[27] conducted a focused ethnography to examine the process of clinical teaching. Using a focused approach, they observed three general internal medicine teams located in different hospitals, spending two weeks of observations with each team. In addition to the 160 hours of observations, the ethnographer engaged in brief interviews with team members during the field work. The ethnographic approach allowed the researchers to provide insights to the ways in which clinical teaching varies according to the context and the artifacts that are embedded in the clinical setting. The authors provide suggestions for how the findings can enhance clinical teaching and faculty development.

However, debate over the opportunities and limitations of focused ethnography continue. There is a risk that the term 'focused ethnography' is used as a legitimisation strategy[28] without sufficient attention to ensuring its rigour. Thus, ongoing attention is needed to ensure the value of ethnographic research and to the creation of the conditions that support such work in health professions education. Rashid and colleagues[25] provide practical tips for conducting focused ethnography in health professions education. As they note, although focused ethnography emphasises 'fast and intense' data collection, rigorous field work remains essential to gaining a deep understanding of a specific subculture and its context.

Illustration of the use of focused ethnography

Linking back to our opening vignette, at the time of writing this chapter, the Covid-19 pandemic conditions seemed to be changing and allowing for a transition back to in-person learning. An ethnographic approach allows for an examination of the everyday social life of students and faculty adapting to teaching and learning in person again. Given the uncertainties of this Covid-19 transitional phase, the inductive approach of ethnography – with the opportunity to refine research questions as data collection and analysis occur – would support the research goals of exploring adaptation. However, this transition period is finite, and occurs both in classroom and clinical spaces, and therefore a focused ethnography could be an appropriate approach to use. The curriculum director, Dr Vax, is well-positioned to create and work with a team to prepare for data collection in the field. However, given her professional role, it is wise to have a team of investigators that would bring different professional and theoretical lenses to data collection and analysis to support the questioning of taken-for-granted assumptions in the field. Multiple people would undertake observations, informal interviews and videos, to collect the breadth and depth of data in a shorter amount of time. The study design would consider where and when learning is happening – in the classroom and in clinical settings – and who the learners and the teachers are, to inform a targetted sampling approach.

As in any ethnography, consent to participate can be challenging. For instance, the evolving nature of the research question makes it difficult to explain the research objectives to participants. The observational nature of ethnography requires all participants to give consent to the presence of the ethnographer in the field and to collect data; this can be more challenging in a clinical context where the teachers are constantly changing, and other healthcare providers are interacting with the learners. Initial data collection could focus on learners' feelings and behaviours of being in-person again, the physical layout of classroom and clinical spaces to account for continued public health requirements, interactions that occur amongst students and teachers, and how technologies continue to be used given the immersion in virtual learning during the pandemic. Given the condensed time of data collection, the field workers would meet regularly to code and analyse field notes and refine subsequent strategies for data collection to focus in on developing topics of interest; these might include the management of public health requirements, new ways of interacting between human and material artefacts and changes in formal and hidden curricula of medical professionalism. The short time frame of this transition period, perhaps around six months at most, would require an immersive period of data collection and analysis, regular team meetings and a commitment to ethnography as a methodology that can provide a rich focussed account of the social world of UGME.

Autoethnography

The role of the ethnographer is always central to the ethnographic method because the researcher serves as the primary source of data in their role as the observer. Historically, the authority of the author and validity of the representation (ethnography) have both been constructed through the description of seeing, observing, and being 'in the field'. This authority has often been implicit, an 'I was there' claim to truth that does not necessarily draw attention to the research process, but rather maintains a simultaneous objectivity/separation and involvement. In autoethnography, the role of the researcher is foregrounded. This method confronts the idea that the researcher is removed from the research process, and instead looks at the production of meaning *through* the researcher as a subject.

The rise of autoethnography not only disrupts the hallmarks of traditional ethnography in anthropology by making the role of the observer explicit, but also reconfigures the traditional object of study. Both methodologically and theoretically, the role of the observer as *outsider* has been central to the idea of 'culture contact' whereby the researcher sees what is exotic and different in another culture. Autoethnographic works have not only drawn attention to the role of the researcher in their research, but also shifted the object of study itself, by studying their own culture, most famously described as 'anthropologizing the West'[29] or 'an ethnography of the particular'.[30]

In a manual on how to conduct autoethnography, Chang[31] details how a researcher's own experiences are the primary data and lens from which they explore broader social realities. The key point here is that autoethnography is not only about the personal experience, and thus avoids critiques of researcher self-indulgence.[32] While the method uses the self as both a tool for research and its object, it is always concerned with the self within the social realm. In the simplest terms, this is because culture is shared and shaped by social forces. A further and perhaps more critical point, however, is that in autoethnographies, we must also examine the construction of the self as created *through* the cultural and social realms.

Autoethnography in health professions education research

Autoethnography is still an emerging qualitative research methodology in health professions education. Farrell and colleagues[32] argue that autoethnography is a powerful tool that helps enhance our understanding of the culture and practices of medical education as it draws directly from the individual experiences of the researcher located in the field, and thus has the potential to resonate strongly with other members of the medical education community.[32] However, there are relatively few good examples of autoethnographic research in the field of medical education.

A study by Farrell and colleagues,[33] constructed on feedback theories, applies autoethnography to highlight the nuances of using a goal-oriented feedback approach during brief encounters with learners. Specifically, the study examined preceptor's feedback related interactions with students over an eight-month period, both in the ambulatory setting and on the wards. The findings revealed the importance of medical educators to re-conceptualise feedback in order to create a safe environment, to promote an ongoing dialogue between preceptor and learner, and to acknowledge and negotiate learning goals throughout their encounter.

Walker *et al*.[34] provide a compelling collaborative autoethnographic study concerning the experiences of a UK medical student living with dyspraxia within the contemporary UK medical education environment. The authors' work is steeped in reflexivity. They provide an extensive description of the standpoint of each author as they partnered together to conduct a collaborative ethnography. The team consisted of a medical student with dyspraxia (researcher/subject), a physician instructor living with dyslexia, and a researcher with training in psychotherapy who had previous experience in the supervision of autoethnographic research. The researcher triangulation approach was coupled with data triangulation in the form of an autobiographical account, and two unstructured interviews that were analysed in both text and audio forms independently by members of the team. This process generated a deeply personal, rigorous and conceptually generalisable account of the medical student's experiences. This analysis was elegantly connected to broader sociocultural issues surrounding medical education in the UK by creating new insights into the intense competitiveness of medical education; the stigma surrounding learning disorders that might result in discrimination that can impact future career opportunities; the importance of positive feedback to support and motivate learning; and, lastly, the positive therapeutic impact of autoethnography on the researcher.

There are high-quality examples of the application of autoethnography in health professions education and interprofessional education (IPE). For example, collaborative analytic autoethnography (CAAE) has been used as an action research tool for improving the quality of practice and promoting practitioner-research (practice-based action research), thus contributing to knowledge-building in health professions education.[35] The CAAE process supports reflexivity, awareness and agency as it offers practitioners a clear framework for constantly appraising the 'complexities of their personal and professional self, the Other (e.g., experiencing self from another's perspective), and their context'[35] (p. 426). In a qualitative longitudinal study, Hurst *et al*.[36] describe an IPE collaboration between a public university with medical and pharmacy schools and a private, non-affiliated university with a nursing school. The authors used an autoethnography inquiry technique to explore the dynamics of the IPE partnership by interviewing those who designed and implemented a large-scale IPE simulation for medical, pharmacy and nursing students and health faculty members (interprofessional facilitators). An autoethnographic approach using two group narrative interviews was employed to gain a reflexive understanding from nursing, pharmacy, medicine and medical education, who partnered together as designers and facilitators for an IPE simulation. Five themes emerged from the series of autoethnographic interviews with collaborators: (1) a positive experience, personally and professionally; (2) the utility of teamwork competencies in building partnership and developing the IPE simulation; (3) instances of apprehension and disagreements, but over time, collaborators became more comfortable voicing concerns and compromising to fulfil each discipline's needs; (4) the importance of administrative institutional resources; and (5) the IPE simulation unexpectedly served as a regional building event as community clinicians and educators participated as facilitators and were inspired to implement similar activities in their own institutions.

All three examples of the application of autoethnography to health professions education demonstrate the breadth of its applicability and utility to the goal of advancing healthcare provider education.

Illustration of autoethnography

Returning to the methodological dilemma faced by Dr Vax, we are provided with a concrete example of how one could investigate research questions using an autoethnographic methodology. The COVID-19 pandemic creates a point of disruption to routine educational activities, and simultaneously provides an opening for new forms of teaching and learning to emerge. This also presents an opportunity to investigate not only how the curriculum might change, but to delve deeper into the underlying assumptions about learning, and the implicit rules and informal interactions surrounding it. In approaching these questions as an autoethnographer, the UGME curriculum director would take their own role as a starting point for understanding these many layers. As a starting point, it is necessary to formulate a research question, or thematic area. This can be developed through a process of brainstorming and keeping a journal of compelling experiences, professional curiosities, nagging issues and intense emotions,[31] or even conversation with collaborators.[37–39]

Thinking critically about what is particularly challenging and being able to inquire about the feelings of unease or tension can be especially useful in uncovering unspoken expectations or rules. For instance, are there aspects of the curriculum that are 'automatically' included? As a result, what gets excluded? What are the underlying assumptions about how learning happens, and how is that implied in the ways teaching is adapted to an online setting? Once research questions are identified, an autoethnographer collects data through both critical reflexivity and interaction with others, by 'recalling, collecting artifacts and documents, interviewing others, analysing self, observing self, and reflecting on issues pertaining to the research topic'[31] (p. 13).

As an autoethnographer, the curriculum director, Dr Vax, has a unique vantage point to explore, document and analyse a period of transition to reveal aspects of medical education culture often taken for granted. This approach could be used to unpack the experiences of UGME curriculum director as a moral entrepreneur – an actor who is actively involved in the creation and application of rules of social behaviour[40] in medicine. This could shed light on her involvement in the creation of the professional identity of physicians, and, in turn, explore what the implications are for changing medical education culture. For instance, by taking a step back from the process of designing a curriculum through regular (auto)ethnographic notes, she can detail the process of the mapping of in-person learning experience into a virtual space, and, in doing so, potentially reproduce norms relating to hierarchies, expert knowledge and preferred types of learning. Dr Vax would document her role and experiences related to how the curriculum is being adapted, while being careful to also maintain a focus on what is left in and what is being left out. What is lost when teaching and learning are no longer face to face? What kinds of informal and candid conversations are missing? 'Corridor talk' and gossip are powerful domains that are central to hierarchy and power relationships in any field, especially medicine. Do these take on new forms, for example, in chat rooms or over email? If so, what are the implications of informal 'off the record' conversations being preserved in digital form? Who is included in these conversations, and who is left out? Taking the time to reflect on where and how informal conversations take place is critical, as is the ability to take notes on the autoethnographer's experience of them. From an autoethnographic standpoint, Dr Vax can also examine how her involvement in new technologically-mediated forms might promulgate or challenge hierarchy or subtle forms of discrimination by shifting from an embodied to virtual experience. This form of ethnographic approach is termed 'digital autoethnography', which again, relies on personal experience(s) to foreground how meaning is made among people 'living in' or connected to digital spaces such as social media platforms[41] or in the case of our UGME example, interactive online educational technologies. To explore these questions, Dr Vax may collaborate with others – i.e., instructors, students – in order to engage in collaborative conversations about what they are experiencing during these shifts in order to situate one's own experiences.

While these are just some examples of what questions autoethnography can reveal in this research programme, the key principle is to use the self as a barometer for tensions and challenges that point to unspoken or powerful cultural beliefs. To achieve this, the autoethnographer must write careful journal 'field notes' to best record these observations. Writing these notes as they occur is especially critical, as they reflect experiences as they happen, and before the process of data analysis.

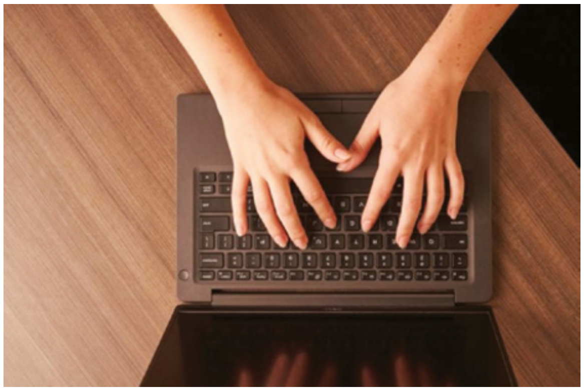
The autoethnographer is always engaged in a process of interpretation even through the data collection phase where this process becomes more explicit once they feel they have reached thematic saturation and can begin the analysis process. This process involves reviewing the collected data for dominant themes, recurring ideas, or topics that seem powerful. The next step involves 'coding' and grouping data in ways that allow the ethnographer to find patterns and relationships.[42,43]

Finally, in terms of quality, an autoethnographer should maintain transparency and rigour. To this end, Chang[44] provides standards for judging the quality of autoethnography in health research:

1 *Authentic and Trustworthy Data*: Does the autoethnography use authentic and trustworthy data?
2 *Accountable Research Process*: Does the autoethnography follow a reliable research process and show the process clearly?
3 *Ethics Toward Others and Self*: Does the autoethnography follow ethical steps to protect the rights of self and others presented and implicated in the autoethnography?
4 *Sociocultural Analysis and Interpretation*: Does the autoethnography analyse and interpret the sociocultural meaning of the author's personal experiences?

5 *Scholarly Contribution*: Does the autoethnography attempt to make a scholarly contribution with its conclusion and engagement of the existing literature?

Going online: digital ethnography



Digital ethnography has evolved alongside the rise of the Internet and the emergence of the many forms of social media that have created novel forms of social interaction. It is also frequently referred to as online, virtual or Internet ethnography, with its primary focus being the study of online group culture through the application of modified traditional ethnographic approaches to online spaces and places.[45–47] In particular, attention is paid to describing place-making activities (meaning formation in groups) by mapping the construction of social interaction patterns amongst particular communities through close attention to the interplay between users and devices.[48] The physical 'immersion' of the researcher into the online culture is not essential. Rather, the work of the digital ethnographer is to obtain digital artifacts such as textual discourse, audio/video files and pictures in order to develop a rich understanding of the sociocultural aspects of that space and the members that occupy it.[49,50] More broadly, such technological artifacts are, in effect, forms of material culture and provide a gateway into analysing the relationship between such objects and the conduct of social relations in communities and the formation of cultural groups.[51]

Digital ethnography is not restricted simply to online social interaction. Indeed, Hine[52] who coined the term virtual ethnography, provided a seminal contribution to the field through her modification of ethnography to explore the creation of both online and offline social worlds. For Hine, the Internet is simultaneously a cultural space, containing value systems and normative group behaviours, but as alluded to above, it is also a cultural artefact that is shaped by the various uses of social actors themselves. The aim of the virtual ethnographer is to explore how online platforms and the discourses they promulgate are experienced as somehow qualitatively different from the 'real'.[52] As such, virtual ethnography necessitates the adaptation of ethnographic methods by 'virtualising' them; for instance, virtual surveys, conducting interviews via chatrooms or via Zoom calls. These 'digital' ethnographic techniques are often paired with 'analogical techniques' such as participant observation in both online and offline modes.[53]

Digital ethnography in health professions education research

The use of digital ethnographic methods in the field of health professions education is still nascent. However, there are a few pertinent studies worthy of review. The first concerns a digital ethnography of medical students' use of Twitter for professional development.[46] Guided by the theory of connectivism, Chretien and colleagues explored the culture of medical students' Twitter use, asking questions regarding how they use Twitter, whom they interact with and what value those interactions have. The authors observed the tweets of medical students over an eight-month period creating analytical descriptions guided by classic ethnographic observational dimensions (space, actors, activities, objects, acts, events, time, goals, feelings). This in turn guided sampling for the recruitment of medical students for qualitative interviews in order to map out and generate a rich description of the network of relationships that held value for the students. Chretien *et al*.[46] provide a rigorous example of how a basic social media platform can provide the opportunity of powerful moments or professional development for medical students through networking, mentorship and learning.

Research by Tummons *et al*.[54] concerns the exposition of an ethnographic methodological approach to exploring a new distributed medical education (DME) programme across virtual and physical spaces in the Canada/UK. What is interesting here is the application of a digital ethnographic approach to a curriculum that is built on the use of technology – digital video, digital learning platforms and e-learning devices – that enables the synchronous delivery of the curriculum across two physical locations. The data collection methods reflect traditional ethnographic approaches – participant observation, text analysis and document analysis – but what is distinctive is that they are deployed across physical and virtual spaces, i.e., in lecture halls and online lectures. The same group of authors also provided invaluable insights into the complexity of 'hidden work' for administrative and audio visual professionals and faculty teachers in the delivery of DME.[55] Their work troubles the old utopian myth of the 'technical fix' tacitly underpinning moves to going online in higher education – notions of cost, labour and pedagogical effectiveness.[56] This is an important lesson for medical schools hoping to reduce cost and complexity of teaching and learning by engaging with online educational technologies.

Earlier digital ethnographic work in higher education has explored the re-organisation of social relations between students, faculty and the university itself during transitions to online education that retains elements of traditional physical teaching and learning environments.[57–59] The focus of this work has been on the unintended consequences of mixing virtual and physical spaces in higher education. Of particular concern is how certain morally questionable faculty and student behaviour is facilitated. Kitto *et al*.[59] conducted a two-year Foucauldian-inspired digital ethnography of the transition of a School of Physical Education and a Faculty of Information Technology into the online realm. Documents governing new forms of curriculum, in-person and online interviews, observational data about student behaviour online and within classrooms across geographically disparate sites, were collected. The subsequent analysis identified new forms of offline and online student behaviour and surveillance practices by Faculty members. Both 'real' observations of student behaviour were merged with digital representations, creating new forms of judgement about 'good' student behaviour and new arenas of contestations about learner performance. In the same vein as the more recent work in medical education,[55] the labour intensive 'hidden' work in making distributed education function was revealed. Disturbingly, the emergence of new highly questionable forms of participation in examinations by students, and the judgement of those performances by faculty members, was also revealed. None of these findings would have been generated without a digital ethnographic approach sensitising the researcher to the interaction between the 'real' and the virtual in higher education.

Illustration of digital ethnography

Digital ethnography is an ideal methodological approach for our UGME director, Dr Vax. As alluded to in the previously described digital ethnography examples, this ethnographic approach provides multiple angles from which to explore online/offline medical educational designs and delivery practices during all phases of the pandemic. Firstly, Dr Vax needs to define what the areas of interest are: is it the 'hidden' work of faculty and support staff in dealing with online and hybrid online/offline teaching? The re-organisation of teaching and learning relationships between faculty and learners? The learning experience for the students online and offline on campus, and in the clinic?

The next issue for the director is to determine what phase(s) of the pandemic and the concomitant character of the re-design and reorganisation of the delivery of the UGME curriculum they want to focus their research on, as that will undoubtedly shape the formation and operationalisation of their research questions. For instance, if she wants to conduct research at the beginning of pandemic where online modalities are beginning to be considered and/or adopted, particular questions around needs assessment research would present themselves, i.e., what are the pedagogical and technological development needs for faculty moving to teaching online in UGME? How are their teaching workflows disrupted and how do they adapt? How do intense technologically mediated interactions with their students transform the clinical instructor–medical student relationship? How are important moments of professional socialisation during the UGME transformed under these conditions?

The possible sequalae of the Covid-19 pandemic is that it is likely that hybrid online and offline teaching and learning will occur where the identities of students and faculty will be (re)represented to each other through 'real' interactions on campus, and potentially in the clinic, mixed with virtual interactions via online educational software programs that track 'learning' behaviour, and social interactions through media like Zoom. Each modality provides the opportunity for the construction and re-construction of the individuals into common binary laden categories, such as 'good' or 'bad' student or instructor. As previous research has found, this hybrid teaching and learning environment can result in questionable educational assessment of student performance in higher education settings.[57,58] This might be particularly problematic in the medical education learning environment, as we know from the 'cloak of competence'[60] literature that student behaviour is curated by students and closely monitored by instructors. Student behaviour is a symbolic indicator used to assess whether the student is on the trajectory to becoming a 'good' physician or not. When bodily (re)representations online and offline are mixed, how are instructor assessments of student behavior (re)generated? What impact might they have on the student's success in UGME, their learning experience or their future career as a physician? What kinds of new normative teaching and learning behaviours could this complex learning environment create, and what unintended effects might result? What new forms of assessment are developed? How are UGME accreditation standards met when in-person procedural learning is reduced, i.e., how are entrustable professional attributes related to non-technical skills demonstrated? How are the 'real' and digital representations of the patient incorporated into the learning environment? How is their voice and body represented? The transition out of the pandemic is as equally problematic as entering and adjusting to it through its duration. In this latter phase, questions arise concerning how the teaching and learning environment has changed? What new practices will stay and what will revert back to 'normal'? These are only some of the pertinent questions that could be pursued from a digital ethnographic approach.

The common binding element to all phases of this digital ethnographic case study is Hine's[52] overarching orientation to interrogating the effects of the collision of the 'real' and the virtual. In the case of our UGME research director, Dr Vax, it would concern investigating the intended and unintended consequences for on-campus and clinical teaching and learning practices, outcomes and experiences for faculty, students and, indeed, patients. All ethnography examines culture. Culture is best understood as how people make meaning of their broader social and material world. Ethnographies examine how meaning is produced, maintained and what its effects are. Culture is shared, and shaped by historical, social and political forces. Practically speaking then, the UGME director as digital ethnographer should be engaging the modes of data collection that enable the collection of existing and new material artifacts that organise social life and create the local medical education culture: curriculum design and content documents, online educational software, social media and the data these generate; online and offline forms of observation; and qualitative interviewing of subjects involved in the teaching and learning environment. It is within this type of methodological and data triangulation that the (in)congruities between the 'real' and virtual educational world can then be analysed to create a deeper understanding of their effects on the teaching and learning environment, and, most importantly, on those who inhabit it.

Conclusion

Ethnography is a valuable tool in health professions education research. The variations in contemporary ethnographic methods outlined in this chapter demonstrate that this longstanding social scientific approach is a viable and feasible alternative to single-method (i.e., one method of data collection) health professions education research designs. The three types of ethnographies described, and the examples cited from health professions education research, demonstrate that contemporary ethnography does not have a singular definition or mode of performance. Nonetheless, the rigour of all types of ethnography is underscored by a commitment to focusing on the social and cultural organisation of 'everyday life' of a given community; the inductive and abductive nature of ethnography itself; the reflexivity of the ethnographer(s); and the use of observation as the primary source of data collection.

Practice points

- There is no 'one-size fits all' approach to ethnography. The research question and nature of the phenomena under study should dictate the choice of ethnographic methodology.
- Despite the variation in ethnographic approaches across time and academic disciplines, the practice of observation and reflexivity are the two key foundations upon which all forms of ethnography stand.
- Prolonged immersion in a cultural environment has been a long-standing feature of traditional ethnographic research. However, there are truncated and focused ethnographic methods that can still generate insightful and trustworthy research findings.
- The key strength of ethnography is in the triangulation of data concerning the collection and analysis of material objects that shape culture, the interviewing of community members about their experience of their social world(s) and observation of their behaviours within their educational communities.

Recommended reading

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13 Visual methods in health professions research: purpose, challenges and opportunities

Sayra Cristancho, Kori LaDonna and Emily Field

In our experience, qualitative interviews sometimes fail to generate data rich enough to unpack the complexities inherent in both medicine and medical education. To illustrate, consider a research exploration of clinical judgement in which we interviewed surgeons before and after an operation to elucidate their decision-making processes during complicated cases. Before the operation, they told us about their plan, focusing on 'textbook details. After the operation, they told us about the tweaks they had to make to the plan once complications arose, usually in a 'tickbox' fashion and using technical jargon. Complex surgeries rarely go as planned, but surgeons' verbal accounts rarely capture the messiness of having to adjust on the fly. Rather, surgeons' verbal descriptions commonly sounded like a tidy, linear story: 'We needed to remove as much of the cancer as possible, but the margins of the tumour weren't clear. So, I had to begin the operation not fully knowing where to start cutting and how much of the tumor to resect.' What typically followed was a description of the surgeon extending her hand, the nurse handing over the surgical tool, and the surgeon making her way through the tissues while a trainee watched over her shoulder. Stress, team dynamics and ethical tensions seemed buried beneath the surface, but our probing questions failed to excavate a rich account. This research challenge isn't exclusive to healthcare providers— it also happened when we interviewed patients about their lived experiences of chronic illness, or when we asked research questions about poorly understood concepts like health advocacy. Every time, we found ourselves asking: what can we do differently during interviews to both disrupt the linear story and encourage participants to dig into the messiness? For us, visual methods were the answer.

Visuals in research encompass a wide range of methods, including, videos, photographs, drawings, cartoons, graffiti, maps, diagrams, cyber graphics, signs and symbols. Throughout the twentieth century, the fields of visual sociology, visual anthropology and cultural studies have done much of the pioneering work on visual-based research. As researchers trained in other disciplines found a place in health professions education, visual methods progressively gained attention and traction in this research. Philosophers and methodologists have contributed to a burgeoning literature providing the theoretical grounding for the value of visual research methods across disciplines. Currently, visual methods in health professions education research are typically regarded as powerful companions of qualitative interviews, useful for eliciting either difficult-to-access or difficult-to-articulate insights.[1,2] In this chapter, we offer an overview of the purposes, features and uses of visual methods in health professions education research. Informed by existing literature and our own experiences, we will specifically offer insights into how to think about visuals, why education researchers might wish to incorporate visuals in their research, when to use them and why, and what challenges and opportunities visual researchers might encounter. At the end of the chapter, we recommend seminal visual research papers to complement the principles and guidance we discuss in this chapter.

Using visuals in health professions education research

Visuals facilitate storytelling, helping both participants and researchers converse about phenomena or experiences in a more nuanced way. Visuals are not fixed or linear entities. Rather, visuals anchor stories within a particular context and time, providing a view into the complexity of human experience. Visuals are powerful because, when coupled with traditional interviews, they tap into different parts of the brain, and 'thus evoke deeper elements of human consciousness than do words; exchanges

Researching Medical Education, Second Edition. Edited by Jennifer Cleland and Steven J. Durning.

based on words alone utilize less of the brain's capacity than do exchanges in which the brain is processing images as well as words'[3] (p. 13). Thus, as conversations unfold around a visual, multiple perspectives and interpretations add to the richness generated by both hearing about and seeing various factors and perspectives.

In health professions education research, researchers have incorporated visuals in their work[4] because:

- **Visuals capture experiences that are hard-to-put-into-words.** Using drawings or photos, researchers have been able to explore how medical trainees and patients process complex clinical experiences[5] or emotional and taboo topics.[6]
- **Visuals can make us pay attention to things in new ways.** In research with patients and physicians, researchers have been able to better understand how they conceptualise advocacy differently[7] and how patients cope at home with their cancer experiences.[8] In both instances, visuals conveyed important lessons for teaching and learning.
- **Images can be used to communicate more holistically, incorporating multiple layers, and evoking stories or questions.** Using drawings, surgeons were better equipped to talk about aspects of their work not traditionally discussed with trainees, but that in hindsight played a significant role in their decision making.[9]
- **Images are likely to be memorable.** Beyond empirical explorations, visuals derived from research have also allowed medical education researchers to implement knowledge translations initiatives. Using the drawings from their study, Cristancho *et al.*,[9] created the Superman installation (Figure 13.1) to spark conversations among healthcare providers around their perceptions of vulnerability in surgery.
- **Visuals can enhance empathic understanding.** In the same research about surgical judgement, the surgeons who were also part of the research team reflected on the ability of drawings to *'borrow someone else's experience for a moment'* during return-of-findings analysis meetings.
- **Through metaphor and symbol, visuals can carry theory elegantly and eloquently.** The broken Superman symbol above, for example, was a powerful metaphor used by surgeons to depict vulnerability. Similarly, participants describing the stigma of poverty used a photo of an ice cube to convey the 'cold communication' under-resourced patients often have with care providers.[10–12]
- **Visuals encourage embodied knowledge.** As Weber[4] points out: '*the visual disarms or bypasses the purely intellectual, leading to a more authentic and complete glimpse of what a particular experience be like or of what people think and feel*' (p. 6). In medical education, recent work using rich pictures has explored the emotional consequences of the experiences of healthcare providers in providing palliative care in rural communities and its impact on learning.[13]

Figure 13.1 Superman installation using rich pictures

- **Visuals can be more accessible than most forms of academic discourse.** As science communication continues to diversify, journals have followed. The introduction of visual abstracts to accompany particularly medical and medical education-related research is becoming more common.
- **Visuals can facilitate reflection.** The power of drawings to foster non-linear thinking have facilitated the exploration of reflection-on-practice in medical trainees. Visually-driven reflection has demonstrated useful for clinical activities such as conducting difficult conversations with parents of sick babies.[14]
- **Visuals provoke action for social justice.** Individuals can use visuals to document and identify issues, challenges or problems that demand attention and action from those in positions of

power.[15] In health professions education, visuals are currently being used by women in medicine to document their experiences of discrimination in the workplace.[16]

- **Visuals may shift research power dynamics.** Visual methods may create space for greater participant involvement and control in the research process. This is not implicit, but rather must be an explicit goal in the study design.[17]

When to use visual methods and why

Knowing which visual methods to use in your qualitative research study can be challenging. A place to start is to think about both the source of the visuals as well as your goal. Visuals can be pre-existing images such as family photographs, or participant or researcher-generated content created specifically,[3,15,18–20] as a technique by which to elicit or to interpret data, as an output of the research process that is intended to represent the data, or as a mediator of relationships. See Figure 13.2 for some guidance on the purposes of visuals.[21]

In this chapter, we primarily focus on using visuals as an elicitation technique to augment qualitative interviews, rather than as stand-alone data for analysis. In the case of qualitative interviewing, visual methods have the potential to elicit deep insights from participants, enable participation of individuals with communication barriers, ensure clarity in questions and responses, convey complex information, target particular aspects of the research question, establish rapport and manage researcher–participant power differentials.[22] If you follow a postmodern perspective, you comply with the idea that visuals are socially constructed, and that their meaning depends on both the creator and the viewer.[23] Therefore, by using visual methods to facilitate the interview process, qualitative researchers can improve the quality, relevance and trustworthiness of their interview data.[24]

For instance, health professions education researchers have used visuals to either understand topics that are emotionally charged, or to tap into largely cognitive processes that may be difficult to access or articulate, such as exercising clinical judgement or navigating complex care. Similarly, visuals have been useful for elucidating skills for critical aspects of care including health advocacy and patient-centred communication that are subjective, and thus difficult to train. To illustrate the kinds of

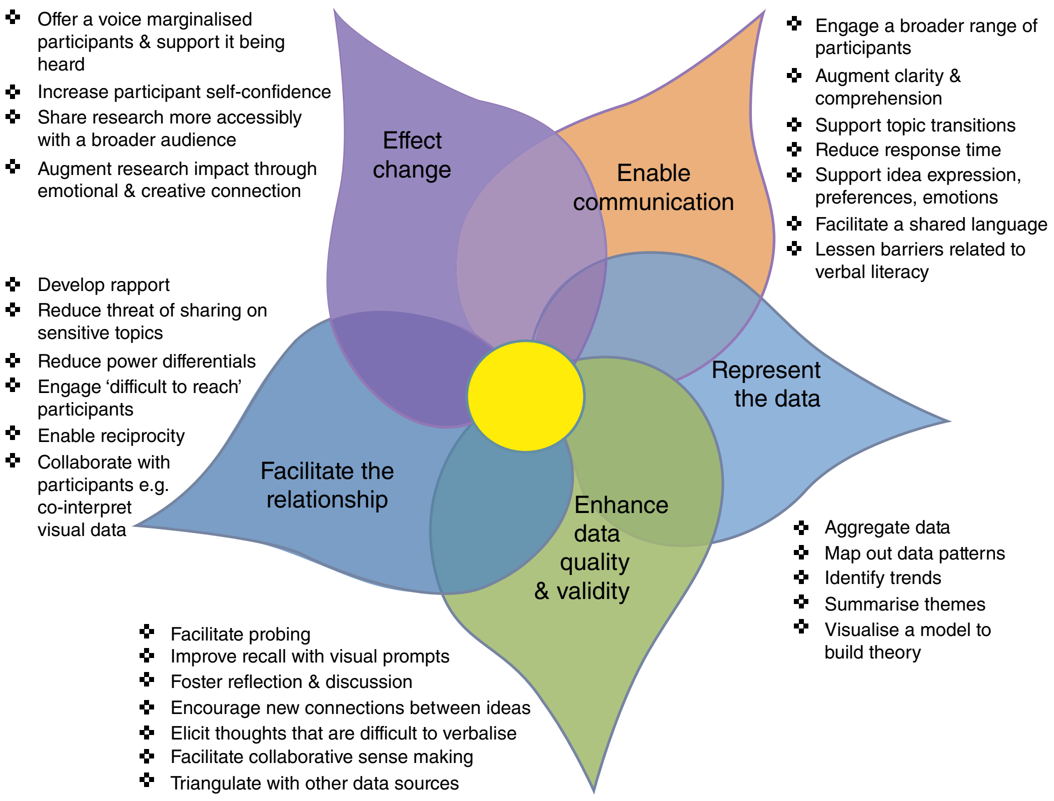

Figure 13.2 Glegg proposed typology of the purposes of visuals from[21]/SAGE Publications.

phenomena amenable to visual methods, below we provide some examples of research questions that have been explored in health professions and medical education.

- How do medical trainees navigate moral dilemmas at the onset of clinical practice?[25]
- How do trainees make sense of their identity and emotional struggles as they navigate their training?[26] (Sawatsky, *et al*., in progress.)
- How do trainee–environment interactions stimulate motivation?[27]
- What does advocacy look like from the perspective of patients?[7]
- What are patients with chronic[28,29] and terminal illnesses[30] willing to share about their experiences for educational purposes?
- How do educators experience governance in curriculum change processes?[31]
- How do surgeons make sense of and resolve complex operations?[32]
- How do difficult conversations with patients impact the learning process of residents?[33]
- How do medical students experience the tumult caused by the COVID-19 pandemic?[34]
- What can medical students learn from adolescents' photographs and stories about their concerns about their community?[35]
- What might patients' photographs teach medical students about biases toward patients living in poverty?[11]

In the next two sections we narrow our focus on three methods – rich pictures, photo-elicitation and photovoice – that we have incorporated in our respective research programmes. Our goal is to provide both an illustration of their underpinnings and guidelines for incorporating them into research.

What do visual methods look like? Epistemological roots and key features

As visual methodologists, we take a constructivist epistemological stance, meaning that we use methods such as rich pictures, photovoice and photo elicitation to facilitate conversations and co-create data with participants. Although participants often worry that they lack the artistic skill to produce meaningful images, the quality of the drawing or photos is irrelevant. Rather, visuals are both a tool and a form of expression for unpacking and articulating complex, problematic or significant aspects of an experience or phenomenon. Stick figures or blurry photographs often do the trick. Ultimately, our goal is not to elicit an objective documentation of all features of a situation; rather, we use visuals to obtain a glimpse of how participants view, understand or navigate a phenomenon or experience, using images to enrich conversation and, thus, understanding.

By using visuals, we strive not only to question deeply held assumptions (both participants' and ours) but also to discover overlooked connections, traps, possibilities, contradictions and so on. The images created by participants in explorations using rich pictures, photo-elicitation and photovoice have personal meaning and require interpretation, making focused probing essential during interviews. Below we summarise key features of these methods and describe how we use them to stimulate perspective taking when exploring participants' experiences of working, learning, or receiving care in emotionally-charged, complex and dynamic environments.

On rich pictures

A rich picture is a pictorial hand-drawn representation of a particular situation. It can include what happened, who was involved, how people felt, how people acted, how people behaved and what external pressures were present. Rich pictures are very specific to the people who draw them, reflecting their own ways of thinking and perceiving their experience. Therefore, they act as both a visual thinking device and a representation of participants' perspectives.[36]

I, SMC, first learned about rich pictures during my engineering training while trying to design a piece of equipment for shift workers at a factory. I was fascinated by how people had different ideas about how to best use equipment, even though they were all carrying out the same task but at different times of the day. I was also intrigued by how much the exercise of drawing helped people express themselves. In engineering we refer to this process as user-centred design. When I transitioned to the medical education research field, I began wondering whether researchers could use rich pictures to get clinicians talking more comfortably and openly about their experiences with complex and unexpected situations. That was the catalyst for our initial explorations of clinical judgement in surgery.

Contrary to what most might think, surgeons proved to be the perfect group to trial rich pictures. As visual thinkers, they quickly realised how drawing could help them to not only depict the technical elements of a complex operation, but also to verbalise their concerns, frustrations and achievements. In other words, rich pictures allowed surgeons to think about a complex operation beyond the procedural dimension.[9,37] For instance, by drawing rich pictures, surgeons were able to depict and then describe their thoughts about how personal discord among members of the surgical team could affect the mood of the operating room complicating the surgery beyond technical issues.[37]

Rich pictures stem from the so-called systems paradigm. Under this paradigm, complex situations are viewed as collections of interconnected parts.[38] Through this interconnecting worldview, a different process for problem solving emerges. Rather than decomposing a problem into parts and then fixing each part separately, the systems approach widens the view to focus upon the interconnections between the parts and within their context. Rich pictures, developed as a part of the Soft Systems Methodology,[39–41] capitalise on the concept of *synthesis* to reason upwards from the perspective of individuals to build a comprehensive understanding of a situation they are part of.[42]

Rich pictures allow individuals to step back, reflect and even notice features not consciously built into the drawing; for example, the way they used colours. They can be used as a vehicle for moving from a state of confusion to a state of insight, where people can begin to appreciate the issues at the heart of their struggle. These struggles can appear for example, in patients while dealing with illnesses,[30] in medical trainees while dealing with moral dilemmas[25] or in healthcare providers while dealing with the complexity of their work.[31,43] Take, for instance, the rich picture in Figure 13.3 – drawn by a surgeon to depict the tension between two competing perspectives: that of the surgeon's and the oncologist's. From the surgeon's perspective, the patient needed chemotherapy prior to surgery to increase the likelihood of a successful outcome. From the oncologist's perspective, the patient appeared 'unreliable', and thus not a good candidate for chemotherapy. These competing perspectives resulted in tension among the care team and left the surgeon unsure of the best course of action to care for this patient. By drawing the rich picture, the surgeon depicted question marks, unbalanced scales, boxing gloves, tombstones and killing knives to help him verbalise his efforts in trying to understand *what was going on*.

On photo-elicitation and photovoice

Like rich pictures, photographs help both participants and researchers tell a good story.[44] Growing up in Rochester, New York, nicknamed the 'World's Image Center' because the Eastman Kodak Company is headquartered there, undoubtedly influenced my – KAL – interest in using photographs to augment my research. When I first learned about photovoice in graduate school, I was struck by how valuable this method might be for exploring the experiences of patients with significant cognitive or speech difficulties who are often excluded from more traditional types of research.[29] Recently, my colleagues and I used photo-elicitation to better understand what health advocacy means to both patients and physicians.[7]

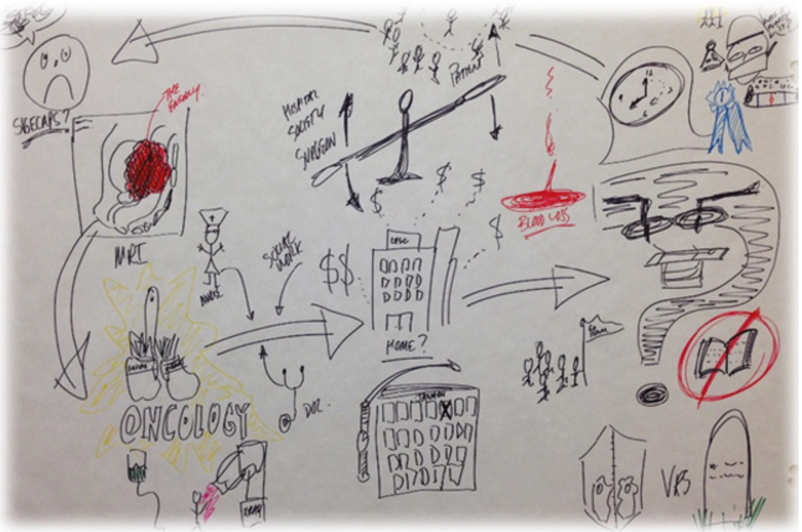

Figure 13.3 Example of a rich picture' On one edge, I've written "the patient" and on the other edge I've got "the hospital, society, me" and the arrows are kind of going up and down 'cause I kind of see that as teetering . . . what's good for the patient may not necessarily be best for society because I'm wasting a lot of money by admitting him . . . and whether, you know, because it's the right thing to do for the patient . . . but is it really the right thing to do for everyone else all involved?' (Published in[7]/John Wiley & Sons)

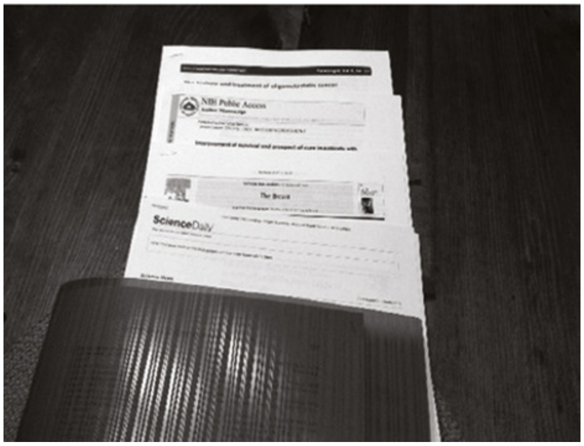

Figure 13.4 Patient photograph of research articles she brought to her clinic visits, detailing how physicians either discarded or engaged with the work she'd done to learn about new treatments for her illness. (Published in[7]/John Wiley & Sons)

Figure 13.5 Physician photograph metaphorically (a deer in the snow) illustrating the challenges of health advocacy

Health advocacy is an intrinsic physician skill known to be difficult to define, and thus to teach and assess.[45–48] Since visual methods are useful for elucidating complex and poorly understood concepts, we asked patients and physicians to take photographs representing their perspectives about health advocacy. Patients and physicians engaged in this process in various ways,[49] taking pictures that were both literal (Figure 13.4) and metaphorical (Figure 13.5) representations of the meaning and work of HA. For instance, one patient participant shared a photograph of the research articles she brought to her clinic visits, detailing how physicians either disregarded or engaged with the work she'd done to learn about new treatments for her illness. Another patient staged a photograph to illustrate how she engages in self-care – a form of advocacy not currently captured in physician-centric definitions.

Although often talked about interchangeably, photo-elicitation and photovoice are distinct methods with different historical roots and goals. Photo-elicitation was developed by photographer and anthropologist John Collier in the 1950s to help solve a logistical problem facing his research team. That is, a multi-disciplinary team exploring connections between mental health and housing quality in the Canadian Maritimes were struggling to develop a shared understanding of 'quality housing'. By asking team members to take photographs representing their perspectives, Collier's team was able to reach consensus about a highly subjective topic.[3] Photo-elicitation – where photos are either researcher- or participant-generated – is now used in a variety of disciplines including sociology, psychology and education, for purposes including: documenting the research context, augmenting interviews and translating knowledge.[3,50]

Although photovoice can also facilitate interpretive research, it more commonly focuses on amplifying the voices and perspectives of those experiencing oppression. Photovoice was created by Wang and Burris[15] as a participatory action research method to empower women living in rural China to identify and document issues affecting their everyday lives. In other words, photovoice seeks to put 'cameras directly in the hands of people who otherwise would not have access, and allows them to be recorders, and potential catalysts, in their own communities'[15] (p. 369). Photovoice is based on three key traditions and principles: documentary photography, feminism and the philosophy of educator Paulo Freire. Specifically, photovoice aims to document and evidence social issues to raise critical consciousness. With these foundations, photovoice strives to encourage shared power between researchers and participants, producing research from the perspectives of those often silenced in the public discourse.

In the context of medical education, photovoice has been used to explore and change the relationship between healthcare providers and patients experiencing inequity, such as amplifying the voices of patients with chronic illness whose perspectives have historically been overlooked,[29] teaching medical students about bias towards patients living in poverty,[10,11] amplifying – and thus transforming – adolescents' concerns about their communities into meaningful learning for medical students. And in addition to our work on health advocacy, photo-elicitation was recently used to understand medical students' complex pandemic-related experiences, including their fears about the future.[34]

Although they have distinct features, rich pictures, photo-elicitation and photovoice are all elicitation techniques useful for enriching health professions education research. They can be used to augment data collection for multiple qualitative methodologies including, but not limited to, constructivist grounded theory, phenomenology and ethnography. We encourage researchers to consider how these methods might help not only document, unpack and challenge complex topics, but also facilitate engagement for individuals (like patients) who are typically overlooked in health professions education research.

How to use visual methods

Research involving visual methods tends to follow a four-stage process for data collection: the set-up, the training, the engagement and the conversation. For studies that wish to be participatory and action-oriented – such as photovoice – this four-stage process is pre-empted with community consultations, collaboration and co-design and co-construction of the research process.[51] While the three methods – rich pictures and photo-elicitation/photovoice – discussed in this chapter share features across the four stages, we provide illustrations of particular details for each stage for those interested in practical implementation (see Table 13.1).

Table 13.1 Data collection process

Stage	Rich picture	Photo-elicitation and photovoice
The set-up	Participants are asked to recall a memorable situation related to the specific research question and to draw everything that they deem important. During the set-up, participants are asked a few semi-structured questions about the phenomenon under study. The purpose is two-fold: (1) to inspire participants' thinking, and (2) to examine whether what participants verbalise differs when they use visuals to reflect on and share their experiences.	Participants are invited to take photographs that represent or capture their perspectives about a phenomenon. Instructions are purposefully vague to avoid either leading participants or stifling creativity. During the set-up, participants are asked a few semi-structured questions about the phenomenon under study. The purpose is two-fold: (1) to inspire participants' thinking, and (2) to examine whether what participants verbalise differs from how they depict an experience or phenomenon visually.
The training	Participants are shown and walked through an example of a rich picture from a previously published paper or textbook. When possible, this demonstration can include both the drawing and the story behind it. While it usually takes place during the same session where data will be collected, it can also be combined with the set-up and implemented in advance.	Since engaging with visual methods may take participants out of their comfort zones, researchers spend time introducing the method and describing its purpose and value. Considerable time is also spent discussing the ethics of picture-taking. Since the ethics are complex, we typically encourage participants to avoid capturing identifiable images. If they choose to take a photograph of someone, they must obtain that individual's written consent. Most participants use their own cameras; however, if the research team is providing cameras to participants, time for instruction and practice are built into the training session.
The engagement	Participants are asked to draw about the situation they were involved in. In HPE research, 20–30 min has been identified as the preferred length of engagement.	Participants are invited to spend up to three weeks taking their photographs. Reminder emails are helpful for fostering engagement.
The conversation	Participants are invited to elaborate their stories during a semi-structured interview. Researchers probe for details of the story using the drawing.	Interviews are participant directed, meaning that participants are invited to share their images with the researcher in a manner of their choosing. For example, participants direct not only the order in which they present their photos but also how much time they want to spend describing each image. Depending on the participant, follow-up questions might either be asked before moving to the next image, or after the participant presents all images. Regardless, the researcher and the participant have a conversation guided both by what participants share and researcher-generated questions about the phenomenon. To deepen reflection, participants are sometimes invited to title each image. Additionally, photo studies sometimes use both individual interviews and focus groups where participants are invited to share their photographs to encourage dialogue with fellow participants.

During **the set-up** researchers familiarise participants with the activity. They explain the purpose of the study, the reason for using visual methods and what they will be asked to do. This stage could be implemented via email as part of the letter of information that needs to be sent for ethics purposes, or in person while obtaining consent. Once consent is provided, researchers move to **the training** stage to help participants understand the type of visual method to be used. This can be done either by showing an example or training participants in the use of technology, if needed. The training stage can either take place during the same session where data will be collected, or in separate sessions. In **the engagement** stage, participants are invited to apply the visual method to their experiences. The length of the engagement (minutes to days to weeks) depends on the type of visual method. Finally, during **the conversation stage**, researchers conduct a semi-structured interview where the visual product generated by the participant is used to elicit their stories and to elaborate on behaviours or feelings evoked, as well as ideas and perceptions they have developed around the specific topic under investigation.

Depending on the research question, data analysis may focus on the content of the interviews, or on a combination of the visual and interview' data.[2,44] For the former, thematic analysis, content analysis, grounded theory and various forms of discourse analyses[52] are appropriate. We have predominantly used constructivist grounded theory (CGT)[53] as our methodological lens because of the social processes that characterise complex human phenomena (see also MacLeod, Burm and Mann in this book). For the latter, iconographic analysis along with the standard CGT analytical principles can be used when analysing combined 'visual and interview data'. This is akin to the constant comparative approach customary of CGT, where researchers go back and forth between and across interview transcripts and visuals for a richer analysis.

In our research using rich pictures, iconographic analysis has been informed by arts criticism[36] and consists of two steps: (i) rich picture viewing sessions, and (ii) gallery walks. Rich picture viewing sessions are akin to the multiple readings of the data in qualitative data analysis. Researchers engage in looking at and describing one rich picture at a time in as much detail as possible. Features such as symbols (e.g., arrows, question marks, timetables), facial and body expressions, specific icons and visual metaphors can be included in the annotation of the rich pictures. In our experience, these rich picture viewing sessions are useful to the research team as they engage with coding of the interview transcripts. Gallery walks are akin to the constant comparison step. During gallery walks, a set of selected rich pictures are hung on the walls of a big room and participants are invited to compare and contrast as per their perspectives. The aim of a gallery walk is to gather different stakeholders to discuss patterns, structures, differences and similarities across rich pictures. An analytical memo is written at the end of the exercise and used to inform the refinement of themes and categories from the interview transcripts.

An array of approaches exists for analysing photo data, but choice depends on both the research question and the researcher's skillset. For instance, some analytical techniques draw on photo theory to examine photographic elements including line, shape, form, texture, colour, size and depth.[54] Admittedly, we are neither trained to conduct this type of technical analysis, nor would such an analysis aid in answering our health professions education research-related questions. Instead, our training in qualitative analysis is more amenable to the SHOWeD analytical method for photovoice,[55] where we co-construct meaning with participants by asking variations of the following questions throughout the iterative data collection and analysis process: What do you **S**ee here? What is really **H**appening here? How does this relate to **O**ur lives? **W**hy does this condition **E**xist? What can we **D**o about it? This approach has been useful, for instance, to reveal deeper meaning from photographs that seemed literal, such as screenshots of Oprah Winfrey and Mother Theresa shared by two physicians to indicate their perception that advocacy is a highly specialised skill best left to those with saint-like status.[49]

We've only scratched the surface of possibilities for analysing visuals, and we remind readers that – like any methodological approach – the research question (and the skills of the research team) should drive analytical choice.

Challenges of using visual methods

Visual methods entice us because of their versatility. Yet, using visual methods in research requires thoughtful consideration about a number of challenges. In this section, we discuss two challenges we have experienced in our research: ethics and dissemination.

Ethics

One of the appealing aspects of visual methods is a sense that it can change the power dynamic in the research relationship – providing participants with the opportunity to generate a drawing or take a photo of their own choosing.[17,56] This may encourage participants to have greater control in shaping the direction of the interviews, share images and stories that they feel are relevant, and may require the researcher to follow the participant's lead in the interview versus having a set list of questions – especially when participant's drawings or pictures are used as a springboard for discussion.[17] However, the polysemic nature of images may also provoke adverse reactions or the possibility that participants might reveal more than they were expecting to share.[57] While shifting power dynamics is a possible strength of these methods it is not a given nor necessarily 'empowering' for participants.[56] It is important that the concept of empowerment be participant driven rather than defined by the research team.[51] Additionally, one must consider how we can adapt visual approaches for persons who have difficulty manipulating a pencil or camera to ensure equitable access to the method.[58] Therefore, considerations around confidentiality, consent, authorship and ownership, equity and harm must be carefully justified and continuously re-visited.[44,57] In Table 13.2, we present selected

Table 13.2 Ethical considerations

Ethical challenge	Key questions to consider	Our reflections
Confidentiality	• How will participants' confidentiality be protected in the visual research process? Is anonymity an appropriate strategy to maintain privacy and protect confidentiality (for example, blurring faces in photographs)? • Who needs to be consulted about privacy and confidentiality in the course of visual research, for example, research participants, research team members and community gatekeepers?	• Conversations about ethics, particularly regarding participant confidentiality, are re-visited throughout the study.
Minimising harm	• What harm might participants potentially encounter as a result of telling their stories through visual methods? • How do researchers identify and respond to their own experiences of potential vulnerability?	• Depending on the research context and question, visual methods have the potential to cause significant harm. Some images may be identifiable, and depending on the research question, the act of taking pictures, could be unsafe for participants. Much effort should be devoted to safety. First, participants are encouraged not to include identifying details in their photographs or drawings. If participants choose to take identifiable photographs of others, they must obtain written consent.
Consent	• What will happen if an individual or community chooses to participate in research and then subsequently withdraws their consent? How will any research data relating to that individual or community be treated? Is there a point where withdrawal of consent is not possible or appropriate? • Have the researchers been open with participants about potential future implications of the research, including the possibility that they could be identified by third parties not involved in the research process? What specific efforts have been made by researchers to help participants understand and address such implications?	• It is helpful to have a frank conversation with participants that, once published, an image will be publicly accessible indefinitely. Participants are invited to choose which of their photographs (if any) are used for dissemination purposes, and their decisions are re-visited prior to public presentation of findings. In the case of rich pictures, participants are consulted if their drawings contain identifiable information that need to be blurred during the publication process. • Because data collection and analysis are iterative, it is hard to untangle participant data from the evolving story. However, participants own their drawings and photographs, and they can withdraw images at any time prior to publication.
Authorship and ownership	• What protocols are in place to generate, and sustain, a common understanding between researchers and participants around who owns images produced in the course of visual research, who can access them, and who is entitled to disseminate them? • How will authorship and ownership of visual products be acknowledged in project reporting and dissemination?	• While participants own their images, they may not necessarily meet criteria for authorship unless they are involved in other aspects of the research process such as project design and data analysis – as is the case when images are used as part of in participatory-action research. For other methodological approaches, participants should – at minimum – be acknowledged.

(*Continued*)

Table 13.2 (Continued)

Ethical challenge	Key questions to consider	Our reflections
Power dynamics	• Is power sharing limited to data collection or will participants be included in the data analysis process? • Will research participants be invited to review the written results and/or how their images/drawings are used and contextualised? • Will participants' goals be considered in how the results are disseminated? • How much time and labor are we asking of participants? Will their time/labour/images be compensated in some capacity?	• If the potential for power sharing is the draw of this method, researchers should consider what power sharing looks like for the duration of the study.

questions that researchers might consider to build their approach to ethics.[44] At the core of these ethical quandaries is the need to consider the power dynamics in the research design and relationship. Grappling with these early on and in a transparent manner with participants is critical.

These and other ethical issues that require attention are outlined in detail in the Guidelines for Ethical Visual Research Methods.[57] This is an excellent resource developed by an interdisciplinary group of visual researchers from Australia and Canada who formed the Visual Research Collaboratory (http://vrc.org.au) to pool their expertise and develop practical resources to support researchers using visual methods. We encourage all researchers interested in using visual methods to review this resource in its entirety.[44]

Dissemination

Decisions around which visuals will be displayed, how, when, where and in what contexts are also central to the dissemination of visual research. Three premises underpin this challenge as per related ethical considerations: 1) the meaning intended by the researchers when they create or publish a visual may not be the meaning that is 'read' by the viewer. 2) In selecting visuals, researchers must balance minimising harm without disempowering participants. And 3) the meaning of visuals changes over time as additional audiences engage with them.

Whether in public speaking or in writing up, researchers using visual methods will inevitably find themselves walking a tight rope. How can researchers do justice to describing the context of the visual within the word limit constraints of journals? How do researchers choose visuals to support thought-provoking claims while maintaining confidentiality? These are only a few examples of the multiple issues that visual researchers navigate. From our experience, asking for feedback from both participants and colleagues as we draft manuscripts or prepare presentations has become instrumental for holding ourselves accountable to both our research teams and participants.

Conclusion – and new frontiers

So far, health professions education researchers have used visual methods to more deeply explore and richly convey the complexities of medical expertise, patient experience, reflective practice and emotion. We have introduced the what, why, when, how of rich pictures, photo-elicitation and photovoice, to illustrate some of the uses of visuals in medical education research. But they are not the only ones. Before closing this chapter, we would like to acknowledge a few other innovative uses of visual tools that our colleagues have incorporated into their research.

Visual methods are valuable, not only for eliciting or disseminating rich data, but also for ensuring the integrity of the qualitative research process. For instance, Koopman *et al.*,[59] recently used visuals as a strategy to engage in reflexivity – or the active process of identifying how researchers' personal and professional knowledge and experiences might influence the interpretation of their findings. Scholars are also considering the merits of visuals as pedagogical tools, strategising opportunities for using visuals to help residents reflect on their communication skills, to assist[33] nurse practitioners in better understanding the lived experiences of patients they had cared for over decades,[60] to aid healthcare providers in revealing the sources of their implicit bias,[61] and to teach both physicians and physicians-in-training about the nuances of engaging in health advocacy.[49] Finally, with the increasing focus on equity, diversity and inclusion, we anticipate the increasing use of visual methods, such as photovoice, to help researchers grapple with and contribute to the conversations around social change in health professions education.[62]

Visual methods are powerful conduits for understanding, and these are only a few of the new frontiers scholars are exploring to enrich the health professions education discourse. In this chapter, our goal was to provide an overview of visual methods, using our experiences to convey straightforward guidance for researchers seeking to broaden their methodological repertoire. Although this chapter only skims the surface of visual methods and their potential for deepening understanding, we've tried to provide a useful starting point for researchers wanting to learn more. Mostly, we hope we have inspired education scholars to think outside the box and consider incorporating novel techniques into their research and teaching practices.

Practice points

- Visual methods are regarded as powerful companions of qualitative interviews, useful for eliciting either difficult-to-access or difficult-to-articulate insights.
- Knowing which visual methods to use in your qualitative research study can be challenging. A place to start is to think about the source of the visuals as well as about and how they might align with a research question or goal. your goal.
- In health professions and medical education research, visuals have been useful to explore phenomena where the complexity of the human experience troubles challenges medical learning and practice.
- By using visuals, researchers strive not only to question deeply held assumptions (both their own and participant's) but also to discover overlooked connections, traps, possibilities, contradictions and so on.
- Visual methods entice us because of their versatility. Yet, using visual methods in research requires thoughtful consideration about ethics and dissemination.

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14 Critical discourse analysis: questioning what we believe to be 'true'

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During an undergraduate curriculum committee meeting reviewing content for a unit on diabetes, a committee member discloses that her son was recently diagnosed with the condition. She shares her experiences: being told of the diagnosis, her interactions with multiple healthcare team members, and the attention needed to control glucose levels to prevent the risk of diabetes-related complications. She details all the hard work she is doing to help her son learn to self-manage his diabetes, which his current providers support but aren't really good at helping with. She suggests the committee consider incorporating more content on disease self-management, on patient empowerment, and on person-centred care into the diabetes curriculum.

The other committee members seem to initially agree but subsequent discussions prove to be unproductive: some members say this content doesn't belong in the diabetes curriculum and suggest it might be more appropriate for other kinds of healthcare workers rather than doctors, while others express concern that doing so will result in the sacrifice of biomedical content.

The committee looks to you for guidance on how to resolve these tensions.

Health professions education is governed by sets of rules, some of which are explicitly stated on admissions documents, policy websites or accreditation guidelines. But not all rules are so explicitly stated. Some rules that govern how we conduct ourselves in the classroom or clinic are much more implicit, telling us what is possible to say or do. When a medical student steps into a clinical rotation for the first time, they may feel nervous or uneasy. They may defer to their more senior colleagues. They may listen more than they would speak. They may follow rather than lead. Later in their career, as a physician, they may walk into a patient room for the first time and behave quite differently. They may command more space this time, demonstrating both authority and compassion, and they may wear the accoutrements of a 'good doctor'. That same person, later on in life, may become a patient themselves. They may wear a hospital gown rather than a white coat, they may ask more questions than they might answer, and they may, once again, defer to others in the room for learning about a course of care. Discourses govern how a medical student, physician or patient interact with the world around them.

There are also times when a health professional may not align with the expected 'norm'. A student may speak up as they witness a mistake, and they may lead as well as follow. As a physician they may not choose the typical accoutrements of a 'good doctor' knowing that in the context in which they practice, a 'good doctor' looks different than the 'norm'. And later in life, as a patient they may be unwilling to ask more questions and may choose not to defer to anyone but themselves and their own chosen path. In these moments, discourses too govern how people interact with the world around them; but in these cases, they resist the dominant ones.

In this chapter, we describe the utility of critical discourse analysis as a method to rigorously examine, and potentially navigate, complex challenges in healthcare and education. We will offer some definitions, describe the method, provide examples, and discuss critiques and extensions.

What is a discourse

A discourse is a set of statements that form what we have learned to be 'true', and that thereby regulate our practice. Discourses can be implicitly handed down from one generation to the next: from parent to child or from teacher to student and last for decades, or a discourse may develop within a year and then disappear just as quickly. Discourses govern our conduct in ways we may not even realise. They are constructed through documents and texts, through verbal declarations, and also through

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gestures. When a government issues policies limiting the mobility of Indigenous populations who rely on being able to travel to visit family, perform ceremonies and hunt and gather, there are discourses at work that construct the nature of the relationship between government and an Indigenous person or community.[1] When a parent shakes their head at a noisy child in a library, there are discourses at work that dictate what a parent's role is, what an expected noise level is in a library, or what a child's conduct should be in that space.

A dominant discourse is what many in a certain society have come to accept as 'true', and so implicitly accepted that people may no longer even question why it might be so. But once that discourse starts to shift, other discourses may arise which raise questions about the original 'truth' that had once been implicitly accepted. Why is it that in many societies more people are ignoring the advice of medical professionals? For years, the opinion of a medical professional in Eurocentric society was almost revered, the dominant discourse was that the medical professional was an educated expert who served society. Now people have begun to question physician's expertise, perceiving they are biased towards the interests of pharmaceutical and medical technology industries. Those who follow this and other connected rising discourses do not see the same 'truth' as those who accept the dominant discourse. Their taken-for-granted assumptions declare different truths. And these assumptions make them take different actions when it comes to seeking care. In another example, the concept that a medical expert even requires extensive university training and a residency programme is itself another often taken-for-granted 'truth' – one that replaced millennia of sophisticated Indigenous Knowledges, in part because of colonisation.[2] There are multiple discourses here, and they each produce and reproduce different truths, create what is considered to be 'normal,' and affect what we can say or do in a certain space.

Why is discourse important?

Discourses are important to health professions education because healthcare is not just governed by the pieces of curriculum presented on a slide deck in a classroom or conveyed in a textbook. Healthcare is not just about the transfer of textbook knowledge from one person to the next. Healthcare operates within systems that are tied to political, social, economic, educational and cultural institutions, bodies or beliefs. Undergraduate medical education, for example, operates mostly within universities and colleges, embedded within societies that value formal education and credentialled practitioners. Some of these systems may mean a student graduates from medical school with high debt load, while others may mean a student graduates owing nothing. Postgraduate medical education operates more within clinical systems. But these systems differ too. In a publicly funded clinical system, patients may be assessed and treated without seeing a bill, while in a privately funded clinical system patients may make choices about which care provider they seek, or base their decision on how much care they can afford. Continuing professional education operates within accreditation systems that may regulate how many credits one might need to maintain competence in their discipline, or which set of courses one may need to take across different areas of knowledge. Each system carries with it different practices, different norms and different things that are acceptable to say or be or do. Furthermore, these systems also shape educational experiences; how one teaches, learns or works is shaped by the system and the discourses in which one is embedded. A discourse that disciplines people into behaving certain ways may operate silently and even unproblematically in one system, but may be met with resistance and challenge in another.

Every system is imbued with discourses. A student in a system where it is expected they will graduate with significant debt may hear teachers suggest high-salaried disciplines. A resident in a system where patient care is largely funded through tax dollars may be trained to request fewer tests. A physician in a system where the social determinants of health are often discussed may be trained to learn more about advocacy. Discourses circulate within these systems, quietly influencing the choices one makes.

Understanding what discourses are circulating within a system helps researchers answer questions such as why certain directives or guidelines within a system may be followed or not, or why miscommunications may occur between a physician and patient, or why public confidence in medical expertise may have shifted. Researchers of medical education may choose to analyse discourse to unlock what may not be visible through formal assessments or evaluations.

Discourse analysis

There are many forms of discourse analysis, this chapter will focus primarily on one: Foucauldian critical discourse analysis. Michel Foucault was born in France and lived from 1926 to 1984. He is known as a Chair of the History of Systems of Thought at the Collège de France, a philosopher, an activist and an intellectual radical.[3] Foucault is recognised as a contemporary icon of revolutionary Western thought. He resisted labels, unwilling to cast himself as either a theorist or methodologist and perhaps rightly so as his contributions range from historical records on the history of knowledge[4] or corporal punishment,[5] to an exploration of the clinical and legal documentation of a confessed murderer[6] to a study on sexuality[7] and the subject of the self.[7,8] Foucault's work continues to be far-reaching in influence, range and complexity even though it is characterised by his notoriously dense and nebulous writing style. Nevertheless, his work explains the social world in new ways, uncovering and contesting long-held assumptions. While Foucault was largely rejected in his native France, derided for both his homosexuality and radicality; the methodology of critical discourse analysis become popular after his death[3] and is frequently utilised within medical education.[9]

Critical discourse analysis

There is no single overarching methodology that sufficiently explains Foucauldian discourse analysis. There is no textbook. There is no static body of work. Foucault wrote one book that laid out a methodology[4] and then immediately proceeded to change it in his next books. Rather than one Foucauldian theory, there are multiple. Some have even described them as a methodological 'tool box'[3] but they all (eventually) align towards one concept – the 'history of the present'[5,10] – how what we understand to be 'true' is constantly and iteratively constructed and reconstructed through discourse.

Analysing statements that form discourses is not solely a review of statements: for Foucault and those that conduct critical discourse analysis it is about understanding how a certain set of statements come to be accepted as 'truth'. It is about how those statements formed discourses, and sometimes how a discourse comes to be dominant. To conduct a critical discourse analysis means one needs to consider power.

For Foucault, power is not something that one person holds nor a form of domination. In the context of higher education, for example, power is not held solely by a dean or a manager over a staff member or a student. Instead, power is an energy that circulates. We are all always 'undergoing and exercising this power'[11] (p. 98). Power is therefore a relation between us/people, and these relations are 'mobile, reversible, and unstable'[8] (p. 292). Power 'traverses and produces things, it induces pleasure, forms knowledge, produces discourse'[12] (p. 61). These power relations construct how our society is ordered, and how we come to accept discourses as true.

Discourse analysis is about understanding this order. It is about identifying the rules, seeing how these rules are formed, what legitimates them and how they change in different contexts (i.e., time and space). Foucault writes:

> *we must grasp the statement in the exact specificity of its occurrence; determine its conditions of existence, fix at least its limits, establish its correlations with other statements that may be connected with it, and show what other forms of statement it excludes . . . we must show why it could not be other than it was . . . what is this specific existence that emerges from what is said and nowhere else?*[4] *(p. 28)*

We do this through Foucauldian methods of building an archive and genealogy. The researcher who uses discourse analysis as a method moves back and forth between these stages, constantly adding new knowledge to their archive as they explore how those discourses came to be formed with the genealogy.

Building an archive

An archive is the 'system of statements'[4] (p. 128) that form 'the law of what can be said' (p. 129). We use the archive to map statements of truth and to identify shifts or discontinuities in the discourse.[9] The texts gathered together in an archive mark the statements as relational, connected and operational within a specific context.

In Foucauldian discourse analysis, the researcher gathers their archive by selecting the texts that form and transform the statements that form the discourse. For example, for a study aiming to understand power relationships between administrative staff and faculty within medical education at a university, one might gather historical documents related to the practice of administering a medical school: records, meeting notes, job descriptions, annual reports or policies. The archive might then expand to include the knowledge that determined how the university system came to be, or how medical education is structured. The archive might also include information about the role of the professions, or what administrative roles have developed over time to allow a medical education system to function. Foucault himself writes 'the archive cannot be described in its totality'[4] (p. 130).

It is near impossible to gather every document related to the formation of a large system over time, so the researcher determines an informed timeframe. A frequently used timeframe in studies related to North American medical schools reaches back just over a century to when significant reforms were recommended by Abraham Flexner's 1910 *Report on Medical Education in the United States and Canada*.[13] This year, for many researchers, is set as the starting point upon which to build an archive. In a study of the 'good doctor' in North America, Whitehead writes that because of the Flexner Report, 1910 has become 'the accepted historical starting point for North American medical educators'[14] such that 'discursively, "in the beginning was the word of Flexner"' (p. 51). Other discourse analysts in North America may choose to form their archives much earlier, using narratives reaching back to pre-colonisation. This archive would enable one to better see how Indigenous Knowledges have been suppressed by the Eurocentric settler biomedical model. Analysts in other parts of the world would likely find either of these timeframes to be meaningless and would instead need to identify a timeframe that is right within their own contexts from which to build their archive. Pande[15] comments that 1836 is sometimes seen as a starting point of medical education in the context of Bengal as this is the reported date of the 'first dissection' of a cadaver at the Calcutta Medical College. However, in her analysis, she suggests that this timeframe is insufficient too as 'centuries before this, an Indian medical text had described the art of studying the human body through dissection' (p. 66). Her archive therefore reaches back much further than 1836, to the beginnings of Ayurvedic medicine as she carefully traces the discursive construction of medical knowledge in Bengal. Instead, 1836 marks but a shift in the discourse from the Indigenous Knowledges that came before.

In forming the archive, the critical discourse analyst may choose to use text-based documents, for example books, journal articles, letters, record, or, a more current example, social media.[16] Foucault usually restricted himself to text-based documents (often going back as far as Greco-Roman times). Many present-day researchers choose to add the use of interviews as these conversations allow them to explore current dominant discourses, allow for probing questions, and offer an opportunity to witness the 'struggle' between potential discourses.[17] However, not all researchers choose to employ interviews in their analyses, some arguing that the interview process subjectifies the interviewee (the very thing that Foucault's work tries to expose).[18]

Genealogy

With the archive formed, the genealogy is where researchers trace the statements that form discourses. Foucault originally conceptualised this phase as an archaeology.[4]

> *Archaeology was Foucault's term for a method of research and analysis in the history of thought that he himself had developed: one that digs down into the past, uncovering the discursive traces of distinct historical periods and reassembling them, like so many distinct layers or strata, each one exhibiting its own structured pattern of statements, its own order of discourse.*[10] *(p. 369)*

The archaeologist would seek to uncover the underlying logic behind the differing layers of discourse, or as Foucault rather lyrically put it, archaeology 'is to define discourses in their specificity; to show in what way the set of rules that they put into operation is irreducible to any other; to follow them the whole length of their exterior ridges, in order to underline them the better'[4] (p. 139).

Beginning with his work *Discipline and Punish*[5] in the late 1970s, Foucault switches to the language of *genealogy* (a term he borrows from Nietzsche). Both archaeology and genealogy are designed to critique the present, but while archaeology is intended to dig and explore the various layers that form discourses, genealogy takes this one step further, showing how those discourses continue to affect the present.[10] To conduct a genealogy is to trace descent – 'to identify the accidents, the minute deviations – or conversely, the complete reversals . . . that give birth to those things which continue to exist and have value for us'[19] (p. 355). Many researchers, ourselves included, conduct genealogical analyses of taken-for-granted 'truths'.

What do we take for granted today in health professions education? Let's take one example: some students will 'fit' well into health professions training and others will not. Why is that? *Discipline and Punish* [5] explores, for example, why some individuals who have gone through a formal education programme might regulate their behaviour to fit the mould of a model student. They will diligently do their homework, raise their hand to ask or answer a question, and submit their assignments on time. They will be assessed, marked and ranked. Foucault traces the beginnings of this form of education, taking the reader from Bentham's panopticon – a physical prison – to an entire disciplinary 'panoptic mechanism' where those in power could 'see constantly'[5] (p. 200). Foucault thus links the present-day (Eurocentric) education model to that of the prison system. In much the same way that a prison guard could always see their prisoners, teachers can always see their students. Not only do teachers stand at the front of the classroom, but just as prisoners have numbers, are classified and coded, so too are students. They are assigned grades and ranks, and these grades and ranks are entered into systems that allow others to see those students as well. If a researcher wanted to better understand why some groups follow an educational practice 'better' than others, they may wish to conduct a critical discourse analysis: to trace the descent of the 'truth', the 'assumption' that some students 'fit' better than others and some students may not. Critical discourse analysis lets us trace the 'accidents' by which these assumptions were made and then allows us to ask: why does it exist now, and from where did it emerge? Foucault's genealogy 'is to trace the erratic and discontinuous process whereby the past became the present'[10] (p. 372).

Discourses are not stand-alone words, but they are made up of statements that are formed by a set of rules. The researcher would therefore trace the statements in their archive that form truth statements, trying to see how far back they reach in time and in which contexts they may appear. Here the researcher would also identify the discursive shifts; the discontinuities and the contradictions. What new discourses are formed that contradict another? For example, when and in which contexts do patients begin to question their physicians' medical expertise, believing them to be corrupted by industry? From where do these statements begin to appear and alongside which other types of statement can they be found? The purpose of archaeological analysis then is to create a map of statements that form a discourse that creates a 'truth'.

Bourke and Lidstone[20] outline four steps to the archaeology. The first step is to look for 'surfaces of emergence', mapping the archive to see when similar statements emerge or when new statements begin. Here Bourke and Lidstone also identified if the subjects were passive or active. In their study on education, they were identifying if teachers were actively using statements or if statements were being applied to them by others. The second step is to look for contradictions or distance between sets of statements, how do they start to differ and where do these differences appear? The third step is to see where the different statements cross paths – how and where do these statements interact and intersect, what was happening at those times and places that permitted some statements to be present and others to not be present. Bourke and Lidstone's final step is to analyse all of these different elements together (the appearance, disappearance, contexts and connections of similar statements) to identify the discourse – the 'regime of truth'.

Extending this to the idea of genealogy, one then next needs to understand how what is present today has been shaped through power. How has one regime of truth been legitimated over another? What struggles have existed between competing discourses? Where and from which forces do these ideas emerge? How has it come to be that certain students will 'fit' in medical training programmes more than others? Which rules have been constructed to perpetuate this? What systems have been created that legitimise this, and who created them? Which voices gain power, and which voices have been silenced? Critical discourse analysis is about identifying the groups of statements, following their line(s) of descent, and identifying from where and how they emerge.

Critical discourse analysis allows us to dig into taken-for-granted assumptions: that a good doctor is scientific,[14] that common core educational standards are inherently beneficial,[16] or that interdisciplinarity in research is a way to solve important questions.[17] Foucault writes: 'the search for descent is not the erecting of foundations: on the contrary, it disturbs what was previously considered immobile; it fragments what was thought unified . . .'[19] (p. 356).

Freire[21] referred to this kind of work as 'problem-posing education'. The critical discourse analyst will not wrap up every question they pose in a neat and tidy bow at the end, presenting clean unambiguous results back to an audience. It just isn't that tidy. Critical discourse analysis opens up cans of worms and challenges the tenets many of us have long held to be true.

Opening the can of worms

Much the same way as discourse develops through a specific set of rules and power relations and constructs a specific regime of truth, research methods have developed the same way. Foucauldian critical discourse analysis sits within an array of choices, each choice also having developed (and developing) their own set of rules, power relations and regimes of truth. Power relations construct discourses *as well as* our ontologies (what we believe to be real), epistemologies (how we 'know' something is real), our research approaches and our methodological choices. Each of us has access to different choices based on regimes of truth. Foucauldian discourse analysis may make sense as a choice for one of us but may not make sense as a choice for another. It may also make sense as a choice in one research project but not another, depending on the research question and context. We acknowledge a fine balance between developing expertise in a specific research approach, while also being open to the juxtaposition of a few approaches. A careful balance, alongside appropriate expertise on the research team, can add depth and nuance to scholarly analyses.

Foucauldian discourse analysis uses archeology and genealogy to examine discourse paying close attention to power. However, because Foucault's approach was open, broad and philosophical it leaves space for researchers to use more specific theoretical lenses to analyse discourse. Simply put, there are alternatives and extensions to the Foucauldian method that researchers may wish to consider. In this next section we offer a brief glimpse of some of those options, bearing in mind that while some of us use Foucauldian CDA in our research, we do not suggest that everyone should. We each have access to different choices, and we encourage you to explore your own.

Limitations of and alternatives to foucauldian discourse analysis

Critical discourse analysis can be conducted in many different ways and emerges from a combination of linguistic analysis and critical social theory.[22] Rather than focus on the individual words, syntax and structure at the sentence level as linguistic analysts might do,[23] or at the level of the interaction as systemic functional linguistic analysts might do (see chapter by Konopasky and Diaz for more on this approach), critical discourse analysts focus on the level of the social world.[22]

The social world in which Foucault was embedded was Eurocentric. While Foucault's theories and systems of thought may appear to be methods that one can just pick up and move to a different social context, they were embedded in very particular ways of knowing. Foucault's way of knowing, like Western philosophy itself, emerged from what is called the 'zero-point epistemology'.[24–27] It is a way of knowing 'based on the knowledge produced by a few men from five countries in Western Europe'[28] (p. 74) that assumes a knowing subject: that 'man' has control over his own mind, and that there is something that is the 'truth' (however slippery it may be). Western (white) philosophy, which would include this discussion of Foucauldian methods, 'functions as a site of white cultural hegemony, sustained and perpetuated in terms of the particularity of race and gender related institutional power'[29] (p. 8). Despite Foucault's concepts having been considered radical at one point in time, the root of Foucauldian discourse analysis remains within this Western philosophical tradition. As such, it is now very much an accepted approach and has been ascribed legitimacy within a dominant Western global perspective on research.

Foucault and the work that he has inspired has been criticised for the limitations that this Eurocentric model places upon it. For example, using Foucault's practices usually centres around an individual person coming to learn something. However, the idea of the knowing individual is itself something that is not universal but emerged from ideas of Cartesian dualism during the Enlightenment.[30,31] While we offer responses from outside the Eurocentric model, we invite the reader to also realise the limitations of this book chapter. It too centres largely around a North American presentation of a Eurocentric model, detailing how an individual analyst can proceed to study a social problem and leaving little space for the examination of equally valid perspectives outside that model.

Below we offer a handful of these perspectives and provide a brief explanation of their focal points. In order to make these concepts more tangible, we explore a single concept common to many medical programmes (admissions) and how this could be analysed using different critical approaches (Table 14.1). Foucauldian approaches are now increasingly combined with these critical approaches to strengthen both, and to lever the legitimacy that a Foucauldian approach offers.

A return to the curriculum problem

Now let us return to the scenario described at the start of this chapter.

As someone with experience analysing discourses, you are intrigued by the different ways the committee members seem to be talking about diabetes care. It seems to you that they are talking at cross-purposes with different goals for the diabetes curriculum. What one committee member sees as fundamentally important; another sees as a waste of time. This contradiction makes you wonder if their debate is limited to your committee or if they are constructing the notion of diabetes care from within different discourses that are circulating within the community of professionals who care for people with diabetes.

In order to better understand what is going on in your local context, you decide to compile an archive of professional and educational documents written to guide diabetes care. Then you use tools from traditional Foucauldian discourse analysis to study the use

Table 14.1 Critical approaches

Approach	Focal points	How they may be used to analyse the admissions process
Critical Race Theory	Critical race theory[32–34] is rooted in the understanding that race is a key social construct (as in, race is something that has been created, legitimised and used to divide).	The admissions process is built on the assumption of whiteness and therefore alternative forms of knowledge or experience are denied. This standard has implications for equitable representation of students and faculty within health professions education programmes and ultimately for patient care.
Queer Theory	Queer theory[35–37] is a family of theories that disrupt the Eurocentric model of dualism. They see sex and gender identity not solely as male/female or man/woman but instead a 'third-space'[38,39] or, more recently, an ontology of becoming that takes into account the diverse, multi-faceted nature of sexuality as a series of temporal experiences, attractions, desires, sensations, practices, and identities.[40]	Admissions processes which seek to balance 'gender' if defined as solely male/female fail to account for ontologies outside of this dualism. Ultimately this choice may compromise patient care and health outcomes where a health professions workforce is ideally representative of their patient population.
Decoloniality	These approaches[41,42] disrupt the hegemony of the Eurocentric model by making visible how colonialism by European governments and monarchies continues in the present through the ideas and ways of knowing that still permeate dominant understandings of the world.	Admissions criteria, such as required scores on standardised tests or bioscientific pre-requisite courses, advantage positivist ways of knowing and perpetuate the hegemony of the Western Eurocentric biomedical model as 'truth'. Ideas 'on the margins' are given less legitimacy and constructed as only transitional alternatives to this truth.[25,42]
Indigenous Knowledges	These Knowledges[43–45] disrupt the stability of the Eurocentric model. Models of Indigenous health practices, for example, challenge the biomedical model upon which academic medicine has been built in colonising countries. Many also challenge the focus that Eurocentric models of research (critical discourse analysis among them) have on the individual, arguing instead for more collective, holistic, community-based approaches to understanding and resolving social problems.	Admissions criteria are designed to advantage individual achievements and individual experiences rather than to support collective or group achievements. Admissions practices that do not recognise collective achievements or the importance of community, or that are punitive for those who have non-Eurocentric ways of knowing, may disadvantage applicants with world views that have been shaped by Indigenous Knowledges.
Feminist Theory	Feminist theories[38,46,47] disrupt the male-centric tradition of Western philosophy, arguing instead for perspectives centred around the female experience. Feminist theories are used to grant agency to individuals who otherwise are constructed as passive.[17]	Reference letters provided to admissions committees have been shown to focus on male applicants' achievements and female applicants' caring demeanours, disadvantaging female applicants to programmes that value traditional Eurocentric notions of 'excellence'.[48]

The above examples are illustrations of these approaches designed to demonstrate how they may be applied to a particular scenario. This list is not comprehensive of all possible equity theories; nor do we discuss approaches that combine multiple equity lenses. The citations provided also serve solely as starting points into deeper explorations. These approaches are sophisticated and evolving and we encourage readers to explore these further.

of language in those texts. You want to understand discursive shifts in ways of thinking about diabetes and how these create the possibilities for (or obscure other ways of thinking about) interactions between healthcare professionals and patients (see Table 14.2).

The fundamental insight from your analysis is that the term 'diabetes care' has not signified the same thing over time. Different discourses have predominated in different historical times; one is the discourse of self-management, another the discourse of evidence-based medicine (see Table 14.3). These discourses produce different truth statements, subject positions and objects – that set boundaries for how to think about patients with diabetes, and thus for what healthcare professionals need to learn in order to care for them. A curriculum that trains physicians to be good partners for patients who are *participants* in care would be quite different from a curriculum that trains physicians to be decision-makers for patients who are the *recipients* of care.

Note that, while these two discourses of diabetes care are distinct, one did not replace the other. Rather they both continue to operate, interacting with each other in complex and somewhat contradictory ways. Although a Foucauldian discourse analysis will not necessarily prescribe solutions for the committee, it makes visible previously invisible tensions. It provides you with helpful insights that you then bring back to the curriculum committee. After you explain to the committee that different healthcare professionals who provide diabetes care do their work in these different ways, the curriculum committee decides that they need to include material that will allow learners to appreciate the value of both perspectives and to have an approach to working within each one of them.

Table 14.2 Critical discourse analysis process

This example is taken from Dr René Wong's doctoral thesis entitled: A Foucauldian Discourse Analysis of Diabetes Knowledge Translation and the Governance of Family Physicians and Endocrinologists in Canada.[49]

Construction of the research question	Used clinical expertise and lived experience to identify an issue in care and education. Identified the research question: how are the practices of family physicians and endocrinologists in Canada governed through discourses of good diabetes care?
Application of an analytical framework	Identified Dean's[50] 'analytics of government' (encompassing ideas such as problematisation, visibility, techne, episteme and identities/subjectivities) as a useful tool to understand discourses.
Compilation of the archive	Assembled formal text documents written to guide the conduct of healthcare professionals involved in diabetes care. Using Foucault's idea of archaeology, assembled documents from the discovery of insulin to present day. With institutional ethics approval, extended analysis to include semi-structured interviews with physicians to understand how discourses are operating in the present.
Data management and analysis	Assembled all material electronically to note-take, tag, label, document, highlight or link data, statements and/or reflections. Analysed through three phases – reading (describing documents), interpreting (for themes, functions and potential actions), and applying Dean's governmentality analytic[50] (explaining how each regime of practice operates through dominant discourses).
Key findings	The quantification of good diabetes care makes it possible for the panoptic surveillance of family physicians. The manifest construction of education as a mechanism for specialists to correct problematic family physician practices may unintentionally reinforce intra-professional hierarchies and power relationships. Physicians occupy multiple, historically-constituted subject positions to interact with patients as both active participants in care, and passive recipients of care. The resultant tension experienced by physicians may limit the utility of knowledge translation initiatives designed to improve application of clinical practice guidelines. As physicians navigate tensions within intersecting discourses, patient-centred care in diabetes is constructed in ways that may paradoxically promote disease-centric, biomedical approaches to care.

Table 14.3 Discourse analysis of 'diabetes care'

	Discourse of self-management	Discourse of evidence-based medicine
Surfaces of emergence	Declaration of diabetes as a threat to public health, requiring more economical models of care	Publication of randomised controlled trials demonstrating improved clinical outcomes in patients achieving target levels of disease biomarkers
Discursive Statement Statements	Good diabetes care: 'Fosters patients to make decisions independent of physicians and direct their own care' 'Fosters patients to take accountability for their own health'	Good diabetes care: 'Lowers the results of biomarkers down to target levels defined by evidence-based medicine.' 'Is evidence-based' 'Can be assessed quantitatively'
Exemplar Quotation	'It is overwhelmingly evident that the patient should take the major role in applying diabetes care and undertaking management schemes. The patient's role should extend far beyond control of diet and medication, and requires understanding of the disease, motivation, and willingness to accept responsibility.'[49]	'It is hoped that primary care physicians and other health care professionals who care for people with diabetes or those at risk for diabetes will continue to find the evidence compiled in these guidelines a vital aid and resource in their efforts. We are confident that, ultimately, if applied properly, these guidelines will lead to improved quality of care, reduce morbidity and mortality from diabetes and its complications.'[49]
Subject positions produced through discourse	Patients as participants in care Physicians as partners	Patients as recipients of care Physicians as decision makers
Objects created through discourse	Specific types of literature: e.g., commentaries, descriptive studies, opinion pieces Standards for diabetes education	Specific types of literature: positivist research: e.g., intervention studies, systematic reviews, meta-analyses Knowledge translation
Instantiating Texts	World Health Organization position papers (1965–1985)	Clinical practice guidelines (1989– present)

Conclusion

Throughout this chapter we have endeavoured to give the reader a sense of what Foucauldian critical discourse analysis is and how it allows one to question what is 'true'. We have explored some of the steps in conducting this research, including building an archive and conducting a genealogy. We then opened the proverbial can of worms (as discourse analysis often allows one to do). We discussed that our own methodological choices are also set within an array of power relations. We discussed 'zero-point' epistemological origins and offered for consideration other critical theories that one can combine with, or use separately from, Foucauldian critical discourse analysis. Finally, we have used a case about a curriculum committee to explore how tools from Foucauldian critical discourse analysis can be put to practical educational use by making the invisible visible.

In closing, we repeat once more that Foucault did not offer an ever-static methodology that one can easily apply to any problem. Instead, critical discourse analysis challenges us to question assumptions, demands that we explore what we believe to be 'true' and requires the researcher to be both nimble and reflective. Within its own limited context, with all of its own historical assumptions, and increasingly with the aid of critical theories stemming from non-zero-point epistemologies, Foucauldian critical discourse analysis unsettles the apparent coherence that seems to surround so many of us. It exposes power and, in so doing, opens up more possibilities for meaningful change.

Practice points

- A discourse is a set of statements that form a 'regime of truth', and that thereby regulate our practice.
- Foucauldian critical discourse analysis uses the concepts of archive, archaeology or genealogy to make discourses visible.
- Foucauldian critical discourse analysis allows one to open up a problem, make the invisible visible, and has the potential to make practical, meaningful change.
- Recognise the origins of any methodological choice, as these are also implicated into a specific regime of truth.
- Consider complementing your analysis with critical theories or approaches in line with the perspectives of value to you and your research.

Recommended reading

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15 Functional and corpus linguistics in health professions education research: the study of language in use

Abigail Konopasky and Brett A. Diaz

As linguists, both authors have had the experience of joining an ongoing health professions education (HPE) research project. Imagine a research team consisting of physician and doctoral researchers exploring the thorny problem of improving health professionals' and trainees' clinical reasoning. The team has gathered an array of data to address this problem. They have surveyed physicians, nurses and allied health professionals on their efficacy for reasoning through various problems; they have used observational protocols and checklists to assess their reasoning in simulated clinical situations; they have applied hierarchical linear modelling to determine the relative importance of individual, group and institution in reasoning errors; they have given written assessments of reasoning; and they have interviewed health professionals about their reasoning, using thematic analysis to draw out important themes and constant comparative analysis to develop a theory of clinical reasoning success. Yet this team is still struggling to understand the process of clinical reasoning and how to better teach it. All of the tools this team have used thus far are rooted, more or less, in language: the choices humans make in speech or writing to encode their thoughts, beliefs, desires, needs and emotions into words and phrases. These words and phrases are strung together to form pivotal building blocks for the relationships, communities and institutions that make up academic health professions. Yet they have not yet drawn from the robust tools that the various subfields of linguistics offer.

In this chapter we discuss two approaches to linguistics that health professions education (HPE) researchers can use to make sense of the educational contexts they study: functional and corpus linguistics. When HPE researchers do functional or corpus linguistics they are simultaneously producing two kinds of knowledge: (1) knowledge about language itself and how learners and teachers make choices about language use as they move across contexts, and (2) knowledge about HPE itself: how teaching and learning work in HPE, and how we might better support teachers and learners. Whether HPE research teams have a linguistic focus or not, functional and corpus linguistic tools and methods can open these teams up to valuable dimensions in their data they may not have otherwise seen.

In the following two sections, we introduce readers to some of these tools and methods. In the first section, we introduce functional linguistics, including a brief history, and then explore both existing and potential HPE work across the three metafunctions of language this theory proposes: representational, interpersonal and textual. In the second section, we introduce the discipline of corpus linguistics and its origins and methodologies, briefly review work done in HPE using its methods, and discuss some of the tools and proficiencies readily accessible to use in HPE.

Functional linguistics in health professions education research: making choices to make meaning

Systemic functional linguistics, or functional linguistics, is an approach which holds meaning making at its centre.[1] Within this functional approach, speakers and writers make linguistic choices from amongst a system of linguistic resources in order to *use* language for their purposes (i.e., take advantage of language's functions) in a particular context.[2,3] For instance, when a health professions educator offers positive verbal feedback to trainees, the educator engages in a complex act of meaning making. Functional linguistics views this act as a choice from

Researching Medical Education, Second Edition. Edited by Jennifer Cleland and Steven J. Durning.

Table 15.1 The systemic functional approach to meaning making

Language system	Function	Example Choices
Representational metafunction	To construe our experiences and perceptions	You (single resident) vs. you (all residents) vs. you (full team)
Interpersonal metafunction	To enact relationships, often indicating our attitude	Extremely good vs. very good vs. somewhat good
Textual metafunction	To build sequences of text that cohere	You all did a very good job as a team ***with this intubation*** (setting up intubation as the next thing to be discussed) vs. You all did a very good job with this intubation ***as a team*** (setting up teamwork as the next thing to be discussed)
Register	To signal a particular social-linguistic context	Y'all, kinda, sorta vs. numerical assessments

amongst a dizzying variety of alternatives that linguistic systems provide (see Table 15.1). For instance, will they represent the accomplishment as that of a singular trainee (i.e., you), the team of trainees (i.e., you residents), or the broader team (i.e., all of you involved with this patient's care)? And how much will they amplify their attitude, from 'extremely good' to 'very good' to 'somewhat good' to the choice of some more specific lexical item beyond 'good', signalling different appraisals to trainees? Moreover, will the feedback be framed so that the emphasis is on the procedural skills ('You all did a very good job as a team with this intubation') or the interpersonal skills ('You all did a very good job with this intubation as a team'), starting a conversation about the procedure or the team respectively? Finally, what register will the educator use to send this message, the more informal register of a coach or friend (marked perhaps with terms of address like 'y'all' or informal hedges like 'kinda' or 'sorta') or the more formal register of an instructor or assessor (referring perhaps to residency standards and even ranking performance on a formal scale of some kind)? Each of these different systems of linguistic resources are present simultaneously when we speak or write and educators' choices from amongst these resources signal different nuances of meaning to trainees, whether either party is fully consciously aware of these nuances or not.

This functional linguistic system for approaching language and context was developed primarily by M.A.K. Halliday beginning in the 1960s.[3,4] He drew together existing traditions that (a) viewed language as influencing our perceptions of reality, (b) sought functional explanations for the structure of language, (c) held the context of language use to be critical, and (d) saw language as an interlocking set of systems (see Bloor & Bloor[3] for a more detailed history). Halliday's functional approach to linguistics was in direct contrast to the structural approach, which was concerned with describing each language scientifically, or the generative approach, which is concerned with developing a universal structure for all languages. Instead, Halliday was concerned with the authentic ways people choose to use linguistic systems in context and the semantic consequences of those choices. Studying these systemic functional linguistic choices aids in understanding language systems themselves and the contexts in which they are used.

Functional linguistics in Health Professions Education Research (HPER): attending to educators' choices

While not yet widely used across the field, some HPE researchers have recognised the potential power of the functional linguistic lens.[5–9] For instance, both Emmerton-Coughlin and Konopasky and colleagues argue that functional linguistics could help us address areas of interest in HPE like learning in simulated contexts, reflection and metacognition, learner emotions and implicit bias.[5–9] They argue that careful structural analysis of linguistic choices in health professions learning environments – i.e., not just *what* individuals say, but *how* they choose to say it – can help us 'recognize and decode social influences in our educational contexts and better support our learners'[9] (p. 1169).

One central aspect of functional linguistic theory is the structural division of any given utterance or group of utterances into 'simultaneous strands of meaning' or *metafunctions*[2] (p. 2). As in the positive feedback example above, all language is simultaneously (a) *representing* the world (e.g., different references for 'you' above), (b) sending out *interpersonal* signals (e.g., 'extremely/very/somewhat good' above), and (c) organising the flow of the written or verbal *text* (e.g., focusing on intubation versus teamwork above; see Table 15.1 for metafunction definitions and examples). Functional linguistic studies in health professions education have touched on each of these metafunctions using a variety of tools. In this section, we review the ways three studies have used some of these tools (see Table 15.2 for an overview) and suggest other potential uses researchers can explore.

Table 15.2 Health professions education studies and the three metafunctions

Study	Primary Metafunction	Tools	Selected Findings	Further Opportunities
Konopasky *et al.*[5]	Representational	Transitivity system (process types)	-Women represented authorship more materially (i.e., doing) than men -Typology of authorship agency	-Learners' representation of selves and others in reflections -Representation of marginalised individuals
Gallardo & Ferrari[7]	Interpersonal	Appraisal (affect, judgement, appreciation, amplification, and engagement)	-Doctors appraised their profession, health, and medical institution -Negative appraisals of own health behaviours -Positive appraisals of medical work	-Learner appraisals of each other in interprofessional contexts -Educator and learner appraisal choices in evaluations of each other
Emmerton- Coughlin, Schlachta, and Lingard[8]	Textual	Identification (deixis)	-80% of educator–trainee verbal interaction involves deictics (context-dependent words like pronouns) -Deictics can lead to misinterpretation -Physical gesture can disambiguate deictics	-Use of deictics in clinical teaching and potential effects on safety -Flow of information in professional identity narratives

The representational metafunction: using process types as a tool

In a study of how first authors of multi-author papers choose to construe the decisions and actions of their author team in interviews, Konopasky and colleagues draw primarily on the representational metafunction.[5] This analysis was based on the English language's transitivity system, which allows speakers and writers to represent actions along a continuum from high (e.g., 'Alice obtained the degree', where Alice is construed as committing a purposeful action) to low (e.g., 'Alice was hiccupping', where Alice is construed as experiencing an inadvertent state).[10,11] The transitivity system is expressed through process types, choices speakers and writers make to represent people and things engaging in, for instance, material (i.e., doing) versus verbal (i.e., saying) versus mental (i.e., experiencing) actions.

Konopasky and colleagues coded a portion of participants' interviews about the authorship process for Halliday and Matthiessen's six process types (material, verbal, mental, behavioural, relational and existential), examining how different participants used them to *represent* the authorship process.[5–11] They found, for instance, that women represented authorship more materially than men, focusing on the actions of team members versus their resources or thoughts. They also used process types to create a typology of authorship agency, providing insight into the often-fraught world of academic authorship. For instance, some participants narrated distributed agency, a typology focusing on how the separate actions of team members came together to create the paper. The process of how they collected, analysed and interpreted data for this study is outlined in Figure 15.1.

The representational metafunction offers many further opportunities for HPE researchers. First, while process types have already been used to explore the quality and focus of learners' reflections,[12,13] there is more work to be done in this area. They could also help us to explore how health professions educators and learners represent those marginalised in medical contexts due to their race, ethnicity, sexual orientation or gender identity so that we can work towards equity and justice (for use of the representational metafunction to study gender and evaluations, see Isaac, Chertoff, Lee and Carnes).[14] Whenever people write or talk about their educational environment, they are making choices about how they represent that environment, providing opportunities to use functional linguistic tools.

The interpersonal metafunction: using appraisal as a tool

Gallardo and Ferrari centre their study of an online message forum of doctors from Spanish-speaking Latin America on the interpersonal metafunction, exploring how they signal attitudes about their own health and their medical practices.[7] They draw on Martin and colleagues' system of appraisal: a part of the interpersonal system used by speakers and writers to signal what they think and feel about the

Timing	Procedure	Purpose
Data Collection	• 45–60 minute interviews • 26 participants initially; $n = 24$ after exclusion of incomplete data • Choose interview segments for analysis	• Collect narratives of first author perspectives on recent multi-author publications
Quantitative Coding & Analysis	• Identify all main clause subjects and predicates (i.e., verbs) • Categorise subjects into first author (*I*), first author and others (*we*), other authors (*he, she, they*), non-authors (e.g., editors), and other (e.g., *paper*) • Categorise verbs into material (doing), mental (experiencing), relational (being or having), or verbal (saying) • Paired consensus on categorisation • Calculate percentage of time participants used each code type (e.g., 10/20 of a participant's main clauses are material → 50 %) • Calculate variables' mean and range; compare by gender and academic rank	• Categorise and quantify categories posited by prior research to reflect agency • Create variables using percentage to allow comparison across participants, regardless of how many words they use • Mean and range allow comparison of groups (i.e., men/women, assistant/associate/full professors)
Qualitative Coding & Analysis	• Holistic reading of each narrative by at least two team members • Using participants' words when possible, give each narrative a title (what the story is 'about') and a coda (a moral or what the story suggests) • Meet in pairs to come to consensus	• Holistic lens allows understanding of each narrative as a whole • Brief synopsis allows comparison across narratives
Qualitative and Quantitative Integration & Interpretation	• Create matrix (i.e., table) including title, moral, and most frequent subject and verb types for each participant • Use matrix to characterise types of agency • Re-examination of narratives to create subtypes of agency • Team discussions around interpretation of results	• Create dialogue between the two data types to note difference and dissonance • Theorise agency to build theory • Narrative re-examination keeps *individual* narratives at forefront of analysis

Figure 15.1 Worked example of study design from Konopasky and colleagues' *'I, We,* and *They'* study from[5]/John Wiley & Sons.

world.[15,16] Appraisal tools capture five important aspects of the use of language to evaluate: affect (expressing emotion through language like 'ecstatic' or 'devastated'), judgment (evaluating a person's character like 'smart' or 'innocent'), appreciation (evaluating a thing or situation like 'beautiful' or 'serious'), amplification (grading of appraisals along a continuum like the 'extremely/very/somewhat good' example above), and source (projecting a judgement on to someone else like 'Brian says that . . .' or 'according to the literature').

Gallardo and Ferrari coded the online messages for markers of affect, judgement and appreciation. They found three types of people or things appraised: the doctor's profession, the doctor's health and the institutional aspects of the medical system. Most appraisals were negative, and many participants judged their own health behaviours (e.g., working too much) negatively. This analysis revealed that these doctors were indeed aware of the issues and risks of their profession (something not known previously) and were not only open to change but were, in some cases, reaching out to readers of their posts to bring about change.

Much linguistic work in HPE, whether explicitly using functional linguistics or not, draws on the interpersonal metafunction.[14,17,18] Continued work on how educators and learners use language to signal attitudes and enact different kinds of relationships will help us to continually improve learning environments. Yet HPE researchers have not, to our knowledge, widely taken advantage of appraisal tools (see Konopasky *et al*. for an exception).[19] Carefully exploring attitudes would be particularly helpful in the growing field of interprofessional education, where the interpersonal judgements of doctors, nurses and allied healthcare professionals as they work together could possibly affect patient care (see Ruitenberg and Towle for a functional linguistic exploration of modality and interprofessional learning).[6] Moreover, the appraisal system could help us better understand the choices educators make in evaluations of learners and vice versa.

The textual metafunction: using identification and reference as tools

To our knowledge, only a couple of HPE studies make significant use of the textual metafunction.[8,20] Emmerton-Coughlin, Schlachta and Lingard's analysis of the language and gesture surgeons and trainees use in laparoscopic cholecystectomies, for instance, use what Martin and Rose call linguistic tools of identification: keeping track of people and things across a text (e.g., using 'Dr Smith', 'my attending', and 'her' to track Dr Smith across a conversation).[16] Identification begins with the introduction of a person or thing (e.g., 'I was rotating with Dr Smith at that time) and continues with the tracking of that person or thing through pronouns (e.g., 'she' or 'her'), names (e.g., 'Dr Smith' or 'Sarah'), and nominals (e.g., 'my attending', 'a great instructor'). Emmerton-Coughlin and colleagues focused on the use of *deixis* in identification: words and phrases that are dependent on the present context, whether textual, physical or social.[8] Deictic words are interesting because their successful use requires a shared context (in this case, shared by surgeon educators and trainees) and hiccups in deixis can indicate places where educators and trainees are not on the same page.

For the linguistic analysis, the authors coded transcripts for use of deictics (they later enriched this analysis by examining gestures as well). They found that deixis was pervasive, accounting for 81% of all verbal educator–trainee interactions, and that some of these deictic uses were misinterpretations. For instance, at one point an educator tells a trainee to put a clip on an area 'to your right' and has to clarify 'the OTHER right' due to confusion about whether the deictic 'right' is relative to the monitor, the patient, or the trainee.[8] Emmerton-Coughlin and colleagues noted that educators often used physical gesture to disambiguate in these cases. This study points to the potential unreliability of these common identifiers in surgical education, providing opportunities to shore up both teaching and patient safety (also see Gormley and colleagues' work on deictics).[21]

Since so much instruction in health professions happens during patient treatment, with potential impacts on patient safety, further exploration of functional linguistic tools in identification would be useful. The textual metafunction also offers tools for tracking the flow of information across any verbal or written text (e.g., the intubation versus teamwork focus above). As HPE researchers continue to explore professional identity formation, for instance, functional linguistic tools of information flow[16] could be useful to examine which themes health professionals carry through a discussion of their identity, which themes they take as simply given and which themes, perhaps, they do not discuss at all.

Conclusion: functional linguistics offers a wealth of tools

In the sections above, we suggest tools from the representational, interpersonal and textual metafunctions that have been and could be used to address important HPE issues. Yet there are a myriad more tools available. For instance, we did not address how HPE researchers could use formal and informal registers, discussed in our introduction to this section. One could explore, for instance, whether graduate medical trainees use formal and informal registers differently to support interpersonal relationships with each other, supervisors and undergraduate medical learners. We also did not have room to discuss modality: assessments of how probable something is (e.g., might be, could be, is) or how obliged someone is (e.g., should do it, must do it, do it!). This is another aspect of the interpersonal metafunction that individuals use to enact relationships. We encourage HPE researchers to explore the many untapped resources functional linguistics offers.

Corpus linguistics in HPE research: a pragmatic, accommodating approach to language in use

Corpus linguistics: a big tent theory

The subfield of corpus linguistics emerged during the mid-twentieth century. Though the use of what we call *corpora* (plural; singular: *corpus*; intentional collections of authentic language use by a language community for a specific purpose or practice) could be stated to apply to any period or project in which texts, transcriptions and features of language were intentionally collected for the purpose of analysis, it is the emergence of computerised or electronic corpora that tends to anchor the area as a subfield itself.[22] Accordingly, the brand of corpus linguistics that one subscribes to can originate with a number of schools of thought, particular methodologies and assumptions about what language consists of for analysis. However, what is accepted amongst views is that the descriptive and revelatory power of corpus linguistics increased many fold as it moved from manual word counts and sentence analysis, to the computational means to find nearly hidden patterns within millions and millions of running words.

At the same time, in the last 60-odd years, corpus linguistics accrued myths about what it does, in a sort of folkloric history.[23] Many myths and controversies stem from notions people hold about the nature of language, or that no corpus can capture all of language in its entirety. Secondly, methodological controversies have arisen due to the tendency of work in linguistics to use fabricated language, such as fragments produced to exemplify or express certain ideas about a feature, to rely on intuitions by native speakers or insiders, or comparative work. In contrast, corpus linguists insisted that questions about language could only be answered by observing real language used by people in the world and, crucially, that one needs enough of the stuff in naturalistic circumstances to make certain evidentiary claims.

In linguistics there are, broadly speaking, three areas: phonology (sound systems), syntax (structure) and semantics (meaning). Corpus linguistic work focused on *syntax* draws heavily from linguistic theories of structure. Together with their corpora of real language use and theories of linguistic structure, corpus linguists created and revised part-of-speech tagging systems (see, e.g., Marcus, Marcinkiewicz and Santorini)[24] to identify parts of speech – such as nouns (e.g., researcher) and verbs (e.g., think) – and structure – such as noun phrases (e.g., the busy researcher) and clausal structures (e.g., the busy researcher is thinking). These systems were then used to create parsing computer programs to automatically annotate corpora. Many, though not all, corpus linguists will begin with some form of parsing, or tagging, of their corpora to structure their data for analysis. It bears mentioning that a track of computational linguistics, including natural language processing, AI and machine learning, and information theory, is also widespread, with many applications to the health sector (For example, see Kilicoglu *et al*.),[25] but falls outside the conceptual sphere of this chapter.

Corpus linguistics and HPE

Work in syntactic analysis has identified aspects of language proficiency,[26] linguistic complexity[27,28] and other markers of literacy. Each of these areas are key components in the practices of academic health discourse, for health professions and the populations to be served. The consequences of these linguistic features cannot be overstated for health literacy, inclusion and diversity, and produce a deep well of potential questions. Consider that, under the best conditions, access to HPE is highly competitive, highly skilled and highly lucky. Before one can apply to study in HPE, language proficiency has already come into play: does one have sufficient exposure to academic language use, probably in English, to write and participate in the application process? If so, does one also have the ability to produce work using the appropriate register and linguistic complexity to be recognised as *fluent* in English for Medical Purposes? Assuming they are accepted to a programme of study, speakers of non-English languages, or people who need accessibility accommodations, may experience linguistic erasure at worst, and undue burden at best.

Researchers and educators in HPE also have a reason to be interested in the words and meaning-making of language use. This leads us to the *semantics* branch of corpus linguistics, in particular, work on key words[29] and phrases.[30] Each of these subareas have unique methods for analysing language, and gleaning insights about what people are doing with their language at any given time.

In this regard, corpus linguistics as a whole owes much to the work of John M. Sinclair, an empirical lexicographer who, among other things, defined the Idiom Principle.[31] In substantiating the Idiom Principle, he showed that meaning is constructed not just in individual words, but in patterned co-selection, with different discursive purposes and effects, that are built up over time by speakers of a language, in a construct called the Extended Lexical Unit.[32] The Extended Lexical Unit (ELU) uses four parts: (1) collocation, two or more words that regularly appear together; (2) colligation, the words' parts of speech; (3) semantic preference, the associated meaning of the words in context; and (4) semantic prosody, the discourse function of the unit. Corpus linguists attend to each of these subcomponents in different ways, and with different levels of focus. What is important for those interested in corpus linguistics approaches to HPE research is that, when key words and elements of the ELU are operationalised through sustained, rigorous analysis, we can understand a great many aspects of what and how people communicate.

Returning to the types of questions that corpus linguists might answer, HPE researchers might ask: what is it like for highly educated trainees to practise with everyday people? Do they know how to find or produce adequate health literature, written in plain language accessible to their community? Are trainees' interactions discursively appropriate? Are they serving their patients in linguistically sensitive manners (e.g., considering mono- or plurilingual patients and in which language(s) or modes of communication are they comfortable and at what proficiency level). And crucially, how do instructors teach these skills?

Even with this limited number of questions, and the need to create corpora to answer them (e.g., collections of health training literature to compare to real doctor–patient interactions), it should become apparent that language and social exclusion, in the form of health literacies, are social determinants of health and that how trainees are taught about them can be directly investigated by corpus linguistic measures, and addressed. Corpus linguistics can help answer questions about what communication actually looks like in trainees' and instructors' landscapes of learning and practice, the policies and relations that make up those landscapes, and ultimately how the professions can be better taught in response.

Corpus linguistics methodology in HPE

When an investigator decides to utilise corpus linguistics, they will wittingly or unwittingly decide on one of two paths forward: corpus-based or corpus-driven. The distinction is methodologically important, because it is at this point that the research team begins to make their assumptions material. They decide what counts as data, what questions are being asked, and what sorts of observations are likely to be possible. In a sense, the weight of scientific praxis becomes tangible.

Corpus-based analysis will be recognisable to qualitative researchers in HPE. Corpus-based approaches take the assumptions of corpus linguistics, the real language in use, specific features under investigation, and in specific contexts, to build their corpus (much as a qualitative researcher determines which data to collect: whom to recruit for a study and what questions to ask them). They then use prior knowledge or criteria to query the corpus for results (much as a qualitative researcher selects a construct for analysis from prior working theory). For instance, a researcher might be interested in the verb forms used during patient consults. They begin by searching prior literature that suggests certain verbs are part of a salient pattern, and build a model or framework for analysing verbs. They might select present tense and past tense verbs, or a class of verbs, like signalling verbs (e.g., *according to*; *reported*), or metaphorical aspects of a set of verbs (e.g., *to build a case*). At this point, they are bringing what to look for, and how to look for it, to the corpus they've built. They are fitting the corpus to their model, using the corpus instrumentally to *base* their analysis on. In short, corpus-based methods are, for the most part, deductive.

Corpus-driven approaches,[29,33] on the other hand, are inductive. Rather than bringing prior questions or observations to the corpus, the linguist uses tools and measures to produce queryable data. The linguist builds their corpus in such a way that its parameters are tightly constrained, so that aspects of the communication contained can be measured and described without prior assumptions. For example, that same linguist may take a corpus-driven approach to verbs in patient consults. In this case, rather than bringing verbs or forms to look for, they use methods to let the corpus *drive* their observations and results, and the verbal constructions they analyse. They discover which verbs or forms are used, and how. In effect, they fit their model to their corpus, using the corpus as a ground to learn about how language is used.

Existing corpus linguistic studies in HPE

Corpus linguistics has been brought to bear on health topics across a number of applied purposes, including methodology (in summative content analysis in Hsieh and Shannon),[34] healthcare contexts and specialisations[35,36] and patient feedback,[37,38] to name but a few. But how has corpus linguistics been used in HPE proper? A narrow view might be that, if it hasn't been called corpus linguistics, and doesn't attend specifically to the linguistic features, it isn't corpus linguistics. A broader view, perhaps more consonant with paradigms of HPE,[39] is that corpus linguistics is being used when its methods, measures and assumptions are respectfully deployed. In the hopes of threading this needle in a haystack, we will briefly review some works in HPE (1) that specifically refer to language within their methods, and (2) where their data form a corpus.

There have been a number of studies in HPE that use corpus-based discourse analysis.[40–42] In their article, Cleland and Fahey Palma (2018)[43] began with a critical discourse analytic lens to understand widening access to medicine. The authors used the concept of 'othering', wherein people or groups are (figuratively) pushed away or made socially distant in some manner, combined with the corpus linguistics techniques of *frequency* and *concordance analysis* to find manifestations of power in discourses of widening access. The authors used quasi-corpus-driven methods here, by generating lists of high frequency words (frequency), looking at their use in context (concordance analysis), and selecting from those results for further content analysis using a primary conceptual framework. Looking at talk-in-turn interaction, Bristowe and Patrick (2012) wanted to better understand how the language used in doctor–patient interactions was affected by the presence of additional medical personnel.[41] The authors focused on doctors' responses to patient questions, patient-initiated topics and invitations to ask questions at the outset, making this corpus-based. Their results showed that, when another health professional was involved, the interactions were significantly longer, and patient-initiated topics remained unresolved. When a student was involved, fewer patient questions were answered, and there were fewer invitations for questions.

A separate track within HPE has used corpus-driven approaches as well.[44–48] These authors used tools, usually automated, to inductively learn about the language used in their corpora. Seale and colleagues used a true corpus-driven approach by carefully composing a corpus of texts produced by persons with cancer, and then utilised automatic key word analysis (Chi-squared test) to compare their subcorpora for which words were most frequent and salient.[47] They then categorised key words into groups for shared meaning or function and analysed how language use differed between genders (Male–Female in this article). This difference in language use can directly shape how clinicians are taught to talk about cancer with their patients. Zahra and Burr synthesised measures of linguistic complexity and literacy levels to analyse demographic variation in medical education assessment.[48] Their results illuminated relationships between language complexity, item scores and demographic differences. The authors' methods showed that including linguistic complexity would not be burdensome for candidate assessment practices and could be used in tandem with equality and diversity measures. Finally, Jaworska and Ryan used a quasi-corpus-driven approach by beginning with the specific word, *pain*, and then using automated collocation measures to find associated patterns of pain talk in patient narratives.[45] The authors found that women talked about pain more frequently, and with a wider vocabulary, than men. In contrast, men's descriptors for pain were emotion laden, implying a threshold of tolerance that, once breached, produced more emotive expressions. Better understanding the role of gender in pain communication, based on empirical linguistic evidence, has the potential to positively impact the way we educate health professionals through a reduction of bias when understanding patient expressions of pain, and thus the delivery of care.

Access to corpus linguistics tools

For a corpus linguist, observations of linguistic phenomena have meaning for their disciplinary nous. But for an HPE researcher, the utility is in uncovering how healthcare gets done, and by extension how those discoveries can be activated in the pedagogical project. From a practical vantage point, the tools of corpus linguistics are available to the non-expert (for introductions see e.g., Bednarek and Carr, 2020 and Wynne, 2005).[49,50] Many corpus linguistics tools, including those with graphic user interfaces (GUIs; some examples include but are not limited to AntConc[51] and WordSmith),[52] can be learned efficiently to a high level of competence. These tools align numerous, disparate spates of text, and capture behavioural data that can be 'studied at leisure' (Mauranen, 2004 cited in Stubbs).[53] Even more, basic text analysis is available to researchers right now, through the Microsoft Word program. Using the proofing tool, you can see Insight statistics about the document, such as Flesch-Kincaid Grade Level score, average words per sentence, and length of words, all of which are common but informative metrics used in corpus linguistics. Figure 15.2 gives a very recent example of the process of collecting, analysing and interpreting data using corpus linguistics.[54]

Conclusion

In this chapter, we presented two versatile traditions in linguistics that focus on purposeful language in use in context using empirical, systematic methods of investigation. Functional linguistics

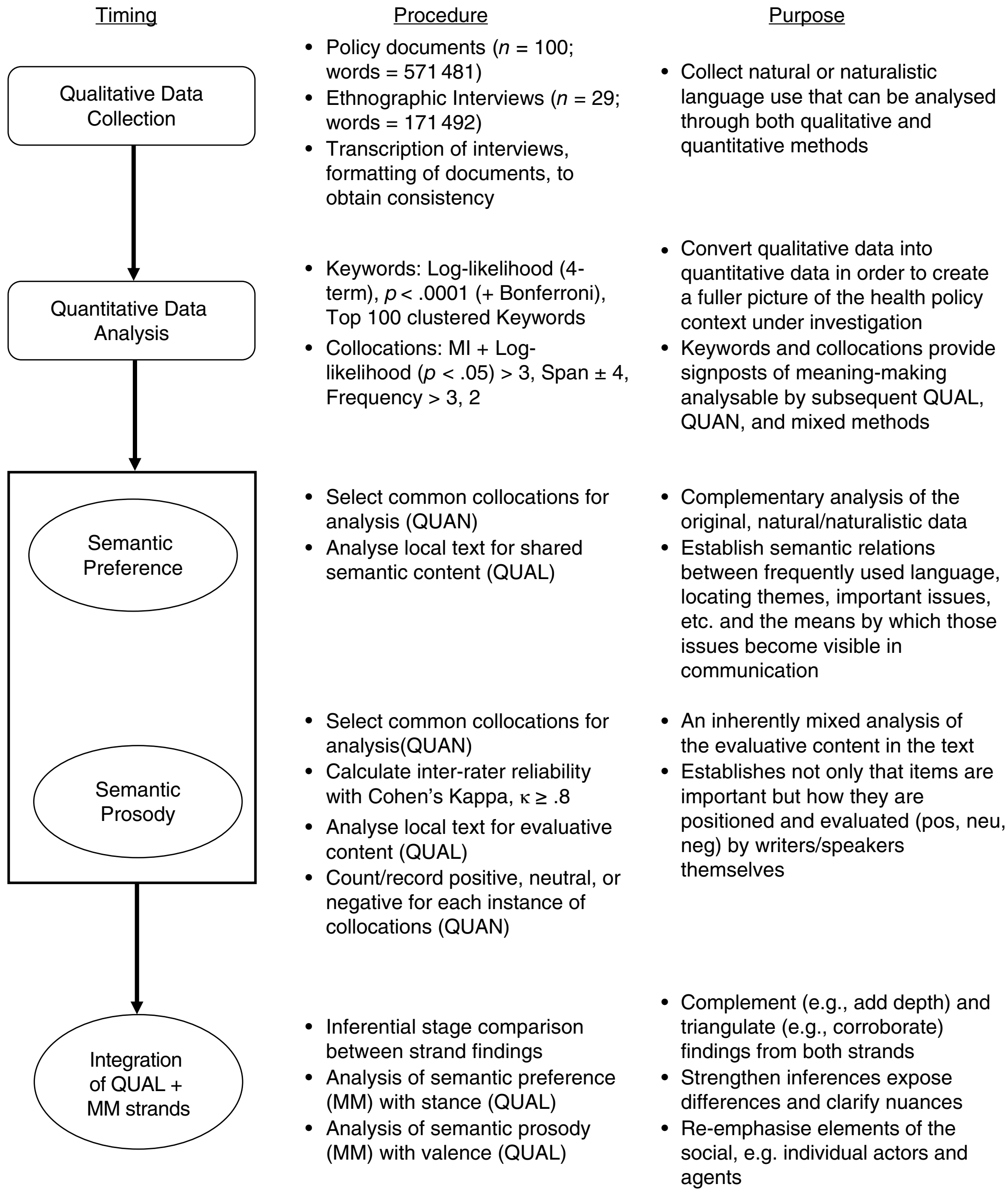

Figure 15.2 Example conversion mixed methods study using corpus linguistics from[54]/The Pennsylvania State University.

gives us tools to better understand how teachers and learners in HPE express their stances, perspectives and goals through the purposeful selection of language like process types, affect, judgement and deictic references. And in corpus linguistics, corpora of the real language of HPE learners and teachers, both talk and text, can be queried for deeply embedded patterns, using corpus-based or corpus-driven methods.

Functional and corpus linguistic methods can be accessed several ways. First, there are certainly online and in-person courses in both of these linguistic methods that can deeply enrich scholars' research practice. While this may be time consuming, study of language in this way can be rewarding. Second, HPE researchers can read some of the primary linguistics sources along with HPE publications using linguistics that we have cited in this chapter. These can be used to enhance qualitative, quantitative or mixed methods tools researchers may already be using. Forming a journal club of interested researchers can be a good way to learn about these methods together. Finally, researchers can partner with applied linguists: interdisciplinary linguistic scholars who are trained to use linguistics to address real-life problems. Many universities have applied linguists in their school of humanities or social sciences who would be interested in learning about HPE and collaborating.

However you choose to incorporate either of these sets of linguistic tools into your research approaches, they can add significant depth to your understanding of teaching and learning contexts in healthcare. From our positions as linguists, we hold that healthcare – and, hence, health professions education – is about people and the ways they manage their everyday life worlds. As a result, communication, social interaction, situated practices or, in short, culture, are attendant phenomena in their study. Thus, HPE should welcome the methods of functional and corpus linguistics and the expertise of applied linguists to help shape new ways of seeing and being in the health professions.

Practice points

- While health professions education researchers use a broad variety of linguistic *data*, there are numerous functional linguistic and corpus linguistic *methods* that they could be using to better understand these data. In fact, there is an opportunity to find more data in the data that researchers may have already collected.
- Researchers can examine teacher and learner language through three *metafunctions*: how they choose to *represent* the world, how they send out *interpersonal* signals, and how they organise the written or verbal flow of *text*.
- Language markers as simple as types of verbs (e.g., doing, saying or experiencing), appraisals of people or things (e.g., using modifiers like 'smart' or 'serious'), or identification terms (e.g., 'right' or 'this') can offer insight into health professions education contexts.
- Corpus linguistic tools and software are freely available and easy to learn, while capable of processing voluminous amounts of textual data, organising it and presenting it to the researcher for ready analysis. Health professions education researchers have access to a variety of these tools, and can begin using them immediately, such as e.g., AntConc, Wordsmith and Wmatrix2, with guides and documentation provided and basic text analysis is available through Microsoft Word.

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16 Challenging epistemological hegemonies: researching inequity and discrimination in health professions education

Saleem Razack, Andrea McKivett and Marco Antonio de Carvalho Filho

Inez Guttierez, a racialised senior clinician educator, comes to see you as director of the programme, and her mentor. She is a highly regarded educator and teaches in the professionalism components of the undergraduate programme. She relates that she is having great difficulty with how professionalism is socially constructed in the course that is taught. Students are taught about the social contract between professionals and society, in exchange for 'privileged' status. From Inez's perspective, students are too often given the message that they are the best and the brightest, and that they will go on to live uncommon lives of excellence. 'If it's one thing the COVID pandemic has taught us is how unjust healthcare is towards persons who are marginalised or discriminated against in society. I want my students to learn how thinking of yourself as a professional in this way can be part of the problem rather than a solution to it. What's so tough is that all of this is bringing up in me how it has always been a problem for me, and yet I just taught what they asked me to teach. It feels so inauthentic. Professionalism is so white!' Inez wants to understand how to bring a critical perspective to the socialisation process that students undergo in transforming from new medical students to physicians. She wants to understand issues of hidden curriculum, intersections with race and other forms of difference, and how it might be taught differently for greater social justice.

As key and powerful groupings of institutions within society (medical schools, academic teaching hospitals, prestigious research institutes and the like), the enterprise of health professions education and medicine in general can be understood as major tools through which injustices such as discriminatory practices in healthcare are perpetrated within societies.[1–3]

Within early versions of the Hippocratic Oath, there are echoes that health equity ought to be a concern of physicians. The part of the oath that states, 'Into whatever homes I go, I will enter them for the benefit of the sick, avoiding any voluntary act of impropriety or corruption, including the seduction of women or men, whether they be bond or free'[4] is often quoted as evidence of early recognition that concern for health equity is built in. This part of the oath basically states that the ethical practitioner swears to not engage in sexual acts with men or women in the homes that he visits, *even if they be slaves*. Most physicians would agree with that statement today. Perhaps what is a dynamic tension in the place health equity should hold in what it means to be a physician is this: sure, this part of the oath makes sense, but do physicians also have a duty to question the actual *institution* of slavery, i.e., the structures of society that promote the injustice in the first place? Is that part of the 'job' that should be taught to future physicians?

Health professions education has always had the power to shape minds. How diseases are called into existence, whether that be the malady of 'drapetomania'[5] (the desire of a slave to run away from his/her master) in the 1800s within American medicine, or the pathologising of homosexuality[6] (listed as a psychiatric illness in the diagnostic and statistical manual of psychiatric diseases until 1973), shows the power inherent in the curricular choices that are made, and the social responsibilities that come with curricular design in health professions education.

In most parts of the world, the institutions of medical education are also in full continuity with past injustices, in addition to engaging in current injustices. In Canada, for instance, academic institutions were active participants in past injustices in which unethical nutrition studies were approved and conducted on Indigenous peoples.[7] Institutional legacies of injustice must be owned, studied and dismantled for true inclusion of diverse learners, who will ultimately care for diverse populations, with the aspiration that this be in learning environments that promote their flourishing.

Researching Medical Education, Second Edition. Edited by Jennifer Cleland and Steven J. Durning.

In this chapter, we will seek to provide some frameworks through which research questions related to equity in health professions education (HPE) can be done rigorously and with attention to the researchers' own social positioning (how who they are as a person impacts upon the knowledge that might be produced through research) as the research is conducted.

Issues of equity, social injustice, discrimination, racism and colonising practices and epistemologies are therefore important to study in medical and health professions education (see chapter by McMillan and other chapters in this book for more discussion of epistemological framing in research). It can be useful to organise the issues worthy of study within a curricular framework that includes the formal curriculum, the informal curriculum and the hidden curriculum[8] (represented in Figure 16.1).

With respect to equity in HPE in the formal curriculum, research questions that might arise would fundamentally be about the epistemology and philosophy of what is taught.[9] Are there anti-racist elements within it? Are there instances where racial hierarchies are promoted? What is the experience of diverse learners with respect to the curriculum? To give a practical example of a potential study, a comparative curricular survey of how race is presented and discussed (as a social construct or a biological one) could be undertaken of undergraduate health professions curricula in various programmes. Surveys of the impact on diverse learners could then also be undertaken.

Within the informal curriculum, research questions related to medical education as a culture come to the fore.[10] What is the learning environment like for diverse learners? Are there biases in assessment? A practical example within the informal curriculum here might be to study the impact of explicit gender-based stereotyping experienced by medical students in various rotations on later specialty choice.

Within the hidden curriculum, research questions related to institutional structures[11] become important. What are the barriers for diverse learners to participation in health professions education? How is excellence and meritocracy defined in student selection? Within the study of the hidden curriculum, a practical example might be to look at how the valuing of volunteering experiences are used in student selection processes in health professions education, and how such uses might introduce class bias to selection that need not be there.

Researcher positioning and critical reflexivity are particularly important in the work of researching equity in health professions education. The demographics of researchers show that they mostly belong to the dominant and empowered groups within societies, and non-critically reflexive research runs the risk of perpetuating harms through the non-consideration and suppression of voices of persons from structurally marginalised groups. We will also seek to demonstrate the fundamental linkage between theory and praxis, through the use of case studies within methodologic discussions. Research in medicine is fundamentally a scholarship of practice and the contextual rootedness of theory within a practice (also referred to as praxis) is of pre-eminent importance (see elsewhere in this book for examples of the use of theory within practice).

Moving from numbers to words: a plea for theory–praxis linkage

In health professions education research, we can always count things, measure their scale after manipulating variables or, through the use of statistical tools,

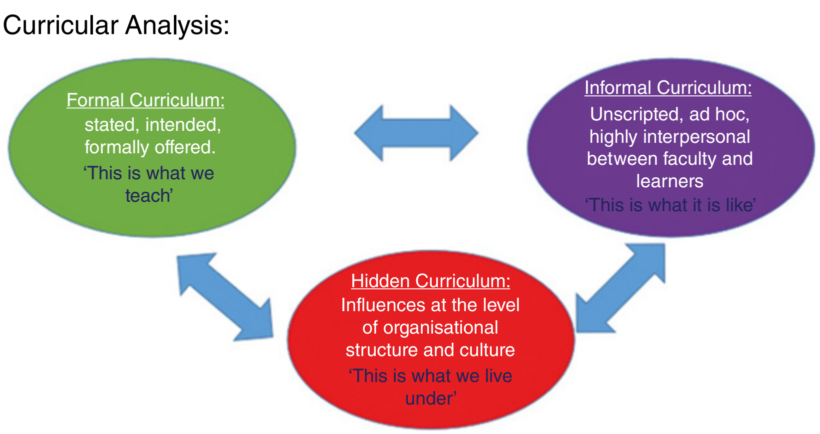

Figure 16.1 The formal curriculum, the informal curriculum and the hidden curriculum

quantify a population with respect to specific traits. The same is true of research related to equity, diversity, inclusion and anti-racist/anti-discriminatory/decolonised (EDI/A-RDC) practices in health professions education.

In the opening case ('Inez'), a racialised educator, has identified a concern for what students are learning with respect to professionalism and health inequities and how this learning is being manifest in clinical care. If we wanted to study the phenomenon through a quantitative lens, we could define and justify learning outcomes with respect to professionalism, vary the way students are taught, and measure those outcomes through tools that have gone through an accepted process for gathering validity evidence. Although difficult, a study measuring healthcare delivery and outcome differences might also be possible. In the Case 2 ('Race versus being racialised as'), we could ask a research question that makes us count the number of such incidents and interactions within a defined programme, and maybe even the magnitude of the effect of the differences on learners' experiences and wellbeing.

But would such an approach get at the heart of the problems identified in the practice of health professions education? Would we really learn about and be able to dissect the fundamental dissonance about the privilege in constructs of professionalism raised by Inez?

Similarly, while counting incidents in Case 2 would likely be helpful in understanding the magnitude of the problem, how are we to apprehend through research the fundamentally social-interactive nature of the teachers' eye rolling, and what factors allowed her the permission to do so?

Case 2 Is it 'race' or 'being racialised as . . .'?

In nephrology small-group teaching, the incidence of hypertension is discussed in an article looking at epidemiologic risk factors. The paper identifies 'Black race' as a risk factor. One student who is Black raises her hand and says, 'We have learned that race is a social construct, and as a determinant of health operates through social mechanisms. Is it not better to say "being racialised as . . . or experiencing racism as . . ." is the risk factor rather than race?' The teacher rolls her eyes and says, 'I'm not sure what you learned in that public health block, where they teach all of that "sociology stuff", but here I am teaching you "real" science and "real" epidemiology, so I think we should just use the term "race" because that is what is in this paper, that was reviewed by leading expert peers before it was published . . .'. The student is quiet and does not participate further in the small group for the rest of the session. She relates this story to her research supervisor and wants to understand how race can be taught one way in one part of the course and another way in another part of the course, and how to address the resistance of her nephrology small group teacher to the social determination of race. She also experienced the occurrence as a microaggression and wants to study how frequently other minoritised students experience microaggressions of this nature. She has ideas for an educational research project.

The answers to so many of the 'why' questions in the practice of health professions education, in particular those related to EDI/A-RDC, are firmly rooted in the interpretive social world, with its focus on symbolic representation within 'texts', meaning making and subjectivity/intersubjectivity.[12–14] When 'outcomes' are counted, measured or 'statisticised' what is being learned are observations that can at best serve as hypothesis generators for the interpretive social meanings behind the institutional practices that produced them.

A critical scholarship of practice is one in which rigorous observations (quantitative or otherwise) made within the praxis of a craft (such as medical education) are deliberately linked to theoretical underpinnings through an interpretive process of qualitative research.[15] In both cases, those of us more rooted in practice must ask 'why, why, why' at least three or four times, in order to get to the social meanings driving the quantitative observations resulting from specific institutional and individual practices. Those among us more rooted in theory are similarly required to ask 'how, how, how' for our theoretical understandings of complex phenomena such as EDI/A-RDC and how they might manifest within the varied contexts of medical education. Theory–praxis linkage is the key to EDI/A-RDC programmes of research in medical education which respond to the needs of the excluded, the under-served and the inequitably treated.

Criticality[16] is fundamentally about understanding how knowledge–power relations impact on the observable world through their ordering of social institutional practices. In the case of Inez and her observations about professionalism, we might ask what societal forces have driven the creation of current constructs of professionalism, what evidence we have that these forces have been implicated and how the constructs are manifested in curriculum and experienced by diverse learners.

Discourse, a term used in many social science disciplines, frequently refers to institutionalised ways of thinking, believing and acting that include social boundaries defining what can or cannot be said about a specific topic.[17] Critical Discourse Analysis,[18] a conceptual frame and methodology many theorists use to explain group norms, conventions and practices, aims to address social problems and how particular ways of representing and constructing complex concepts such as power, equality and diversity are historically, socially, ideologically constructed, reproduced and produced in particular contexts (see also chapters by Paton and colleagues, and Varpio and colleagues in this book for further discussion of discourse analysis). Gee[19] argues that 'Discourses create social positions (perspectives) from which people are invited (summoned) so speak, listen, act, read and write, think, feel, believe and value in certain characteristic recognisable ways combined with their own individual styles and creativity.' There are many discursive frames through which we might try to understand the knowledge power relationships within various educational phenomena (such as the teaching of professionalism or race). Many scholars in health professions education have tended to focus on the theories of Michel Foucault,[20] who sought to frame institutional power as operating through the creation of regimes of truth which constrain what can and cannot be said about a particular topic. Pierre Bourdieu's theories of capital[21] centre upon the factors that grant specific actors within a phenomenon greater or lesser agency to act. Finally, Mikhail Bakhtin's[22] theory of language centres on the notion of 'voice', viewing phenomena such as 'professionalism' as complex and multi-voiced, with some voices more powerful to the story (authoritative discourse) than others (internally persuasive discourse), through his concept of heteroglossia.[23]

Both Inez in our first case and the student in Case 2 raise profound issues about the philosophy of an educational curriculum. Inez asks if the structures that have given rise to current constructs of professionalism create learners ready to meet the challenges of highly unjust and inequitable healthcare systems. She links the privilege she sees within constructs of professionalism to whiteness. The many research questions that could be derived from these two postulates can be richly understood as a complex interplay between knowledge–power relations,[24] structure versus agency binaries[25] and multi-voiced phenomena.[26] Methods such as critical discourse analysis are rich and ripe to the task of understanding the phenomenon.

In Case 2, research questions posed through the methodology of critical discourse analysis are likely to produce very useful interpretive understandings as well. How did it come about that 'race' can be so easily essentialised in a health professions education curriculum despite many years of scientific consensus of its social construction? We can also ask questions related much more to the experience of specific actors within the phenomenon (the teacher, the learner) of the knowledge–power relations. Methodologies such as phenomenology or critical hermeneutics[27,28] can be helpful for research questions with this focus. These methods focus on the idea that experiencing the world (e.g., a teacher saying 'race' instead of 'being racialised as . . .' in a teaching session) is an interpretive act of meaning-making (we 'read' the world), which produces knowledge for future interactions.

To expand on this, phenomenology is a methodology in which how subjects construct meaning from lived experience is the focus of study. For instance, in Case 2 we might bring our attention to how non-racialised learners derive an understanding of race in the care of future patients when it is presented as primarily a biologic reality versus a social construct. Critical hermeneutics studies the process of meaning-making through the interpretation of various texts. Again, using the example of Case 2 the content of lectures in which race is discussed could be analysed critically for whether they promote a racial hierarchy as essential and immutable or as a socially determined idea. The work of Heidegger, Gadamer and Habermas[29] can be particularly useful for research questions with the focus of critical hermeneutics.

More specific to the notion of anti-racism and anti-discrimination, if we were to ask research questions more rooted in the idea that the curriculum of professionalism (our first case) or that of epidemiology (Case 2) are tools within broader systems of discrimination or oppression, critical race theory[30] and intersectionality theory[31] might then become useful.

We now discuss each of these briefly in relation to specific research questions. Critical race theory grew out of the critical legal studies movement and originally provided a framework to study structural forms of racial discrimination in legal systems. It has since been applied to education and health. As an example of its applicability in research in health professions education, the theoretical frame of critical race theory might prove useful if we were to ask how learning about race in the way it is being taught in the journal club example in Case 2 perpetuates broader systems of oppression within healthcare, perhaps through methodologies that link learning to outcomes. Intersectionality theory was originally conceptualised in feminist studies to make sense of how different systems of oppression, such as racial hierarchies, patriarchy, heteronormativity or ableism, interact with each other to create unique experiences of discrimination for persons subject to two or more forms of discrimination. For example, in case one, we might ask how constructs of professionalism are gendered and heteronormative, and how they may impact upon persons of different genders and sexualities.

We are conscious that in this section the reader has been taken on a whirlwind tour of qualitative methods from multiple theorists, as these both might prove useful to the understanding of issues of EDI/A-RDC in medical education. The goal is not to overwhelm or superficially treat each of the methodologies discussed. Rather, we want the following logic arc to be considered in the research cycle for EDI/A-RDC issues in medical education:

- Observations, often quantitative, in the observable world, lead to a noting of social inequities in medical education.
- This should lead to a questioning of the social world that orders the practices that produce the inequities within institutions, with deliberate linkage between theory and praxis.
- The methods to study the social world are rich and diverse, requiring methodological justification, critical reflexivity and rigorous interpretation in their use.
- A better praxis of EDI/AR-RDC will result if the phenomena in medical education in which EDI/AR-RDC plays a part are studied in this way.

Equity seeking versus sovereignty seeking groups: indigeneity and decolonising health professions education research

Health professions education institutions play a pivotal role in being agents of change to address the determinants of health disparities experienced by Indigenous peoples compared to non-Indigenous peoples.[32] This can be achieved through curricula, research, advocacy and leadership that acknowledge and promote the rights of Indigenous peoples to self-determination and equitable health.[32] Health professions education research plays a key role in the decolonisation of healthcare institutions as it provides the opportunity to redress colonial legacies that have negatively influenced the health and wellbeing of Indigenous peoples.[33] It also provides the platform to Indigenise medical curricula whereby Indigenous ways of knowing, doing and being can safely co-exist alongside Western knowledge paradigms of health.[34] Decolonising, in this sense, posits that the institutions of medicine were and are primary agents in the processes that have resulted in the dispossession of Indigenous people from land, resources and power in various settler societies. To decolonise a curriculum is to share curricular governance power with Indigenous people and to ensure that the perspective of Indigenous people is brought to understandings of health and illness.

Whilst health professions education research may lead to the promotion of educational praxis and transformative learning in Indigenous health, to be effective the historical positioning of research in Indigenous communities must be acknowledged and addressed within the research process.[35] By this we mean that the act of undertaking research must necessarily contain within it a deliberate approach to sharing power as knowledge is generated, given the significant past of unethical research on Indigenous populations. Many strategies are possible, but the adage ‘nothing about us, without us’ captures them well – Indigenous representation on research teams is a key approach. Appropriate research methods that challenge the colonial legacy, embody Indigenous leadership and promote meaningful participation of Indigenous peoples are required for any change to be achieved, sustained and support principles of Indigenous health equity.[35] The research must address key research domains of governance, relationships, prioritisation, methodologies, participation, capacity, analysis and findings and research dissemination.[35] These domains will be considered further within the context of a case study (Case 3) to provide insight into how health professions education research can be a platform for positive change in this space.

Case 3 Education research can be a platform for positive change

An Indigenous medical education team are revisiting the medical curriculum for fifth-year medical students as part of a curriculum renewal project. Through this process, the Indigenous health learning outcomes are updated in alignment with current graduate standards, local contextual needs and the latest evidence in Indigenous health curricula. The updated learning outcomes have a focus on health advocacy and communication skills. The team begin to consider effective and meaningful assessment approaches for students to demonstrate whether they have developed the capabilities described by the learning outcomes. A new assessment item is developed in the form of a podcast, and the health education team wish to better understand the usefulness and effectiveness of this assessment to determine student's capabilities in the complex space of Indigenous health.

This case study raises many potential research questions. These include:

- How does a health advocacy podcast assessment enable students to demonstrate complex cultural capabilities in Indigenous health?
- Does a health advocacy podcast assessment encourage and motivate students to learn and develop their critical thinking skills in Indigenous health?
- From the perspective of key stakeholders, how does the health advocacy podcast promote student learning and validate the required knowledge and capabilities in Indigenous health?

The Indigenous health team in this case study might begin by reviewing the relationships they have formed with each other, the wider medical school and local Indigenous community to provide clarity on their own research positioning and accountability mechanisms. The team might also review whether the research they are proposing is a priority within the Indigenous community. Research priorities can be sought through meaningful engagement with key stakeholders such as students, staff, local community organisations and research bodies. In short, strong Indigenous leadership and governance mechanisms within the research team can provide a structure for prioritising and privileging Indigenous worldviews and values throughout the research process.[35] In our case study, this might be critical when defining cultural capabilities, determining the assessment criteria and reviewing the implementation of Indigenous curricula that fosters student capabilities in health advocacy and communication. This is critical, as assessment in Indigenous medical education is a complex process that requires a shift towards focusing on capabilities of thinking and acting in a critically reflective and transformative way.[35]

Research that seeks to both decolonise and indigenise medical curricula requires added considerations regarding ethical approaches to knowledge creation and translation.[36] This is due to the historical context of research that has exploited vulnerable and marginalised Indigenous up to and including the point of significant harm.

Critical pedagogy – researching praxis towards social justice

Our fourth case is the adaptation of an actual situation that happened with a medical student admitted to a medical school in Brazil through affirmative policies. However, these experiences of microaggression, racism and sexism are frequent worldwide.[37] Even when the privileged who occupy leading positions look the other way, they are there, happening daily.

Case 4 Microaggression, racism and sexism

Maria is a black medical student rotating in the Emergency Department of a tertiary hospital and is taking care of Joana, a young white female who was brutalised by her husband. Joana addresses Maria assuming she was the janitor, not knowing that Maria was responsible for stitching her facial wounds. When the supervisor (Mario) arrives, he thinks that Maria is the nurse and asks for the stitching material while making derogatory comments about the whole situation ('my time is too precious to spend with such basic procedures – where is the medical student?'). The police officer (João) comes in for the second time to gather information on the assault and addresses Maria as 'doctor.' Everyone looks surprised and stays in silence. Maria thinks, 'If I were on the street, this police officer would not be calling me doctor. On the streets, I am always the delinquent.' The supervisor asks Maria if she needs any help and leaves the room. Silence.

If we dissect this situation, we will find different layers of sexism and racism, and if we are committed to social justice and inclusion, we feel the urge to take action. In most of Latin and North America, as a consequence of the non-compensated burden of slavery, low income and black race frequently come together.[38,39] This injustice is legitimated through a meritocratic discourse[40] that does not resist a more in-depth analysis. It is well known that the power structures in place tend to reproduce themselves and sustain this inequality.[41] In our case, there is social and racial tension everywhere. The patient was brutalised by her husband in a demonstration of extreme misogynism. The medical student experienced overt racism and sexism coming from the patient, the supervisor and the police officer. The supervisor neglected his role of supporting the student and fled; we do not know if out of a racist stance or unpreparedness. The result, however, from an educational perspective is that the medical student felt isolated, alone, probably experiencing strong negative emotions without being supported. Her voice is not being heard. She feels powerless.

As researchers, we can focus on different aspects of this problem. We can try to understand the experience of this student. We can explore how black female students experience medical training in this school. We can focus on students who were also admitted through this affirmative policy and explore their socialisation process. We can map the power and social dynamics that underlie the organisational structures that keep this injustice alive. We can devise a plan to change this reality. Or we can do all these steps together in the same research protocol using Participatory Action Research (PAR).

Participatory Action Research (PAR)

Participatory Action Research (PAR) is a methodology that applies qualitative and quantitative approaches in cycles of understanding, reflecting, planning and acting.[42] PAR's fundamental characteristic is that the research subjects go through an empowerment process to become researchers themselves and, ultimately, change agents.[43] Expert researchers facilitate this empowerment. This facilitation encourages participation and critical reflection on subjects' own realities, addressing the different layers of the social processes: personal, group, organisational and cultural. PAR works under a constructivist paradigm and has a deep commitment to social justice.[44,45] In different parts of the world, PAR has been used to dismantle oppressive realities, particularly in healthcare and education.

Supporting subjects to become agents of change demands active listening of their realities, stepping back from the power position generated by 'knowing'. Facilitators need cultural humility – 'a process of openness, self-awareness, being egoless, and incorporating self-reflection and critique after willingly interacting with diverse individuals'[45] – and compassion to connect to the subjects, comprehend their context and learn from them. Subjects who are used to experiencing the 'power over' them need to develop the 'power to' change their reality.[43,46] This 'power to' becomes 'power with' when the subjects who share the same experience of injustice come together to reflect and act as an articulated and politically active group. However, this empowerment is only complete when subjects develop the 'power within', which is related to acquiring self-confidence and self-awareness associated with a historical comprehension of the political, social and economic forces that act upon them and need to change in order to achieve social justice. This empowerment is only possible when facilitators manage to engage subjects in the process.

Considering the steps of PAR, subjects participate in the design of the research protocol, data collection, data analysis, intervention planning, implementation and evaluation of the process. There are different levels of participation. The most superficial form of participation is called 'nominal participation', in which participants are used to legitimate the process without having their voices heard. In 'Instrumental Participation', participants use their skills and capabilities to work on the project decided by the people in positions of power. In 'Representative Participation', participants engage in the decision-making process and take an active role in implementing change. When running a PAR project, the research group aims to achieve 'Transformative Participation',[43] meaning that participants engage with and act upon and transform the structural, social, economic and political forces responsible for their marginalisation and oppression.

PAR commitment to social justice and change is deeply rooted in the movement/theoretical framework called Critical Pedagogy. This is discussed further in Box 16.1.

BOX 16.1 Critical pedagogy

Since the publication of the influential book *The Pedagogy of the Oppressed*,[43,47] the ideas of the Brazilian educator Paulo Freire have influenced the educational, political and academic arenas surrounding education. Often it is challenging to position Critical Pedagogy – for some, it is an educational movement; for others, it is a theoretical framework.[48] This ambiguity is not a surprise since, according to Critical Pedagogy, reflection and action should come hand-in-hand as a praxis to transform the reality of oppressed individuals.

Freire considered education as a process born from the learner's reality that targets the development of full citizenship, emancipation and social justice.[49] He called this process 'liberation' and stressed the importance of addressing and fighting to change the structural constraints that society imposes on its members who are lagging behind. In this scenario, the teacher is a facilitator who supports students' transformation through making the learning experience a democratic and horizontal dialogue. This horizontality does not decrease teachers' responsibilities; indeed, teachers' responsibility increases since transferring knowledge are no longer central in the educational process. Teachers need to become facilitators to support students in their processes of co-constructing knowledge and becoming change agents ready to act upon their realities. Once 'liberated', teachers and students work side by side to transform the oppressive realities they are living in. The liberation process is also a political endeavour because it explicitly chooses solidarity and compassion as core values of being human.

Reaching liberation occurs through the development of a critical consciousness, a process Freire called 'conscientização'[43,49] ('conscientisation' would be the neologism in English). This process starts with learners understanding their context, in its cultural, historical, political and economic dimensions, to the point of identifying the oppressive forces that are limiting their development. Oppression, in this context, is defined as any force internal or external to individuals that are functioning as barriers to their development into full citizens, i.e., people who are free to think and act autonomously. As learners become autonomous beings, they naturally experience a drive to act upon their reality targeting social justice. Simultaneously, the 'liberated' learner feels the urge to take responsibility for facilitating fellow learners' 'liberation' processes.

In his later work, Freire recognised that critical pedagogy had become a predominantly cognitive process and reformulated his theory to incorporate the importance of emotions. Freire dared to register and celebrate the transformative power of love and hope to connect people, particularly when mobilised to change society's oppressive structures.

Back to the case

The racism and sexism experienced by the student offer momentum to start a PAR protocol. Maria could reflect on her experience under the guidance of a facilitator and, later, invite her colleagues with a similar race and social background to join the process. The group could reflect upon concepts such as racism, sexism and colonialism and identify the power structures that sustain and ground these practices. Students and facilitators could think of strategies at the personal, group and organisational levels that could be enacted to change their realities. Techniques adapted from participatory theatre (Boal's Forum Theatre, for instance) could help students rehearse different responses to micro aggressions to empower them to fight for their dignity in the following situations.[50] Students could conduct focus group interviews with teachers to understand why they do not respond to these micro aggressions and sustain racist stances. After understanding the standpoint of teachers, students could devise faculty development activities to nurture anti-racist behaviours in supervisors. Mobilised, students could occupy the political spaces of the university to discuss the need to have a diverse body of clinicians and supervisors. All those steps should be accompanied by a continuous process of reflection in, on and for action,[51] with qualitative evaluations and quantitative measurements to guide the consecutive intervention cycles.

Critical reflexivity and inclusive anti-racist research in health professions education

As we have demonstrated through the case studies, education researchers have the privilege to ask questions and seek new understandings about topics and problems important to their craft. The lens we bring to our research is closely dependent on the ontological, epistemological and axiological positioning we hold as educational researchers[52] (see also chapter by McMillan in this book). The ability to bring forth and critique our own positioning, worldviews and values is a key component of becoming a critical reflexive researcher. Such interrogation of our own position can lead to a better awareness of the limitations that exist in our approach to knowing and a sense of appreciation for the diverse social realities that exist in our global society.[53]

The continual interrogation of how researchers come to know can lead to an examination of the underlying power structures that influence our research positioning and the research topic of focus.[54] This can bring conscious attention to the assumptions and practices that might have previously been taken for granted, challenging dominant knowledge discourses and the influence they can have on research practices.[54] When a critically reflexive HPE researcher begins to formulate a research question, they might ask themselves the following: how do I assess the legitimacy of knowledge in this field? What assumptions and preconceived notions might I hold? What other perspectives and knowledge systems can offer insights to this topic, and how do I respectfully work with them? What values do I have about this topic and how might they be different to other key stakeholders? Who seeks to benefit from the maintenance of the status quo?

Critical reflexivity can be an uncomfortable process. It might prompt an uncovering of our privileges and perspectives, and an unlearning of biases that might contribute to the maintenance of health inequities through structural imbalances of power. However uncomfortable, becoming critically reflexive is necessary and important work for HPE researchers to undertake, as it can positively impact entrenched health equities through social change and empowerment.

Transformational methodologies for greater social justice in medical education

Achieving social justice is at the core of healthcare practice and HPE needs to embrace it as an educational outcome. In this chapter, the authors illustrated how different problems connected to social inequality, racism and discrimination, in the context of medical education and practice, may be the starting point for high-quality research. However, research practices committed to social justice need to go beyond developing and advancing knowledge to enact change and promote transformation. Transformative research realises that knowledge generation should serve societal change towards justice, democracy, inclusion and sustainability.

Transformation happens in different layers, all relevant to achieving social justice. At the individual level, research practices committed to social justice need to facilitate the liberation of individuals, empowering them to become the protagonists of their own lives. The researchers also have an opportunity to abandon colonial stances and embrace different academic and cultural traditions, adopting cultural humility as a process to decipher and amplify what is understood as the reality or the truth. At the group level, such practices need to create conditions for marginalised groups to speak and lift up their social status. In this context, research is both an academic and political enterprise. At the organisational level, these research practices should light up and nurture a reformation process that targets power sharing, culminating in inclusion, increased sustainability and democracy. Finally, at the societal level, social just research practices need to contribute to decrease inequality and disparity in healthcare practice and education.[50,55]

Conclusion

Health professions education is a socialisation process into a privileged collectivity with a common goal of members who are competent. Equity research in health professions education ought to be centred on research questions and methodologies that create a strong interpretive understanding of how this process can be made better for greater social justice. If, in essence, a curriculum is a series of conversations between teachers and learners, learners and each other, and the profession and society, then who is at the table matters greatly in what is learned, as well as how it is learned, and how open everyone's eyes are to the structures under which they are learning, which have simultaneously created ways of seeing the world, but also of not seeing it.

Practice points

- In this chapter, our goal has been to argue for the following practice points for research in medical and health professions education related to equity, diversity, inclusion and anti-racism.
- Rigour depends upon:
  - Clear and justified alignment of research questions with appropriate methodologies. Quantitative methods provide observations of inequities, but will rarely help in the understanding of the mechanisms behind the inequities, which are likely to be firmly rooted in the social world and only amenable to study through qualitative methods.
  - Specific attention to ways of knowing and methodologies that privilege the voices of the structurally marginalised. Addressing and mitigating power imbalances is fundamental to this type of research.
  - Critical consciousness and critical reflexivity development within researchers conducting research in equity in health professions education. Without the recognition that researcher social positioning is often privileged, then the knowledge generated runs the risk of promoting inequities rather than tackling them.
- Research in equity in education is fundamentally transformative in purpose. It is about creating a more just professional education for better ultimate care for diverse populations.

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17 Educational neuroscience: current status and future opportunities

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Recently, two of our neuropsychology students were discussing which topic they should chose for their master's thesis. Both were contemplating on having trouble preparing for class in their theoretical courses, since the amount of literature they needed to read was overwhelming, in their opinion at least. They wondered if they could come up with a thesis project that provides evidence of faculty pressuring students too much. The students decided that using a form of neuroimaging needed to be a part of their thesis and Prof. Cortex asked them why. Well, that was because everybody uses those methods and they had overheard that merely looking at behavioural outcomes is outdated. According to the students, knowledge about the brain gives you power. But 'how so?', Prof. Cortex asked them. They had no clue. The professor told them about this relatively young research field, educational neuroscience, and they decided to look into this further.

Educational neuroscience is the relatively novel multi- and interdisciplinary research field that combines various traditional disciplines, such as (developmental) cognitive neuroscience, educational psychology, cognitive science and computer science to name a few. It explores the brain–behaviour relationship and in turn tries to link these relationships to developments in educational practice. By doing so, educational neuroscience aims to learn more about the brain's role in processes that are relevant for education, like reading, memory or reasoning. Additionally, it examines how education may even alter the brain.[1] Over the last two decades, numerous studies have emerged that contribute to this field. While certainly initiating interdisciplinary collaboration between the 'old' disciplines may help guide educational practice, and while trying to speak a common language so that particularly health professions educators may make more sense of neuroscientific data will be of help, the application of neuroscience in educational settings is what should be the main focus of such research.[2]

This chapter will introduce a number of methods that are common in educational neuroscience (see also Table 17.1 at the end of this chapter), after which examples are given on how these may be applied in health professions education. Non-invasive neuroimaging techniques are available that provide information on how the brain responds to certain stimuli or situations. Among two prominent neuroimaging techniques for educational neuroscience are (functional) magnetic resonance imaging and electroencephalography, the latter also includes associated event-related potentials. Another field is that of computational neuroscience, in which computer models are used to learn more about education. This field could be seen as being at the intersection between education and neuroscience, using neuroscientific data to obtain a better understanding of learning behaviour.

A number of examples that may particularly be relevant for students or educators in the health professions are discussed throughout the chapter. In the final section, we will dive into how educational neuroscience might contribute to medical education now and in the future.

Research methods in educational neuroscience

Neuroimaging: (functional) magnetic resonance imaging

Imagine a water molecule (H_2O). It consists of one oxygen ion (O) and two hydrogen ions (H). The hydrogen ions carry a positive charge, which means that water is electrically charged. This is exactly the property we use in magnetic resonance imaging (MRI). Now imagine that the water molecule is not alone but lives together with billions of other water molecules in the brain. Next, this brain is put into a strong magnet, the MRI machine. All water

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molecules will be magnetised by the strong magnet because of their positive charge. Subsequently, the machine sends out a radio signal. The water molecules respond by resonating, thus taking up those radio waves, and arranging themselves in relation to this radio field. In other words, they align such that all are 'looking' into the same direction. Once the radio signal stops, the water molecules go back to their original orientation. This return in orientation can be measured and constitutes the MRI signal. The MRI signal is sensitive to different types of tissue. Some tissues contain much water and might get back into their original orientation at another pace than tissue that contains only little water. This way, one can visualise the structures of the brain, such as white and grey matter or cerebrospinal fluid. The MRI, therefore, produces a so-called structural scan, revealing the anatomy of the brain.

The anatomical view of the brain could be relevant in studies that compare the anatomy of different people and find out that certain brain structures differ in size. This may tell somebody that a particular brain region is relevant for some type of behaviour or cognition. However, how does one translate this into educational settings? For example, take the famous London taxi driver studies. Maguire and colleagues[3] compared structural images of experienced London taxi drivers, who had knowledge of thousands of places and routes in the city, to those of controls who do not drive taxis. The posterior hippocampus was significantly larger in the taxi drivers than in the controls. This suggests that the hippocampus plays a role in spatial memory. Moreover, this part of the brain seems to be able to expand throughout the life span if needed.[3] Although this result in itself is highly interesting for memory researchers, it has not led to any changes in how we teach, e.g., topography, in class. However, understanding the consequences of differences in brain structures of, for example, learners with dyslexia or autism, might tell us in the future how to optimise learning and school environments to fit better with individual learners' needs.

Functional magnetic resonance imaging (fMRI) might be more relevant for educational sciences. In fMRI, a method somewhat similar to MRI is used. Now blood flow in the brain is the major player. This time, imagine brain region X having to perform activity Y. This process uses sugar and oxygen, which is provided by the vascular system. Among others, the blood transports oxygen-rich hemoglobin to region X. Next, region X performs the activity and the available oxygen is reduced. This causes the hemoglobin to lose its oxygen. In turn, the magnetic properties of the hemoglobin are changed. It is this difference between oxygen-rich and oxygen-poor hemoglobin that is picked up by the scanner. The visualisation one makes of this activity is called the Blood Oxygenation Level Dependent effect, or BOLD response. In sum, what we measure with fMRI is the amount of blood flow and oxygen available in certain brain areas. The more active a region is, the more blood flow and the more oxygen being used. This will lead to an increase in BOLD response, which is seen as a proxy of neuronal activity responsible for actions like thinking or memorising (see[4], for more detailed information).

Suzuki and colleagues[5] reported an experiment in which participants studied a number of four-scene comic strips outside the MRI scanner. During a later scanning session, participants saw three types of strips. Some were new and they had to reason which scene would logically be the last one. The second type had been presented before and participants simply needed to recognise the final scene. For the final type, previously only three out of four scenes had been presented and it was now the participant's task to reason which one would logically follow last. They found that the left ventral prefrontal cortex was active during the reasoning, the right medial temporal lobe during memory retrieval, and the left dorsal and right ventral prefrontal cortex when reasoning and memory retrieval were combined. This shows that when linking reasoning and memory, particular brain regions are active. Suzuki and co-workers[5] concluded that these regions probably manipulate the information being processed, monitoring whether the memory is applied appropriately.

Another interesting education-related topic that is examined through fMRI research is the so-called mirror neuron system of the brain. Such a system consists of a group of neurons in the motor and frontal areas of the brain that mirror the actions of others. That is, these neurons fire when they perform an action, but also when they observe others doing the same action. Kok and colleagues[6] examined to which extent this system was activated while surgical novices, intermediates and experts observed videos of surgical procedures. The hypothesis was that the mirror neurons would respond more strongly in surgical experts compared to non-experts. They were unable to find evidence that the mirror neuron system of experts responded differently compared to the other two groups, although the intermediate group showed more activation than the novice group. A potential non-linear relationship between expertise level and mirror neuron system activation was suggested. Given that observational learning is a highly effective method for learning surgical skills,[7] this type of research may in the future lead to insights as to how observational learning changes the functioning of the brain.

As for the reliability and validity evidence for fMRI, it is important to note that the BOLD response is an indirect measure of brain activity.[4] We do not measure the neurons firing at a particular point in time, but only see that the region needs more blood and oxygen, because it is activated. This could lead to interpretation problems compared to the more direct measures presented below. In addition, the transient changes observed with fMRI occur over a period of seconds, which means that we detect a change in brain activity rather slowly. However, the spatial precision of fMRI, so knowing exactly where activity is taking place in the brain, is excellent. This ultimately means that fMRI research in the field of educational neuroscience leads to knowledge about which brain areas are involved in which type of learning. If and how such knowledge can truly be translated into educational settings, is only partly known, though (see also[8]).

Neuroimaging: electroencephalography and event-related potentials

One method with excellent temporal precision, yet less optimal spatial resolution, is electroencephalography (EEG) with its related event-related potentials (ERP). An EEG is a recording of signals sent out by the output region of a neuron, the so-called post-synapse. Timing is optimal, as we can detect changes in the range of milliseconds. EEG is nowadays also portable and thus it can be measured in almost any natural learning environment. For an example of how EEG is used to collect data in museum and festival settings, see[9].

EEG uses the fact that neurons in the brain have an electrical charge. Namely, the brain is full of positively and negatively charged ions that can move in and out of neurons through channels in the cell membranes. If a neuron is activated by another neuron, the result may be that ions move into the neuron. This automatically leads to changes in electrical charge on the outside of the neuron as well. For example, if a positively charged ion like sodium (Na^+) enters a cell, the outside of the neuron will become less positively charged, so more negative. Given that neurons often work like an orchestra, being activated in a similar manner simultaneously, there will be numerous extracellular locations that are simultaneously more negatively charged. Electrodes on the scalp surface can detect those changes. Given that the ions move in an out of neurons at a speed of a few milliseconds, the electrical charge changes all the time. This is what is visualised in the EEG.

When recording EEG, a large variety of signals can be detected. We can observe neural oscillations in different so-called frequency bands. Delta activity, the activity between 1–4 Hz, meaning 1–4 waves per second, is the slowest frequency and most prominent when somebody rests or sleeps. Theta activity, the signal between 4–7 Hz, is related to various cognitive processes amongst which are attention and working memory.[10] The frequency between 8–13 Hz is called alpha and can in humans best be detected if somebody rests and closes their eyes. Beta oscillations have a frequency between 13–30 Hz, whereas gamma oscillations represent the activity between 30–80 Hz. The latter two have often been linked to cognitive processes.[10]

Frequency bands can be studied in relation to learning as well. Pi *et al*.[11] presented participants with short videos of Chinese–English word pairs and instructed participants to study these words. Simultaneously, they recorded their brain activity. When participants had to self-explain words aloud after having seen a video, more theta and alpha was seen during the video as compared to when participants passively viewed the videos. Thus, the fact that participants knew they would have to actively manipulate the words after the video increased their brain activity. The authors[11] suggested that one should pause videos and generate explanations in order to increase learning in class.

EEG, like described above, is a record of spontaneous variations in the electrical brain activity. If one presents a particular stimulus, like a sound or a picture, a direct response to that stimulus is added on top of the EEG. Let's now assume that somebody presents the same stimulus many times in a row. If the segments of EEG in response to these stimuli are averaged, the spontaneous EEG responses will be cancelled out and only the stimulus response persists. A number of positively and negatively charged components become visible, which together represent the so-called ERP (see[12], for detailed information). Regarding such components, the latency at which they occur and the size of the component matter. For instance, if the latency of a component is delayed in one situation compared to another, or if it is smaller in amplitude, this means that the processing of this stimulus is somehow impaired.

The P300 is one of the most extensively studied ERP components. It is a positive deflection occurring around 300 ms after stimulus onset and has commonly been said to reflect attention or working memory processes.[13] The P300 is attenuated and delayed in dyslexics during both listening and reading, probably because of an impairment in attention (see[14], for review). Other ERP components that may be interesting to educational neuroscience are the N400 and P600, which are related to the memory processes of familiarity and recollection, respectively.[15] However, additionally, components occurring earlier and that are less related to complex cognitive processes, but more to sensory or early attention processes,[12] may be of relevance.

ERPs can be used to measure age-related changes in the brain. Two ERP components related to detection of discrepancies between sounds were investigated in children of various ages who either did or did not receive musical training.[16] The youngest children, who were 7 years old and who were just starting music training, revealed no difference with respect to the amplitude of the so-called mismatch negativity (MMN) and the P3a components. However, the amplitudes of the MMN and P3a increased more steeply with age in the group that received musical training than in the control group. The authors concluded that accumulation of musical training in childhood might enhance discrimination of sounds and this learning is reflected already in the subconscious processes reflected by the MMN and P3a.

These two sections described a number of neuroimaging methods that might be used in educational neuroscience. fMRI on the one hand has excellent spatial properties, which means that one can detect which brain regions are involved in the performance of certain tasks. EEG and ERP measures on the other hand have excellent temporal properties, because activity can be measured in the range of milliseconds. Those two different properties, the spatial and temporal precision, should be considered when designing imaging studies that should have impact on later educational activities.

Computational neuroscience

Another important topic in educational neuroscience is that of computational modelling of learning within the context of education. The modelling produces a computer program of a simplified representation of certain behaviour or cognition, under the assumption that both computers and brains process information in a similar way.[17] Such a computer program can either be used to understand cognitive mechanisms, so the learning processes taking place, or to mimic the role of the teacher. In both situations, understanding of the learner is needed. In addition, both situations target individual differences between learners, e.g., which circumstances lead to differences in the amount of learning taking place. Ultimately, the result of computational modeling should be that we make better sense of behavioural data.[18]

Imagine a computational model. It must consist of a number of key elements in order to be functional (see[19], for detailed information). First, a system is needed that stores and manipulates the information. This is called the computational system. Second, the model contains information, which can either be the content supplied to the system or representations of information developed by the system itself. Third, the model should consist of a learning algorithm, a process the system can use to improve performance by changing the internal structure. Finally, there is a training dataset, which resembles the domain, which the model has to learn; for instance, data on an attentional process. When combining these four key elements, the computational model can confirm hypotheses on how behaviour is generated. It does so, for instance, by using a number of simple building blocks to produce complex behaviour, assuming that the brain also works in this fashion.[17]

An example of a model related to learning is that of Eliasmith and colleagues.[20] They produced a neuron model consisting of 2.5 million neurons collaborating in performing visual, motor and working memory tasks. Depending on a task identifier, the model knows which type of computation to perform, for instance storing information in working memory. For this purpose, Eliasmith *et al*. modelled a serial working memory task, in which the system should reproduce a list with numbers of any length. For instance, if the digit '2' is presented on the screen, the model first encodes the visual features of the stimulus into a firing pattern, after which this pattern activates another pattern representing that particular concept, so '2'. Next, it shows a firing pattern that builds the actual memory trace, which is located in a particular brain region, in this case the dorsolateral prefrontal cortex. If the model's task is to retrieve the list that was previously presented, by showing a '?' on the screen, another structure, the basal ganglia, reroutes the system such that the model goes into the recall state, which means that the dorsolateral prefrontal cortex simulated neurons are activated to retrieve the '2' from memory. This time, a motor command is additionally activated which can produce the answer, in this case '2'. Interestingly, this model is based on a combination of behavioural and brain data and it was the first of its sort at the time of publication.

Looking more closely into research benefitting health professions, the field of data science has provided more insight so far. Data science is closely linked to computational modelling, with the main difference being that computational modelling develops causal models and data science extracts knowledge from data by using statistical models. Stated differently, where computational modelling tries to obtain a better understanding of the learner's behaviour, for example how information is stored in long-term memory, data science tries to create predictions of that behaviour, for instance how long-term memory changes if even more information is presented.

A critical review by Tolsgaard and colleagues[21] showed that data science studies in the field of health professions education are hardly ever informed by theory and mainly focus on solutions for particular problems. Studies using this approach relate mainly to procedural learning, like the assessment of technical skills. Many such studies are based on traditional, potentially outdated knowledge, which might hamper the progress that can be made by this discipline. Therefore, it is highly important to involve more educational scientists next to the data scientists to ensure advancements in the establishment of educational theories.[21] One study aiming to advance knowledge on health professions education using a theoretical framework was that of Winkler-Schwartz and colleagues.[22] They identified surgical and operative elements chosen by a machine learning algorithm to rate participants by their expertise level in a virtual reality surgical procedure. For 90% of the 50 participants, who all performed a tumour resection task five times, the algorithm correctly predicted whether the participant was an expert, a junior or a medical student. In the future, such algorithms may be used to determine whether somebody is sufficiently skilled to independently perform surgeries.

Educational neuroscience in practice

Reading

Reading is one of the fields in which much progress was made in using neuroscientific data to inform and develop educational processes. We will only focus on one example here – dyslexia, a relatively common learning disorder that impairs the development of reading. Cognitive neuroscience has informed us not only about brain regions that respond differently in children with dyslexia compared to normally developing children,[23–25] it has also revealed how brain activation may be changed when offering children with dyslexia a remediation programme.[26,27] This latter research showed that dyslexics develop adapted reading strategies to compensate for their disability. While this research at a first glance may not seem to be relevant for health professions education, in which students expectantly have already learned to deal with their reading disability, reading impairments commonly persist into adulthood.[28] In fact, a remediation programme for adults with dyslexia has revealed brain changes similar to those seen in children.[29] Given that medical students with dyslexia often feel inadequate, helpless and hopeless when undergoing their courses,[30] guiding those students may improve their performance by enabling them to read at a speed and proficiency similar to their peers (see also[31]). One might think that behavioural effects may be sufficient to detect dyslexia, so what does the imaging work bring to the table here? Hoeft and colleagues[24] showed that a combination of behavioural and neuroimaging data could predict later reading achievement better than only the behavioural data.

Perry and colleagues[32] developed a computational model of reading acquisition to examine how core impairments due to dyslexia had an influence on learning outcomes of children. They found that individual differences in dyslexia profiles can only be simulated properly with a personalised model, so that differences in the number of neurodevelopmental disorders can be taken into account. Thus also the use of computational neuroscience may provide information relevant to experience of medical students. This information could be used by the educators to equip their students with the best educational activities possible.

Memory

The topic of learning and memory has probably received most attention in education in the last decades. Imaging studies have shown that particular brain regions are activated when performing a variety of different memory tasks. Working memory consistently elicits activity in a number of prefrontal cortex regions, depending on the type of storage material or type of paradigm used.[33] Episodic memory has its roots in the hippocampus and adjacent regions, whereas procedural learning and memory are more regulated by areas of the striatum.[34] ERP research revealed that the N400 component is related to familiarity, whereas the P600 is needed to recollect a particular memory.[15] Models like the one by Eliasmith *et al*.[20] take into account that the prefrontal cortex controls working memory, like imaging studies suggest. To what extent there is a relation between episodic memory, the memory of events, and that of semantic memory, the memory for facts, is still not entirely clear though. Fang and colleagues[35] developed a model that could explain interactions between those two systems. They suggested that during each episodic event, a semantic node is activated. The accuracy of the episodic memory depends on the quality of this semantic representation.

How may all this neuroscientific knowledge be useful for educational activities? For memory research to be useful, one should look into the way memory is used in natural learning situations. For example, there is much evidence that using certain study strategies while studying leads to optimal long-term recall and understanding. Practice testing has advantages over rereading[36] and spacing the learning is more beneficial than cramming the studying one day before an exam.[37] However, what accounts for these benefits is not entirely clear. This is where neuroscience might help. In an extensive review, van den Broek *et al*.[38] showed that performing retrieval practice activates fewer memory-related brain areas in comparison to rereading. Instead, part of the executive control region of the brain, the prefrontal cortex, is activated more. They suggested that a combination of elaboration and selection is responsible for beneficial effects of practice testing.[38] Liu and co-workers[39] compared conditions of practice testing and elaborate studying and used ERPs to determine whether elaboration causes optimal performance in such a test. They found that elaboration was predominantly guided by the N400 familiarity processes, while retrieval practice elicited the P600 recollection component. Therefore, the elaboration account as underlying mechanism for practice testing is not plausible, given that recollection is the process that optimises performance in the long-term.[40] How can these findings be translated to medical education? The imaging findings, for example, show that it is not merely the memory efficacy that should be optimised in students. Rather, executive control processes such as focusing attention, inhibition or problem-solving might need to be trained in medical students, as they may improve memorising of relevant material later on.

Clinical reasoning

Clinical reasoning is a highly important competence of medical education. In clinical reasoning, a student or trainee must observe a patient, collect information and evaluate the data in order to optimally diagnose and treat a patient. This means that a variety of processes is taking place simultaneously. It might be this complexity that explains why far less neuroscientific research has been performed in this field so far. Nevertheless, one could compare brain activity of a novice and an expert clinician and compare how diagnostic problems are solved.[41] Durning and colleagues[42] were some of the first who actually did this. While participants were examined in an fMRI scanner, the researchers showed multiple-choice questions using cardiology and rheumatology vignettes that are part of student assessment. Each question showed a clinical case, which was followed by the question of what the most likely diagnosis was. Although both novices and experts activated a common neural network consisting of prefrontal, parietal and temporal regions, the experts revealed more activity in some of the prefrontal cortex areas. The overlap in activation of a large portion of the brain may rely on the fact that the to-be-performed task was rather complex. The additional prefrontal activation most likely means that executive control functions were more optimised in the experts.

The finding by Durning *et al*.[42] corresponds to those of Suzuki and colleagues[5] who studied somewhat more simple episodic memory reasoning and also found explicit activation of prefrontal areas in that process. This means that one could infer from less complex paradigms what is likely happening during clinical reasoning, at least to some extent. In relation to this, neuroimaging studies have already been performed on thinking aloud,[43] clinical reasoning compared to mere memory recall[44] and clinical decision making.[45] EEG and ERP studies have not been performed as far as we know, although they might offer more insights into the timing of the processes when performing a clinical reasoning task. This is especially relevant for cognitive processes that are mostly implicit or too fast to be unravelled behaviourally.[8] (For an overview of all clinical reasoning imaging studies, see[46].) One question is how results from those neuroimaging studies might be translated into actual education and training?

Another question neuroimaging studies could provide insight to is when and how clinical reasoning relies on fast pattern recognition (also termed Type 1 processing) or slower deliberate reflection (also termed Type 2 processing).[47] Evidence from radiological image diagnosis studies has pinpointed the brain area that was previously linked to recognising faces (i.e., the fusiform face area (FFA)) as also involved in recognition of diseases on X-rays by expert radiologists. A recent study by Kok *et al*.[48] provided evidence that the FFA showed more

Table 17.1 Different methods, typical outcome variables and examples of outcomes from the different approaches

Method	Outcome variable	Example
Magnetic Resonance Imaging (MRI)	Anatomy of brain structures	Increased size of hippocampus after longitudinal spatial memory training[3]
Functional Magnetic Resonance Imaging (fMRI)	Changes in brain activity during task performance	More activity in prefrontal cortex in experts compared to novices during a medical reasoning task[42]
Electroencephalography (EEG)	Change in EEG frequencies in response to stimuli	Increased theta activity when self-explaining word meaning[11]
Event-related potentials (ERP)	Changes in components in response to stimuli	Increased P600 component during recollection[15]
Computational modelling	Analysis of behaviour	A neuron model performing visual, motor and memory tasks[20]
Data science	Prediction of behaviour	An algorithm determining individual level of experience in surgical skills[22]

activation for radiologists in training compared to lay people when they processed the radiographs in a fast, pattern-like, holistic mode. No difference between groups was found for the slower, deliberate, search-to-find mode. These studies show that neuroimaging research can contribute to understanding differences between experts' versus non-experts' clinical reasoning processes.

Table 17.1 summarises the different methods, typical outcome variables and examples of outcomes from the different approaches.

Conclusion

This chapter has provided insight into the methods used in educational neuroscience. In addition, we glanced into how this research field may benefit education as well, taking examples from reading, memory and clinical reasoning. However, how much has educational neuroscience truly helped improve education and training so far? The field has received its share of criticism over the last couple of years.

Methods such as EEG and fMRI could potentially be relevant for educational activities, but quite often they are not evaluated based on their effectiveness in behavioural contexts.[49] Which teacher cares, though, that a particular brain region is involved in a particular type of learning, if they may not use that information in class? Potentially, the step needed to translate findings to the educational setting is too big. It might be beneficial if neuroscientific data are first translated to meaningful concepts on a cognitive level. This may then guide the later translation to education.[50] In addition, sometimes the knowledge we gain does not exceed the knowledge already obtained from behavioural measures alone. This means that they do not progress the field and we might stick to the behavioural measures instead.[8] Computational neuroscience also might have its flaws, which should not be ignored. Models produced are sometimes arbitrary, as one could relate them to real-life evidence in many ways. In fact, one could even claim that any computational model can be made true.[17] Additionally, it is sometimes said that computational neuroscience has not progressed much.[17]

Presently but perhaps even more in the future, educational neuroscience may benefit educational practice. For instance, as shown before with dyslexia, the opportunities to understand both healthy and impaired development in a different way is highly relevant, so that we can take action for those people who need additional guidance.[49] In this respect, it must be said that EEG is sometimes more sensitive to pick up changes in activity, in this case learning, in comparison to behavioural methods because of EEG's high temporal resolution.[12] This might lead to different patterns of results when behavioural and brain measures are combined instead of only assessing behaviour. Additionally, sometimes, we cannot determine what cognitive process is used and how so at a behavioural level. For instance, if the process taking place occurs too fast, as is the case in pattern recognition during clinical reasoning,[48] especially EEG and ERP could be of potential value. Namely, they provide information about the nature of these processes in a more detailed manner. For this to work, however, the research questions being posed should be brain-based, and not (solely) behavioural.[8] Ultimately, if researchers from the different fields relevant to educational neuroscience indeed put effort into understanding each other's research questions, methods and culture when collaborating,[2] education will in the future be enriched by neuroscience.

Practice points

- Functional magnetic resonance imaging can be used to determine which brain regions are involved in which type of learning; for instance, the role of the frontal cortex in complex thinking or the hippocampus for memory. It has good spatial resolution.
- Electroencephalography and event-related potentials are particularly relevant to unravel the timing of cognitive processes in the brain; for instance, if processes occur so fast that we cannot distinguish them on a behavioural level. It has optimal temporal resolution.
- Computational neuroscience can be used to provide better insights into somebody's behaviour and to predict future behaviour in an educational setting. In this respect, it might, for example, be used to determine if somebody is sufficiently skilled in particular procedures.
- Educational neuroscience may benefit educational practice in the future if researchers put effort into understanding each other's research questions, methods and culture in a collaborative setting.

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PART III

Theory informing health professions education research

18 Sticking with messy realities: how 'thinking with complexity' can inform health professions education research

Alan Bleakley and Jennifer Cleland

Recently, one of us (AB) had a skin melanoma removed close to the ear. The General Practitioner – within the UK's National Health Service (NHS) – had referred AB to the hospital Dermatology Department for a carcinoma on the temple. In the process of checking the carcinoma, a senior Dermatology nurse spotted the more serious melanoma. AB was booked for surgical removal of the melanoma within the Dermatology Department. A standard biopsy followed the removal, as did removal of stitches at the General Practice. The biopsy, however, showed some residual cancer cells demanding a second surgical procedure with a wider perimeter of excision. This was a trickier operation, as it would invade the cartilage at the tragus of the ear, and AB was referred to a Consultant Maxillofacial-Oral surgeon.

In the consultation, this (rather brusque) surgeon said that the surgery would be carried out under general anaesthetic as a sample would be taken from a lymph node to make sure that no cancer cells had strayed. A date was made for the surgery. In the meantime, the dermatology nurse wrote to AB to say that she had talked to the surgeon recommending that taking a lymph sample was unnecessary. The operation would then be conducted under local anaesthetic. On the day, a different (extremely attentive and courteous) surgeon carried out the operation, which was successful. AB later attended for a follow up appointment. The biopsy showed no stray cells and the wound healed. The treatment was a success.

This linear narrative suggests a fairly straightforward series of connected care events with a clear beginning (diagnosis) and end (successful treatment and recovery) (with the guiding metaphor of 'the machine'). The reality, however, illustrates nonlinearity (in this case, complexity) with a number of entangled uncertainties (with the guiding metaphor of 'living systems'). First, despite a full body examination, the GP had not noticed the more serious melanoma when checking the original carcinoma, the former picked up by the nurse in a full body examination. Second, the area of incision was too conservative, questioning the validity of clinical guidelines for the individual patient. Third, the original consultation with the Maxillofacial-Oral surgeon was unsettling. He had a brusque and overly 'direct' manner, making statements rather than asking questions; and he decided on a course of treatment that the Dermatology nurse successfully challenged. The second Consultant surgeon in contrast was warm, professional and engaging. Fourth, when AB turned up for the initial surgery appointment, after three hours of waiting he was told that a theatre was not available as there was a shortage of staff. The operation was cancelled and the surgery delayed by over a month. The surgeon was hugely apologetic. But the surgery finally went ahead and was successful. In short, this was not a linear process, however complicated, but rather a non-linear complex process a web of associations, practices, artefacts and communications engaging passions as well as skills and knowledge.[1]

Part I: Introduction and deliberations

And here is the heart of the complexity illustrated in our example – *no one factor was as important as the relationships between factors*. Focusing on the number and quality of interactions, rather than on discrete linked events, brings alive Mennin's[2] definition of complexity as 'the study of the dynamics, conditions and consequences of interactions' (p. 20).

For the one small operation recounted above, four distinct medical communities of practice were involved: the General Practice, the hospital Dermatology and Maxillofacial-Oral Departments, and the Histopathology laboratory. Administrative staff maintained communications between these

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communities. AB attended nine separate appointments and received nine letters and six text messages. In all, five administrative staff, two General Practitioners, a Practice healthcare assistant, six nurses, one surgical Dermatology doctor, two Consultant Maxillofacial-Oral surgeons, two trainee surgeons, an anaesthetist, several Histopathology laboratory staff, and two hospital porters were involved in the full care cycle (a total of a minimum 25 personnel). This does not include two other patients that AB chatted with in a recovery department, and members of family and friends who acted as informal carers during this period. This is a large web of persons with a range of professional and personal attributes, also drawing on a large number of artefacts (paperwork, computers, mobile phones, surgical equipment, dressings, anaesthetics, mild pain medications, car transport, etc.), and employing a complex web of semiotics (signs and symbols) specific to professions or practice activities. Both artefacts and semiotics were key 'actors' in this social learning event demanding high levels of collaboration, such webs of activities termed 'actor networks' and 'activity systems'[2] by contemporary social learning theories that are a key part of the family of complexity models.[3]

In healthcare – and we argue health professions education – the multiple relationships and connections between people and systems, and the consequences of these, cry out for understanding. To do so requires awareness of the alternatives, as simple, complicated or complex problems, and of the core concepts of linearity and non-linearity.

Simple, complicated and complex problems/systems

Table 18.1, reproduced from Glouberman and Zimmerman,[4] illustrates the distinctions and identifies some of the characteristics of simple linear, complicated linear and complex systems.

Even though these are presented as different categories of activities, it is more accurate and useful to think of them as degrees of constraint and conditions that have particular consequences. In other words, linearity can be simple or complex, and complexity can (broadly speaking) be seen as an 'extreme' form of non-linearity where things do not always respond in the same way to the same 'input' depending on other factors, such as context. High complexity can bring you to the edge of chaos without falling into chaos, where spontaneous reorganization of a system at a higher level of complexity can occur.

Simple linear problems may require some skills or techniques, but once these are mastered, success is likely. Complicated linear problems often multiply up the number of components and potential interactions, but maintain the element of rules. For example, space travel is complicated, but achievable because the components and their potential interactions and the consequences of those interactions can be mapped. On the other hand, complex systems are made up of multiple interconnected elements, with the adaptive capacity to change such that the system as a whole learns from experience. The components in the system co-evolve through their relationships with other components. Complex systems cannot be fully understood by an analysis of their parts, as the interactions between these parts and the consequences of these interactions are often unpredictable. A complex problem, such as raising a child, has a large number of components and potential interactions between components, which are dynamic and malleable. The outcomes of these interactions are again often unpredictable, or unknown. While complex problems can include both simple and complicated subsidiary problems, they cannot be reduced to either because of their inherent non-linearity (see later).[5]

Complex systems are also likely to generate the most potential creativity – in terms of high levels of reformulation in adapting to rapidly changing environmental contexts – as high complexity at the edge of chaos (EOC).[6] In this context chaos, with reference to chaos theory,[7,8] refers to an apparent lack of order in a system that nevertheless obeys particular

Table 18.1 Simple linear, complicated linear and complex problems

Following a Recipe	Sending a Rocket to the Moon	Raising a Child
The recipe is essential. Recipes are tested to assure easy replication.	Formulae are critical and necessary. Sending one rocket increases assurance that the next will be OK.	Formulae have a limited application. Raising one child provides experience but no assurance of success with the next.
No particular expertise is required. Recipes produce standardised products. But cooking expertise increases success rate.	High levels of expertise in a variety of fields are necessary for success. Rockets are similar in critical ways.	Expertise can contribute but is neither necessary nor sufficient to assure success. Every child is unique and must be understood as an individual.
The best recipes give good results everytime. Optimistic approach to problem possible.	There is a high degree of certainty of outcome. Optimistic approach to problem possible.	Uncertainty of outcome remains. Optimistic approach to problem possible.

laws or rules. Systems exist on a spectrum ranging from equilibrium to chaos. A system in equilibrium does not have the internal dynamics to enable it to respond to its environment and will slowly (or quickly) die. The most productive state to be in is at the EOC where there is high variety and creativity, leading to new possibilities.[9] Imagine a junior doctor on her first placement in a busy hospital Accident and Emergency Department at 2 am. She faces traumatised and irascible patients, impatient colleagues, endless paperwork and fatigue. She is prescribing, inserting central lines, suturing wounds, breaking bad news, calming an injured child and working to clinical guidelines while also improvising, meeting targets and attempting to contact an orthopaedic surgeon. This is work at a high level of complexity at the edge of, but not falling into, chaos.

An example of such complexity (and spontaneous reorganising at higher levels of complexity) is given in our opening story as the seemingly unnecessary addition of a Consultant and junior anaesthetist, and a junior surgeon in the minor operation, but this expansion of the system afforded valuable teaching opportunities. In contrast, where poor care happens or administrative hiccups occur, the complex system does not expand but crystallises. This happened when the operating list was cancelled due to lack of staff.

Linear systems are not 'bad' and non-linear systems 'good'. We need predictable outcomes and certainty just as we need innovation through unpredictability. The linear is necessary in many contexts (such as feedback systems) and indeed can get very complicated without entering the territory of complexity (as noted, sending humans to the Moon). But the linear will not help us to address, for example, the perpetual problems of non-adherence to prescribed medications and unacceptably high rates of medical and surgical error. Where the system is complex, the solution has to be as complex as the problem itself. For example, command-and-control, logics-based, protocols-based, linear, hierarchical and authority-led management processes are not suitable for most healthcare situations where there is a high level of potentially open-ended decision making, necessary ambiguity concerning best practice – including a need for innovation – and a high level of emotional investment. Activities of care are then emergent properties of the interactions between key elements of a system known as 'attractors'. Typical attractors are clinical teams that have changing personnel but a typical 'shape', and patient groups with similar symptom patterns. Sometimes attractors bifurcate to form a 'strange attractor' through an innovation - such as the initial emergence of inguinal hernia repairs without mesh.

Table 18.2 summarises the main features of complex systems, introducing new terms that will be defined and contextualised as we move through this account.

Complexity and healthcare management

Complexity is probably best known in healthcare for its application to management of large organisations.[10–13] Tuffin[14] notes that in multi-factorial contexts such as managing large organisations, linear problem-solving approaches are outmoded: 'Large, multi-faceted organisations such as the NHS frequently behave as complex systems and as such may benefit from alternative management strategies, informed by complexity theory.' Management models have traditionally viewed organisations as linear machines drawing on instrumental metaphors, such as creating a jigsaw from best fit of the individual parts. Such linearity invites top-down hierarchical approaches focusing on masculinised leadership qualities and control through protocolism – a model now displaced by more collaborative and democratic, participative structures in many – but not all – contexts.[15,16]

There are occasions where linear input–output approaches work well (e.g., protocols such as administering antibiotics before surgery). However, in complex situations, such as improving operating theatre efficiency, linear approaches are inappropriate.

Tuffin[14] gives an example of how the reduction of anaesthetic drug errors within an operating theatre complex might best be achieved. Top-down, authority-led warnings or guidelines are less efficient than promoting vigilance or 'situational awareness' within theatre teams themselves, such as through briefing and debriefing.[17,18] This can also eke out 'attractor basins' around which potential error may circulate and to which teams can be sensitised. This practical example leads us neatly into Part II, in which we discuss how complexity can illustrate and shape health professions education practices.

Part II: Application

Complexity in health and health professions education research: some key, illustrative examples

Complexity is not a research method but a lens and a synthesising structure in which complexity itself is an emergent effect and not a dominant discourse or totalising perspective. Complexity approaches ask for rich 'overview' descriptions that place value upon the aesthetics of research, such as describing patterns to help understanding of the phenomenon under study. Researchers must decide

Table 18.2 The main features of complex systems, introducing new terms that will be defined and contextualised as we move through this account (drawing on Tuffin's[14] eight common features of complex systems, the first of which is that complex systems can be understood but not rationalised)

Dissipative structures	Open systems far from equilibrium that can adapt and reorganise at higher levels of complexity (evolution itself is a key example). Local interactions and self-organisation lead to system-wide adaptive change.
The butterfly effect	Or extreme sensitivity to initial effects, where small initial disturbances in a chaotic system can produce large-scale consequences, as in weather systems. A health professions education example would be the impact of duty-hours regulations in Europe and North America on training and practice, and patient care, for example, increasing the frequency of handover ('hand-off').
Emergent properties	Complex living systems exhibit behaviours and characteristics that are different from those of the individual parts or members. This phenomenon, where the whole is greater than the parts, and where there is a continuous feedback loop (e.g., people shape the organisation and the organisation shapes the people), is called 'emergence'. Rather than being planned or controlled, components in the system interact semi-autonomously , apparently unpredictable, ways. Under particular circumstances and conditions, new patterns emerge, which inform the components within the system and the behaviour of the system itself. Adaptation of dynamic, complex systems to changing contexts is thus not simply functional but creative .
Nested and interacting systems and fuzzy boundaries	Systems are located within other systems (a ward is nested within a hospital, a hospital within a healthcare provider, a provider within a political and social system) and interact with other systems. For example, when we study a team as the unit of analysis, the boundaries of the team and the nature of interactions with other elements in the total process of patient care are fuzzy. At the same time, it is the fuzzy boundary which forms the container that holds the elements together so that they can interact and exchange energy to form new emergent structures. Complexity theory itself is nested in a group of approaches treating interacting phenomena as 'systems'.[7]
Attractors	Chaotic systems show trajectories that distinguish them from mere 'noise' or 'randomness'. Despite the lack of detailed predictability in complex systems, there are often general patterns, or 'attractors', that allow one to make useful statements about the behaviour of the system under the given conditions. An example of an attractor that is variably stable would be an effective team that knows how to work together and can be adaptive to varying conditions (e.g., absence of a member, a change of operating theatre) and still remain effective.
Autopoeisis	Autopoetic structures, such as the human body, have feedback mechanisms that allow for self-regulation, but because they are open systems, they are prone to dissipation – e.g., illness – that eventually overcomes self-regulation.
Ecology rather than ego-logy	The logic of the ego is assimilative self-satisfaction against the grain of circumstance or context, such as singular greed in the face of widespread poverty; the logic of ecology is to accommodate to contextual patterns, such as democratic collaboration and establishing equity and equality.
Fractal variation	At different levels of analysis, complex systems display a striking degree of self-similarity (for example, heart rate variability).
Connectivity	Each part of a complex system responds to and influences all other parts (for example, synchronisation in the human nervous system; murmurations of starlings).

on appropriate methods and methodologies within the overall structure of a complexity approach.

Given the aim of complexity studies is clarification and tolerance of ambiguity rather than reductionism, appreciation and understanding rather than complete explanation, imagination rather than the prosaic, researchers must draw on complex metaphoric language to give rich insight.[19] Researchers and readers must come to terms with, and savour, the representation of complexity issues through use of metaphors ('strange attractors'), images ('butterfly effect') and tangled notions ('edge of chaos') – in contrast to reductions to linear or simplified explanations ('core concepts', 'key factors', 'competences'). While complexity models were born in science that can be reductive and instrumental, their appreciation requires an aesthetic and poetic imagination.[20]

We briefly present four differing examples of complexity research.

Representing complexity well

Lingard and colleagues[21] describe a model piece of clinical education research in which they aim to 'represent complexity well' (p. 869) in respect to interprofessional clinical practice and education. The rationale for the project was that complex clinical settings are often researched in a piecemeal (linear) fashion that misses the richness of relationships between elements, concentrating rather on elements themselves. Using collaborative practice on a distributed, solid organ transplant team as a model, the research employed a binding perspective of complexity theory, a methodology or 'theoretical lens' of activity theory, and embedded methods of ethnographic observation and interviews with key practitioners.

A major finding was that the core transplant team's collaboration with other services, such as pathology, radiology and cardiology, was not linear and predictable, and often problematic. Further, teams did not necessarily share a 'unifying objective' of patient care, but work was formed and patterned dynamically through multiple and contested objectives. 'Everyday' collaborative work then remained intricate and not readily explained through linear input–output models.

PBL as a complex issue

Problem-based learning (PBL) was developed in a Western/Northern European cultural context that values self-direction or autonomy and facilitated (non-directive) learning rather than closely directed pedagogies. Such methods may not translate readily across cultures.[22]

To explore this, instead of asking 'does PBL work in different cultural contexts?' (a linear question with prior assumptions that PBL is a universal method to be applied uncritically), Frambach and colleagues[23] studied how PBL had been applied in three undergraduate medical schools located in three continents, asking 'how might PBL be adapted to work in differing cultural contexts?' (a complex, open-ended question with multiple possibilities). The first level of research, and the most deeply nested, was data collection *methods*. The researchers triangulated ethnography and interviews within a comparative case study framework. The informing *methodology* was activity theory, part of the portfolio of sociocultural learning theories. The encompassing *metaperspective* was thinking with complexity. These research processes are interdependent and arise among one another, rather than being arranged hierarchically or in a linear sequence. Complexity is not the sum of the other research processes but an emergent property of their multiple interactions.

The authors reported contradictions in terms of adopting 'purer' forms of PBL, transformations of rules according to local context, and differences in division of labour across the three medical schools. Externalisation factors that challenged 'pure' PBL included cultural issues, such as how a 'group' is conceived, not losing face with peers, respecting hierarchy and tradition, coping with uncertainty, and integrating achievement and competition. Internalisation factors included variations in forms of self-directed learning, and types of discussion and communication skills. In complexity theory, contradictions are seen as opportunities rather than threats.

Complexity in interprofessional learning and medical school evaluations

Jorm and colleagues[24,25] modelled how health professions education research can enact complexity theory, creatively advertising how we 'do' complexity. They designed cases, format and assessment tasks within a complexity framework with the aim of enabling students to achieve complex interprofessional learning outcomes relevant to future practice. They set expansive 'learning outcomes' rather than specific objectives, including the expectation to integrate and prioritise key contributions from different health professions into a patient management plan. The authors made 'emergence' from complex activities the keystone of their study, requiring students to collaboratively produce a video presentation of a case management plan. Students described emergent negotiation, collaboration and creation of new collective knowledge as key outcomes of the exercise involving self-organisation.

In a later study, Jorm and Roberts[25] re-imagined medical school evaluation – leaping from an input–output, closed linear model, where fine-tuning of individual components is the norm – to a holistic grasp of a dynamic, complex, open system with emergent properties. They used the organic metaphor of the medical school as a neuron situated within a complex neural network to enable medical educators to re-frame the way they think about programme evaluation. Here, interacting systems components within the network include: the health system, evidence-based care, social accountability, research, political oversight of health systems, the university and medical school institution, educational and curriculum design, teachers and students. They posited that the biggest challenge for medical school evaluation is how to include the communities the medical school is nested in, influences, and is influenced by, in the evaluation process. By doing so, the metaphorical 'brain', as an enactive system,[20] will create meaning.

Complexity in simulation-based education

Fenwick and Dahlgren[26] looked at research on simulation-based education (SBE) to show widespread lack of theory driven research, in particular use of complexity as framework. Simulation is largely seen as pragmatic, requiring a 'works' or 'doesn't work' either/or mindset common to closed linear systems. Drawing on contemporary social learning theories (Activity Theory and Actor-Network Theory) that advertise thinking with complexity as 'built-in', Fenwick and Dahlgren assume that learning is embodied, relational and situated in socio-material relations (i.e., takes into consideration the roles of artefacts as key actors). A primary concern for medical educators is how to better prepare students for the unpredictable and dynamic ambiguity of professional practice. Complexity concepts of emergence, attunement, disturbance and experimentation are key to understanding how simulation-based learning can be reimagined.

This was taken up by Cleland *et al*.[27] who reconceptualised a surgical 'boot camp' through a complexity lens, exploring and clarifying the context, complexities, uncertainties and learning associated with this example of SBE. Using an ethnographic approach, they looked at how the bootcamp nested in other systems and the relationships between and within systems, and how passion as well as tolerance of ambiguity and numerous challenges ultimately resulted in associations, practices, artefacts and communications coming together, to result in bootcamp becoming embedded as part of core surgical training in Scotland.

To these approaches we can add core concepts from social learning and sociomaterial learning theories, as: contradiction (within systems), expansion (of systems), translation (across systems), innovation (in knowledge, skills and values) and co-construction (of knowledge, skills and values). We have insisted that a key factor in complexity is the inter-relationship between elements in systems and across systems (rather than the elements in their own right, the key concern of linear models). In this respect, we should mention that complexity theory has a cousin in 'ecological' models of reasoning (including clinical reasoning).[20,28] This model suggests that clinical reasoning of experts is not a logical, linear process that happens in the head as individual cognition, but is extended (to the environment), and situated (in particular contextual configurations). This kind of reasoning has become known as 'enactive', where the configuration of environmental or contextual cues 'affords' a decision, or shapes cognition. This is best modelled as a complex adaptive process in which a variety of key attractors interact (for example, doctors, patient, test artefacts such as high-tech imaging equipment, test results, pharmaceuticals, hospital staff, relatives) to form sets of 'attractor basins' shaping perceptions, cognitions, moods and intuitions. Natural historians and ethologists call this complex an umwelt (the immediate experienced world), after the work of the biologist Jakob von Uexküll.[29]

These studies and the 'bottom line' complexity concepts they illustrate are summarised in Table 18.3.

Table 18.3 Use of 'bottom line' complexity concepts

Authors	Focus of research	Complexity concepts
Jorm and Roberts[25]	Programme evaluation	nesting diversity self-organisation emergent outcomes
Jorm *et al*.[24]	Interprofessional learning (undergraduate)	emergence diversity self-organisation nested systems
Chandler *et al*.[37]	Surgical fasting	self-organisation interaction emergence system history temporality
Doll[32,33]	Pedagogy	richness relations recursion rigour
Mennin[2]	Medical education/ curriculum development	richness relations recursion rigour
Fenwick and Dahlgren[26] Cleland *et al*.[27]	Simulation-based education	emergence attunement disturbance experimentation
Engeström[15,16]	Social activities in healthcare	expansion translation
Social learning and sociomaterial learning theories		innovation co-construction contradiction
Ecological models of clinical reasoning	Cognition	attractors ecological perception umwelt affordance

Part III: Considerations

Resistance and the desire for reduction and linearity

Health professions education has to live with a major contradiction. Biomedical science – as diagnostics (largely testing) and treatment (largely prescribing) – demands reductive and mechanistic thinking. This is focused on explanations through data or information gathering and is intolerant of ambiguity. However, all other aspects of medicine (complexities of clinical work, communication, professionalism) demand high tolerance of ambiguity. Health professions education is filled with similar contradictions[20,28,30] that cry out for attention through complexity modelling. For example, medicine has to integrate linear and reductive science knowledge with complex face-to-face clinical work in which knowledge is applied but feelings and values intervene.[30] Much of the science learned in medical school is never used (but is retained in curricula).[3,22] There are more women than men both entering medical school and working in medicine, yet men dominate in senior positions clinically, in management and in medical education.[3,22,31]

Given these and many other possible examples, why has health professions education not embraced complexity thinking? We ponder two interacting challenges.

Complexity calls forth understandable resistance

In healthcare, we understand that interventions should be based on best available evidence, and it is satisfying when the application of, for example, infection control procedures lead to lowering infection rates, from the Semmelweis era to Covid-19 precautions. But this again reflects a linear, closed system, where input leads to predictable output. In complex systems, where there are many interacting factors and high levels of ambiguity and uncertainty, it is difficult to pick a complexity model off the shelf and apply it quickly and efficiently: complexity, as we might expect, is a jumble of differing models and ideas whose common factor is lack of linearity. Just as complexity models described complex scenarios, so they are complex to apply and evaluate. This is especially the case in medical education, where pedagogy, essentially a human endeavour and not a technical instrument, persists in upsetting linear planning.[28,32,33]

If there were a best linear method of educating medical students, we would have perfected it by now. Many have tried, reducing complex curricula processes to content-based syllabi; pedagogy to instruction; learning to observable competences; patients to 'problems' to be solved through problem-based learning; and assessment to 'objective', 'structured' clinical examinations, and so forth. Instrumentalism and technical solutions are sought through the inappropriate framing of medical education as a closed, linear system, where in reality such an education is complex, and process outstrips content. Whatever the level of strain it puts upon us, we must be ingenious in understanding that just as healthcare is complex, so too is health professions education.

It is as important to recognise, and attend to, defences against adopting complexity models as it is to educate in those models. In fact, the first must precede the second. If complexity is neither grasped nor seen to 'work', then it will be readily ditched as pragmatic healthcare educators return to the safety of closed, linear models rather than embrace innovation (with all its associated risks and uncertainties).[16] We might liken this to climate change denial. Addressing climate change demands that we understand its complex dynamics and grounding in collaborative action. The singular resistance of the individual is an example of burying one's head in the sand. Resistance to complexity theory in medicine in particular may be grounded in an unacknowledged ideology of individualism or autonomy as an historical habit (the lone, heroic doctor), resisting thinking in terms of metaphors such as exchanges, webs, patterns and collaborations.[3,22] Bleakley[28] sees a power or political issue at work here, where lingering hierarchies (in which patterns of medical error are grounded) are being replaced by more democratic structures and habits (grounded in patient-centredness and interprofessionalism). Inevitably, patterns of resistance arise grounded in old habits that frustrate such potential innovation.

Against such resistance to complexity, it is sufficient to know, as Trent[34] points out, that a failure to model healthcare systems on complexity has led indirectly to unacceptably high rates of medical and surgical error. Systems such as clinical teams fail to be appreciated as parts of wider healthcare systems, particularly numbers of teams interacting around a patient, such that communication breakdowns are common not just within teams (because of the insistence on maintaining hierarchies), but also across teams (failure to appreciate how systems can be built that generate both communication and adaptation rather than stifling them).[35] Trent[34] describes this in terms of how feedback is enacted:

> *All complex adaptive systems have some form of a feedback mechanism in place to ensure they can reach a level of optimisation organically . . . When feedback is ignored, the system will quickly spiral out of control and collapse: A cancerous cell ignores the feedback mechanisms that normally would trigger apoptosis. Beta cells in a diabetic person's pancreas ignore the elevated levels of blood glucose . . . when feedback is ignored, the system collapses. The cancer grows, the blood sugar rises, the patient dies . . . Health care systems have little to zero feedback mechanisms in place. When they are implemented, there is an almost immediate improvement.*

So, who will grasp the nettle of complexity and responsibility for ensuring that feedback mechanisms are developed? Cristancho, Field and Lingard[36] claim that 'complexity' 'is fast becoming a 'god term' (an untouchable invocation of something important and mysterious that is immune to critical enquiry) in medical education. However, we question this given the same authors identified only

46 papers describing the use of complexity science in medical education in the period 2000–2017. This is a drop in the ocean in comparison to, say, papers on PBL, professionalism, competence frameworks, learning by simulation, work-based learning, curriculum frameworks and so forth. After two decades, complexity theory simply hasn't got a strong foothold in health professions education. We may be wrong, but we put this down to the relative comfort and safety of linear approaches, compared with the high-risk factor in complexity.

The linear tic – a stain on the cloth of complexity

We earlier shared examples of what we regard as health professions education research which uses complexity well. However, and notwithstanding our earlier comment, while the literature on use of complexity theory in health professions education research has grown in recent years,[19,24–26,36–38] there is an ironic trend – the desire to reduce complexity to instrumental principles echoing linearity. It is like an anchor that prevents us from setting sail or ascending in the basket of the balloon. This is a widespread issue and even the best accounts of complexity seek an anchor of linearity. For example, the educationalist William Doll[32,33] persistently warns against linear restrictions to curriculum such as restrictive pre-set goals (outcomes) that in turn dictate syllabus content and assessment methods. Yet, in the same breath, he calls for a shift 'towards a curriculum *rich* in problematics, *recursive* in its nonlinear organisation, *relational* in its structure, and *rigorous* in its application' (p. 171). Similarly, Mennin[2] echoes Doll's linear summary model, borrowing his terminology, where:

> *The core process of complexity, self-organisation, requires a system that is open and far from equilibrium, with ill-defined boundaries and a large number of non-linear interactions involving short-loop feedback . . . An approach to curriculum based on self-organisation is characterised as rich, recursive, relational and rigorous and it illuminates how a curriculum can be understood as a complex adaptive system. (p. 20)*

We saw above that Jorm and Roberts[25] adopt a four key factors approach (nesting, diversity, self-organisation and emergent outcomes). Chandler and colleagues[37] move to a five core concepts approach ('self-organisation', 'interaction', 'emergence', 'system history' and 'temporality'). Fenwick and Dahlgren[26] adopt a three-factor approach to learning (as embodied, relational and situated in social–material relations), and a four factors framework of complexity (emergence, attunement, disturbance and experimentation).

But, we ask, why the formulaic reduction? Is the anchor of linearity again preventing us from setting sail or unencumbered full flight? Once one enters the field of complexity, all kinds of ambiguities, paradoxes, aporias, contradictions and disturbances arise. Trying to iron them out systematically (such as reduction to principles) is largely counterproductive, simply reinforcing that you cannot reduce an open, complex system to a closed, linear explanation without losing the complexity that identifies the system in the first place.

To research healthcare and health professions education with complexity theory, one must 'think with complexity' or have a complexity mindset that itself rationalises linearity as 'appropriate for context'. Cristancho, Field and Lingard[36] ask a pertinent question:

> *Do medical education scholars understand that there are multiple legitimate orientations to complexity science, deriving from distinct disciplinary origins, drawing on different metaphors and serving distinct purposes? If we do not understand this, a cascade of potential consequences awaits. We may assume that complexity science is singular in that there is only one way to do it. This assumption may cause us to perceive our way as the 'right' way and to disregard other approaches as illegitimate. However, this perception of illegitimacy may limit our ability to enter into productive dialogue about our complexity science-inspired research.*

In short, there are many versions of complexity and systems fit circumstances. One kind of complexity modelling may help to understand how factors interact in the development of skin cancers. Another model may be needed to help us to understand the relationships between health and inequities, and inequalities related to skin colour and ethnicity.

Here are ten pointers for reflection, to support complexity thinking:

1. Resistance to resorting to reductive, linear thinking.
2. Recognising that complexity works at all levels of organisation, from the individual to the culture and environment.
3. A taste for innovation to include risk.
4. High tolerance of ambiguity.
5. An ability to turn contradictions into opportunities.
6. Appreciating and exploiting diversity of approaches.
7. Working with the social, interpersonal and dialogical rather than privileging individualism and 'in the head' cognition.

8 Appreciating process as much as content, where spotting and exploiting emergent properties is key.
9 Recognising that a small change can have major consequences (the 'butterfly effect').
10 Recognising the importance of attractors (key processes that can temporarily stabilise systems).

Conclusion

Finally, and fittingly, as we ponder how health professions education can benefit from 'complexity thinking', we focus on pedagogy within medical education. Health professions education is complex and turbulent, and full of contradictions[20,28,30] that cry out for attention through complexity modelling. For example, medicine has to integrate linear and reductive science knowledge with complex face-to-face clinical work in which knowledge is applied but feelings and values intervene.[30] Much of the science learned in medical school is never used (but is retained in curricula).[3,22] Clinical work is typically focused on hospital settings (as cure) rather than in community settings (as prevention).[28] However, medical education is hamstrung with respect to complexity thinking in pedagogy thanks to subscription to two outmoded historical features: first, the century-old legacy of Abraham Flexner; and second, the half-century old legacy of Ralph Tyler.[22]

These educationalists both brought stark linearity to bear on education. Flexner focused on medical education and Tyler on schools. Flexner's legacy is that of the 2+2 (or 3) model: two years of science education followed by two (or three) years of clinical experience. Here, the identity and the mindset of the medical student are formed initially as a biomedical scientist. Application and clinical identity come later. Tyler's legacy is that of instrumentalism: learning is focused on behavioural, planned learning outcomes that also frame assessment according to preset criteria. Any other learning is incidental and of little concern. Such a frame brings standardisation to the curriculum. Further, learning is conceived as happening inside the learner who then displays preset knowledge and skills as an isolated individual. Collaborative learning is discouraged because it is hard to standardise outcomes.

This legacy focuses on information rather than knowledge and wisdom. It is reproductive of the culture rather than productive of innovation. Judicious use of complexity models, embracing social learning theories and sociomaterial theories, can turn the conservative 'measured curriculum' into the expansive and innovative 'transformative curriculum'. This requires high levels of tolerance of ambiguity as curricula enter territories of disequilibrium, but we should be prepared to embrace this risk to develop edgy pedagogical research.

Practice points

- When dealing with complex situations, researchers can shift focus from discrete phenomena and activities to interactions/connections between phenomena and activities.
- Complexity theory, and an understanding of its key features and core concepts, can provide a conceptual framework through which to view and understand such contexts.
- Complexity theory also informs and shapes research questions and research designs – how studies are conceived, utilised and developed, and how several methods can be productively combined.
- Complexity of context should not present an obstacle to research, but rather a challenge to meet complex situations through 'thinking complexity' in research designs.
- Working with complexity may require a radical shift in thinking and imagination for the researcher, embracing aesthetics and qualities, such as use of metaphor.

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19 Getting active: using activity theory to manage change

Jenny Johnston and Helen Reid

It's an early Monday when I start my GP surgery. Since it's 2021 in the midst of the COVID-19 pandemic, I'm wearing unfamiliar scrubs and a surgical mask. I say hello to the receptionists and go to my room, opening windows and wiping down surfaces now devoid of GP detritus: stickers, tendon hammers, ancient medication formularies. I conduct a long clinic via telephone. One patient sends in photos of a skin lesion. One is referred directly to hospital and others require face-to-face assessment in the practice, where I will see them wearing personal protective equipment. In the midst of this pandemic mêlée, our team try to maintain a fraction of our previous ways of being: I chat with the pharmacist about setting up a new clinic for hormone replacement therapy, and catch up with the practice nurse about the weekend's flu vaccine clinic. This is our new, exhausting normal, and an illustrative example of an ***activity system*** *undergoing* ***expansive learning*** *change.*

With its focus on how humans act within social, cultural and historical frameworks, activity theory (AT) is highly relevant to researching healthcare and health professions education.[1] In the literature, it is sometimes called *cultural-historical activity theory* (CHAT),[2] but we have chosen to use its shorter name in this chapter because we prefer its simplicity and sense of forward movement. AT is dynamic and can be used as a form of action research to engender change in real-life contexts. Working from a clearly outlined theoretical framework and established methods, AT researchers draw on points of tension in systems to bring people together in reflexivity and dialogue.

In this chapter, we will introduce key underpinning principles, focusing on how to recognise and interpret activity systems, and how to use an associated methodology known as Change Laboratory.[3] We draw on the vignette above (typical of both of our experiences as academic GPs working in the UK) and some of our own research and teaching to help illustrate how readers can get started.

Philosophical position

Activity theory has a relativist ontology, constructionist epistemology, and an axiology based around improving how systems serve people. In this sense, it is also a critical approach. In lay terms, this means is underpinned by assumptions that there is no objective reality or knowledge, but that these are constructed by and between people. Its criticality suggests an intention to try to improve things in the world, and its values are based around applying social justice concepts to social structures. With roots in Marxism[4] and Russian cognitive psychology,[5,6] the focus is always on how meaning is constructed by humans, through multiple *dialogues* with communities, cultures and even historical constructions of present-day meaning.[7]

Position statement

As researchers, we position ourselves as critical constructionists. We are both clinical academics and working GPs in Belfast, Northern Ireland.

Whatever your clinical or educational context, however, we offer AT as an insightful, useful and overall hopeful means of engaging with research, teaching and clinical work. Throughout this chapter, we attempt to make activity theory accessible to both novice and experienced researchers.

Theoretical concepts

We introduce here five theoretical concepts which are essential to understanding and undertaking AT research: mediated action, historicity, dialectical materialism, expansive learning and the three-generational model of AT.

Mediated action

The roots of AT lie with Russian psychologist Vygotsky's concept of *mediated action*.[5] A mediator is

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simply something used as a middle step between thinking about an action and accomplishing it. Mediators can be concrete tools (known as *artefacts*) or signs and symbols such as language (known as *semiotics*).[5]

Vygotsky focused particularly on how people learn language skills, theorising that this process is also how consciousness is developed, so that people use language to *construct* rather than *represent* conscious thought.[6] This is a really important point: we use words to learn how to think and create meaning in the world, not just to express it:

> *The relation of thought to word is not a thing but a process, a continual movement back and forth from thought to word and from word to thought. In that process, the relation of thought to word undergoes changes that themselves may be regarded as development in the functional sense. Thought is not merely expressed in words; it comes into existence through them.*[5]

This kind of internal dialogue with ourselves is enhanced by further dialogue with our teachers and mentors. Any learning relationship is *dialogic* by definition. Learners can go further and faster in developing their consciousness through engaging in a learning dyad: think parent and child, teacher and student, experienced doctor and trainee, early-career academic and mentor. It is not just the learner who benefits here, but also the teacher: dialogue goes both ways. This shared space between the learning dyad is known as the *zone of proximal development* (or *zoped* for short),[6] and represents the extra distance that a learner can travel with a mentor compared to on their own. Language mediates new thought in this space, and, reciprocally, new thought mediates new ways of using language.

Across health professions education (HPE), there is a wide variety of people engaging in learning dyads, including academics, clinical teachers, patients, families, peers, the wider healthcare team, and indeed big organisations such as regulators. The essential aspect for learning to happen is mutual engagement in dialogue. Education, like all communication, happens in the space between people and can be seen as socially constructed shared space where language is used to negotiate meaning between learner and mentor.[7] For example, the relationship between a GP trainee and trainer is intended to be highly formative and supportive, helping the trainee to slowly reach clinical independence. In learning relationships like these, not only the primary learner benefits but also the mentor and, potentially, the learning environment. An example might be of a trainee who introduces a new form of clinical management to the trainer, and then implements and evaluates it across all staff in the practice. In AT, researchers can create a new zone of proximal development by bringing different groups together in carefully chosen types of mediated action.

Historicity

Activity systems are inherently multi-voiced, and alongside the multiple players and contexts, a third type of dialogue is with accumulated sociocultural and historical 'baggage'.[8] This includes ways in which power dynamics and structural inequalities have shaped systems and people, and how old norms are perpetuated through uncritical learning relationships. As the space where learning takes place, the zoped is also key to either engendering change or maintaining the status quo at a societal level: it is in this process of learning that historically constructed social and cultural norms are passed on.[6] An example is the historical practice of wearing white coats and using stethoscopes; these artefacts are arguably less practical than scrubs and diagnostic radiology, but convey an important message about identity which until recently has been passed down the generations and carefully protected.[9]

Both as individuals and as societies, the history of how an activity has developed determines its current shape and scope. Meaning is defined experientially and dialectically by how we (individually and collectively) construct our past and future in relation to present events.[10] In examining any cultural aspect of social life, we need to consider where it has come from, where it is going and where we stand ourselves in relation. This aspect explains the sometimes-used synonym for AT we mentioned above: *cultural-historical activity theory*.[11] In Figures 19.1 and 19.2 it is relatively straightforward to see the social and cultural impacts on activity systems, playing out through any system's community and rules, but the crucial aspect of historicity is not fully represented by this 2D model. For example, consider how the rules, systems and division of labour differ between healthcare systems in the US, UK and in developing countries; each of these systems has been built on a historical context which strongly influences the state of the system today. For the US, the history of healthcare is entwined deeply with capitalism and a philosophy of 'rugged individualism';[12] for the UK, the National Health Service (NHS) was a by-product of a post-World War 2 drive towards socialised and nationalised institutions;[13] for developing countries, and sometimes for indigenous peoples in developed countries, a history of Western colonialism is deeply implicated in the healthcare structures of today.[14,15]

In taking an AT approach, it is important to remember that all social life, including social

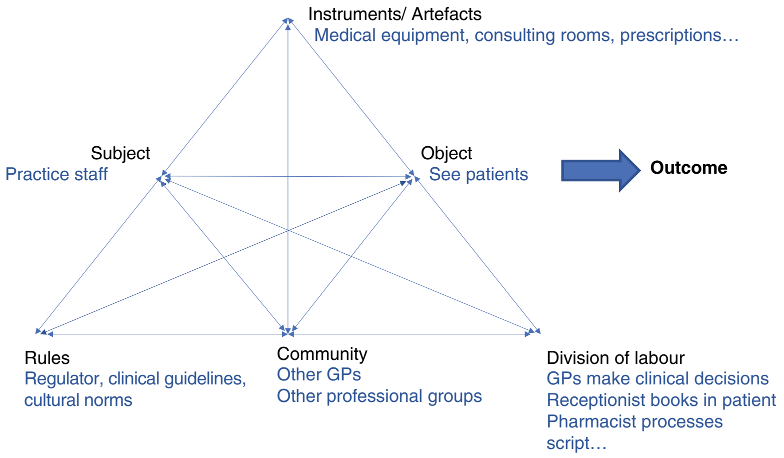

Figure 19.1 Activity system

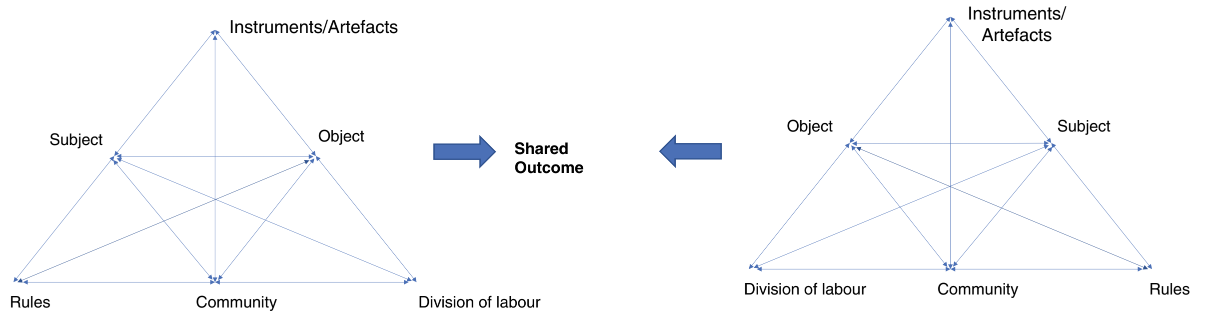

Figure 19.2 Interacting activity systems

structures and discourses of power, are built on older versions of themselves. Contradictions are not just situated in place and person but also in *time*. Any current position is a historical accumulation of dialectic tensions.[10]

As we saw earlier, learning activity within any kind of zoped may include the transfer of information regarding the taken-for-granted way of doing things. This applies not only to formal learning environments such as classrooms, but also to workplace learning in clinical or other settings. Historical roots are important in thinking about future ways of working. For example, values and demographics tend to shift over time and these shifts are likely to be reflected in a diverse workforce with diverse attitudes. The difference between our cultural position now and our cultural position some time ago is an important source of dialectic tension. Exploring this historical aspect may help to expand problematic notions or practices, and to challenge hierarchies which learners may previously have implicitly accepted. An obvious example is the increased proportion of doctors who are female and of other genders. This social progression is offset by residual tensions, such as a lower number of non-male doctors in surgical training and issues around part-time working.[16]

Dialectical materialism

This idea builds on Hegel's concept of dialectics and is central to AT's capacity for change management.[17] Despite the jargony name, the core principle behind dialectical materialism is quite straightforward: the fallout from a clash of opposites can be generative rather than destructive. Marx and Engels simply added their *materialist* philosophy, refocusing dialectics away from abstraction and towards real-life, material problems such as social inequality.[4,18] Marx saw the point of existence as engaging in collective activity (*labour*) towards human progression.[19] All social progress is achieved through dialectic clashes between different social groups. Engaging in labour (in our contexts, through healthcare or education or both) is a means of both personal and societal transformation.

Any form of labour is a mediated action, either by concrete tools or semiotics or both. It is divided up between people (the *division of labour*) and is undertaken subject to *rules* which have been constructed socially, culturally and historically.[5]

The excerpt below from *Anna Karenina* illustrates both labour as mediated activity, and Marx's materialist philosophy that humans use tools essentially to alter the natural world to their benefit:[20]

The grass was short close to the road, and Levin, who had not done any mowing for a long while, and was disconcerted by the eyes fastened upon him, cut badly for the first moment, though he swung his scythe vigorously . . . in spite of the sweat that ran in streams over his face and fell in drops down his nose, and drenched his back as though he had been soaked in water, he felt very happy.[20]

In this short and famous scene, intellectual farmer Levin engages in the unaccustomed labour of cutting the grass. His work is mediated by a scythe and defined by the rules of the community of his workers, who are watching him carefully. The labour is divided up within this community, though Levin is in charge. His aim (*object*) is to cut grass to make hay, and as he works he learns how to do it better. The last sentence, describing his physical and emotional state, is very relevant too: this is an embodied, phenomenological description of his agency and of how he is changed by his engagement with labour. In other words, it is a visceral description of how he experiences that moment in that time.

If we were to transport Levin to contemporary medical practice, specifically that of JJ, what might this scene look like from an AT perspective? A translation to her Western primary care system might mean the 'hay cutting' becomes 'issuing repeat prescriptions' (labour), the 'scythe' becomes her computer and printer (mediating tool), while the task is divided within community members (other doctors in the practice, the receptionist who process the prescriptions and the pharmacist downstairs who dispenses them). The rules come from prescribing guidelines, local government and clinical expertise. While JJ has often had a degree of repetitive strain from reissuing scripts, she has not, however, experienced the same visceral joy in this task as Levin does in his. Yet there is still room for forward movement here: a routine review of medication given, two conflicting medicines stopped, a longer prescription given for the patient's convenience. AT is dynamic, and in that it reflects the constant forward movement of human action.

Although it often seems to focus on systems, collectivism and structures, the philosophy of AT retains a lot of personal agency. Activity systems are composed of individuals, engaged in dialogue and mediated activity. The traditional structure–agency debate is very simply resolved by considering the dialogic relationship between them, and how each is changed by that relationship. An AT perspective allows space for both structure and agency.

Expansive learning

Dialectic tensions exist between all the different aspects of activity systems. Modern Finnish activity theorist Engeström calls these dialectic tensions '*contradictions*'.[21,22] By concentrating on contradictions, researchers can exploit any system's potential for change. Since change results from the fallout when conflicting social forces clash, then as researchers we can cause a deliberate clash between aspects of the activity system in order to bring about and study change. In fact, we can even clash two related activity systems together. Contradictions are the primary source of development or change in activity systems, and the process of creating something new from the dialectic is known as *expansive learning*.[3,23]

An opening for expansive learning can often be spotted where people are grumbling about conflicts, dilemmas or inefficiencies. For example, doctors working at the primary–secondary care interface often complain about how referrals are made or received, depending on their own position! Contradictions do not always lead to expansive learning transformations but, when they do, the original activity shifts its axis to encompass a new purpose (an expanded object). Engeström's work offers many examples of expansive learning in medical work contexts.[21,22,23]

Three generations of AT: origins and evolutions

In the literature, it is common to encounter references to the *three generations of AT*. This simply refers to how the concepts have evolved over time. So-called 'first-generation AT' refers to Vygotsky's mediated activity, as we described above.[4] Levin's mowing, taken apart from the other farm workers, is a straightforward example of individual mediated action.[20]

Digging as mediated action (image: LilyCantabile, Pixabay)

The 'second generation' is credited to Vygotsky's colleague Leontiev, and is really the first to describe a basic *activity system*.[24] Leontiev used his 'primeval hunt' example to illustrate the difference between individual and communal action: with the hunt as the overarching activity, jobs are divided within the community, each with a different short-term aim (e.g., the beaters frightening game for others to aim at) but a shared overall motive (bringing home food).[25] Building on Vygotsky, Leontiev began to define activity as being *object-oriented* and *artefact-mediated*. Our vignette describing our own clinical work within primary care teams is a good example of how Leontiev shifts attention from individual to collective.

With AT's roots becoming more widely known in Western academia, Engeström used the familiar triangle heuristic he created to illustrate the complex possibilities of two systems interacting with one another.[21,22] This is 'third-generation' AT. A simple example of two interacting systems might be primary healthcare interacting with secondary healthcare.

In this case, a form of interaction known as *knotworking* might be taking place: in simple terms, a temporary collaboration is formed between aspects of the two systems as they begin to work together. The 'knot' is metaphorically tied, pulled tight, loosened and retied as solutions are teased out to address the shared object, or perhaps mediate a shift to a new object. In this case, the expansive learning we described above has taken place.[26]

Figure 19.1 is an example of an activity system, and Figure 19.2 is an example of two interacting activity systems. The bidirectional arrows represent the dialogic nature of interaction and emphasise that many social voices are in dialogue with one another (multi-voicedness).[7] Between each element of the system there will be dialectic tensions (contradictions), each of which could potentially engender positive change.

Case study 1: pandemic-induced change in primary healthcare activity

At this stage, we will place these theoretical concepts within our own healthcare contexts, returning to the vignette with which we started this chapter. Neither of us were at the perceived 'coalface' of hospital medicine at the beginning of the pandemic in 2020 – working in intensive care, for example (although HR's husband was, influencing her own views and actions). We were instead at the coalface of a massive new dialectic for primary care: our old ways of knowing and doing medicine were locked in conflict with the new ones. This is a situation that we know many will recognise from their own dialectic shifts in both healthcare and education, and a great example of expansive learning happening 'in the wild'.

To begin with, let's consider how our professional surroundings as primary care doctors can be fitted into an activity system. We note that this is an important initial step in any AT-flavoured research project, but is crucially a starting point. The triangle diagrams are just a heuristic to help analysis, and not an end in themselves.

The **subject** is ourselves, primary care doctors, and the **object** is to provide patient care. The **outcome** can be defined either broadly, as achieving best possible health outcomes for patients, or broken down at a more granular level: for example, getting someone with severe COVID infection timely hospital treatment, witnessing their subsequent trauma in a way that helps them process or managing their persistent symptoms well are all potential outcomes.

The **rules** are those of the socialised public healthcare system we work in (the UK's National Health Service (NHS), free at the point of use); our professional ethical frameworks; current guidelines; pandemic adjustments, such as the use of personal protective equipment (PPE). The **division of labour** refers to how work is shared in our healthcare teams (**communities**). For example, a patient phones the GP practice and speaks to the receptionist. Their name is then placed on the GP's screen, who conducts a consultation, initially over the phone. The GP arranges blood tests in the treatment room, where the patient is seen by the practice nurse, who takes their blood using a syringe, needle and laboratory bottles (**artefacts**). The GP reviews the patient, perhaps using other instruments such as a stethoscope. The GP might issue a prescription. The receptionist organises prescriptions for collection by local pharmacies, where the patient picks up their medication.

This all takes place as a kind of complex dance and is an example of how one of many complex healthcare systems were forced to adapt to a pandemic context.[27] Mediation is visible at every interaction, through language use, nonverbal communication through signs, and physical mediators such as the telephone and computer, as well as healthcare equipment. Adjustments from pre-pandemic working patterns were sweeping – clothes, furniture, consultation style – and the way in which these changes were accommodated by the subjects and communities a key example of expansive learning. The object shifted from simply 'safe patient care' to 'safe patient care in a pandemic', with a very different set of affordances.

This is just one activity system within the massive health service, and interactions with other activity systems are often far from smooth even without a global public health crisis. For example, there is a strong historically mediated dialectic between primary and secondary care, with the former often seen as lower status.[28] This is usually far in the background in everyday working life, yet flavours subsequent interactions between the two systems. Additionally, successive UK governments have sought to defund and undermine the NHS, since its founding ideology as socialised healthcare conflicts with the prevailing climate of neoliberalism.[29,30] From an AT point of view, the rules of the system are subject to political will, and public healthcare providers (such as ourselves) have had to learn to adapt to increased interactions with private healthcare systems; yet another example of an important dialectic.

Getting practical: change laboratory

We described the changes in healthcare as a result of the COVID pandemic as an example of naturally occurring expansive learning. Engeström's Change Laboratory research approach was developed to exploit the tendency towards dialectic interactions and subsequent expansive learning within complex activity systems.[23] Although by no means the only way that AT can be applied in research, Change Laboratory is practical, change-oriented and collaborative, as well as clearly defined. These characteristics have made it popular in quality improvement projects within healthcare and other large-scale complex systems.

A Change Laboratory project brings people together to explore workplace problems either within a single system or between systems. It consists of a number of structured group exercises which are repeated in cycles (typically five to ten over several months) with the focus gradually moving from examining the current system to reifying new working models. It is essential that a clear intervention unit is defined at the beginning; this is analogous to setting a research question in that the entire intervention will flow from it. The multi-voicedness and dynamism of AT make it a great choice for investigating how people learn and adapt in workplaces, particularly within large complex systems. A key advantage over other forms of structural systems analysis is that the individual agency of participants is retained and remains strong. Change Laboratory offers a set of clear methodological steps, making it accessible to interested researchers.[2,23]

Usually recruiting no more than 20 participants, groups must represent the range of relevant stakeholders but also take account of power dynamics which might interfere with contributions. An appropriate location will allow for groups to be managed with the presence of props such as whiteboards and audiovisual equipment. These are used for mirroring techniques which explore experiences, and for imaginative framing of the future. Tasks can then be designed to move participants from the early stages towards an expansive learning outcome.[23] A successful project follows Marxist dialectic materialism in first reimagining the object of shared activity and then translating these ideas into concrete, on the ground solutions.

While it should be possible to translate a Change Laboratory approach into digital pedagogy, we are not yet aware of researchers having taken this step.

Case study 2: OSCEs as activity system

Here, we briefly describe how we have used AT concepts to critically deconstruct that staple of healthcare education, the OSCE (Objective Structured Clinical Examination) and to advance our own assessment practice through a teaching development activity.

The unit of intervention in this case is the OSCE. We have written extensively on why we find the OSCE problematic: it is hegemonic, industrialised (an example of historico-cultural influence) and at worst offers learners a dangerous simulacrum of clinical practice.[31,32,33] The cultural basis for OSCEs lies with current strong discourses of accountability, validity and reproducibility, eliding the 'messiness' of real-life healthcare practice. At a social level, its simulated patients and tightly drawn, academic-authored scripts propagate the clinical gaze and reduce 'patient' agency. While we feel OSCEs, like simulation, still have a place in learning technical and 'craft' skills, we have cautioned strongly against their extrapolation as a convenient catch-all.[21]

From an AT point of view, we can cast OSCEs as an activity system and then consider the potential for expansive learning. The **subjects** are health professional learners; the **object** is ostensibly to demonstrate safe skills, but we have argued that students perceive a more limited object of impressing examiners to pass any given station. The **outcome** follows the competency-based medicine movement, in assuming that students who pass OSCEs will go on to be safe healthcare practitioners. The **rules** are defined by the vast literature on OSCEs and by the all-encompassing role of psychometrics (consider how important Cronbach's alpha has become – it is so influential that it could almost be said to have agency itself). The **community** includes students, teachers, examiners and administrators. **Artefacts** are legion, ranging from simulation suites, to cubicle curtains, bells controlling time, stethoscopes, name badges, clipboards and checklists. The **division of labour** within a station lies between the OSCE triad of examiner, simulated patient and candidate. Beyond, there is a huge amount of hidden labour undertaken by administrators, technicians and assessment leads in order to make the OSCE happen.

Between the social, cultural and historical influences on OSCEs, and the interactions within the activity system, there are multiple contradictions which could be mined for expansive learning potential. In our 2021 activity theory paper,[34] we outline the creation of a teaching development intervention intentionally clashing different parts of the OSCE system together. In essence, we designed a complex workshop based around a number of mediated activities. This intervention drew on AT principles but did not constitute a formal Change Laboratory; this remains a potential area of exploration for interested researchers. At the end of the workshop, an expanded objective was achieved of greater and more authentic inclusion of patient and simulated patient experience in the development of OSCEs to counter the risk of dehumanising this group through checklists and scripts in which they have had no input. The 2021 Medical Teacher AT themed issue in which we report this work is replete with further contemporary examples for any interested readers.[35,36,37]

Where AT fits with other theories

Activity theory is a little unusual in becoming transdisciplinary; while Vygotsky's theory of cognitive development is still popular in social psychology, it is equally useful in education (not only HPE) and in areas such as management studies. Each of these disciplines may use the key concepts slightly differently, foregrounding particular aspects.

For ourselves, we see AT as profoundly constructionist, and find all three elements of its historico-sociocultural orientation essential. AT overlaps with other sociocultural theories which are influential in HPE, such as Lave and Wenger's situated learning (see chapter by Torre and Durning for more discussion) and Holland and Lave's social practice theory.[37,38] These also build on Vygotsky's foundational work.[5,6]

In its systems aspect, AT also shares some concerns with Bateson's cybernetics[39] and Latour's actor–network theory,[40] because these are theories which consider how humans interact with the objects around them (see chapter by Ajjawi, Bearman and MacLeod for further information). As we discussed above, however, one of the most interesting aspects of AT is that is still retains focus on human agency and social change.

If using AT in combination with other theoretical perspectives, it is absolutely essential to ensure congruence: as with any form of qualitative work, ontological and epistemological alignment are important for rigour (see chapters by Cleland, and MacMillan also). We suggest that newer researchers should not be put off using AT concepts in this way but might wish to seek some mentorship while doing so.

Strengths and limitations of AT

AT is very useful for investigating learning, because (like some other sociocultural theories) it considers individual agency and societal structures together. AT is also holistic in overcoming the dualist divide between mind and body and treating people as an integrated whole. As we saw in the excerpt of Levin mowing,[20] in AT, consciousness is embodied; without social interactions, accomplished by our physical bodies within the real world, there would be no thought and no higher consciousness.[5,6]

The potential for expansive learning in particular allows for the possibility that out of difficult situations we can generate creative responses with the power to improve the world around us. In the sense that AT is built on the human need to progress, it is a dynamic and optimistic theory.

As we outlined above, AT offers a clear theoretical framework and, while it affords potential methodological flexibility, we suggest Change Laboratory as a proven and well-documented approach which can generate useful real-life outcomes.[22,23] However, where resources or time make this unsuitable or unfeasible, the theoretical concepts can also be used as a useful 'lens' or sensitising concept, as in any form of theory-driven research. We feel that, despite the complex jargon used in much original literature, AT *can* be accessible to researchers at all levels as well as useful to on-the-ground teachers.

In terms of limitations, a common criticism is that AT lacks 'explanatory' (theory-building) power. It is all too easy to fall into the hole of using activity systems and the ubiquitous triangle diagrams as a simple heuristic for a particular situation. It is often useful to describe a particular situation using the triangles, but often this is just the first step towards a more nuanced analysis. For example, Cleland *et al.*

used activity systems analysis to explore learning in a surgical 'boot camp', finding that cultural and social work was as important to trainees as knowledge acquisition;[41] this is also a good example of an AT study which uses a non-Change Laboratory methodology. In this case, thematic analysis was used to analyse ethnographic data.

A more immediate issue for those new to AT is the density of many of the texts written on AT and overcoming the hurdle of understanding the underpinning theory. Educational researchers from a clinical background may not previously have grappled with Marx, Bakhtin and Vygotsky. We have done our best here to try and make the theory less dense and more accessible and can speak from experience that it is very rewarding to engage in dialogue with it. Below, we list some texts that readers may find helpful in getting started.

Conclusion

Activity theory research is critical, action-oriented and theoretically strong. Drawing on concepts from Vygotsky and Marx, it focuses on the interactions between people and environments while taking account of social, cultural and historical influences. It is very relevant to healthcare in its ability to use dialectic interactions as a means of engendering change. By definition, AT is multi-voiced and draws much of its strength from its democratic and multidisciplinary orientation. We encourage interested researchers to add their own experiences to this ongoing formative dialogue.

Practice points

- Human existence is a constant struggle for improvement.
- We learn and change by engaging in activity.
- Activity is mediated by physical tools (such as a stethoscope) or psychological tools (such as history taking).
- An activity system connects individuals and communities with their social and cultural context as they act in pursuit of an object.
- The clash of perspectives (contradictions) between different voices in or between activity systems can stimulate change, resulting in a new object – expansive learning.
- Expansive learning can be used in workplaces to implement action research projects, facilitating participants themselves to promote change.

Recommended reading

We suggest the following resources may offer readers an 'in' to the denser original texts:

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20 Attuning to materiality: sociomaterial research in health professions education

Rola Ajjawi, Margaret Bearman and Anna MacLeod

A group of educators are discussing an Objective Structured Clinical Examination (OSCE) station that did not go well. They are on a mission: to fix the station. What didn't work? This seems like a simple question; however, upon further consideration, the complexity of the endeavour – representing a real-life patient/clinician interaction in a way that rings 'true' – comes to light. The educators review multiple points of data: test scores; statistical performance measures; qualitative feedback from simulated patients (SPs), students and examiners. They reflect on the intent of the station, the preparation of the SPs, the instructions given to students and the checklists given to examiners. They consider the physical space in which the station was hosted and the arrangements of the various clinical tools students had at their disposal. Finally, they contemplate the time allocated for the station. As the conversation progresses, it becomes clear that the fix is not as simple as updating the instructions, revising the checklist or better preparing the SPs, because each piece is connected to the next and each change influences another element. The OSCE, like every educational encounter is, a complex web of actors: both social (learners, SPs and examiners), and material (trainers, digital scoring tools, instructions pinned to a door). Attempting to blame 'what went wrong' on one individual element is not helpful, and realistically not possible.

Health professions education and healthcare are complex endeavours. This complexity appears resistant to the reductive approaches that seek to quantify and even qualify problems, let alone finding solutions that lead to categorical improvement (see also Bleakley and Cleland in this book). Sociomaterial approaches to research seek to unpack some of this complexity. By showing the interactions and relationships that constitute day-to-day practices, researchers can overturn assumptions and offer holistic perspectives that lead to understanding how improvement might be possible or harms might be minimised. Common to this research tradition is a focus on how material things – objects, animals, machines, humans, organisations – are arranged and how these arrangements interlock with activities or social practices. Indeed, the term 'sociomaterial' reflects the idea that what people *do* cannot be disentangled from the bodies, objects and spaces that they inhabit.

Sociomaterialism is a heterogenous body of work that encompasses multiple theories and positionalities. These theoretical movements have come from different traditions such as the 'practice turn', 'new materialism' and 'post-humanism', as we explore later in this chapter. Examining all these historical traditions and movements in depth is beyond our scope (assuming a single cohesive account can ever be synthesised!); instead, here we tackle more modest aims: to elucidate the value of sociomateriality in the context of health professions education research. We do this by describing underpinning sensitivities, and 'common' approaches to sociomaterial research in medical and health professions education. We acknowledge that the referenced scholarship is situated within Western traditions and schools of thought; there is a wealth of tradition of First Nations ways of knowing and being that also recognise the fundamental entanglement of humans and materials.

Why researching matter matters

Health professions education displays a tendency to foreground people.[1] Researchers and practitioners talk of being student-centred or patient-centred; but humans 'do not exist on their own, in a vacuum. Rather, they are part of a vast and ever-evolving network of elements that includes not only people but also non-people, or things'[1] (p. 2). What differentiates sociomaterial research is that it turns a critical

Researching Medical Education, Second Edition. Edited by Jennifer Cleland and Steven J. Durning.

eye to 'things' in order to unpack complexity. By foregrounding the material arrangements, research can begin to make visible the often invisible patterns, practices, assumptions and unpredictability influencing health professions education.[2]

Orlikowski[3] refers to the ways the social and material come together in practices as 'constitutive entanglements' — 'configurations, networks, associations, mangles, assemblages. . . of humans and technologies' (p. 135). In this way, the nature of being does not concern objective truths – a person, a microscope or a disease – but is constituted through relationships between entities, both human and material. Thus, *becoming a surgeon* happens as a surgical trainee interacts with the scalpel, patient body and nursing colleagues within a theatre. Indeed, one could argue, it occurs when a scalpel interacts with a surgical trainee, a patient body and nurses. Nicolini notes: that from 'this perspective the social world appears as a vast array or assemblage of performances made durable by being inscribed in human bodies and minds, objects and texts, and knotted together in such a way that the results of one performance become the resource for another'[4] (p. 2). This is often referred to as 'performative ontologies'[5] – the nature of being (ontology) is developed through the interactions of human and nonhuman entities and it is only through this interactivity that reality emerges. This makes the distinction between humans and artifacts a purely artificial one.[6]

The value of sociomaterial research approaches is in their potential to go beyond binaries of structure/agency, mind/body and to pay due attention to the materiality of the social world, as it happens, rather than as intended. Anh and Nyström[7] frame this well: 'Many learning theories show interest in the material set-up (things and technologies) but they are interpreted as a means for the human actors' set-up, used for their purposes and a medium for their intentions. However, materiality always produces other unexpected actions and influences practice in unexpected ways, which affect our actions, thinking and even intentions in a practice' (p. 4). This is the crux of a sociomaterial sensibility; not that materials exist, but that the relationality among humans and things is fundamentally entangled and inseparable. A sociomaterial sensibility shifts the mattering, leading to new insights and potential improvements.

If we take the rise of technology as an example, a sociomaterial orientation would attune us to digital technologies not as tools that mediate learning, but rather as active participants in the learning process; a part of the complex and cross-cutting configurations of relationships of learning and teaching.[8] For example, using sociomaterial ethnography MacLeod and colleagues[9] show how videoconferencing technology – a network of buttons, screens, microphones, cameras and speakers – far from merely extending the bricks-and-mortar classroom, operate as unintended 'technologies of exposure' (see Figure 20.1). Pressing the 'button' to ask a question operates a video which beams a student's face into a lecture theatre leading to lack of question asking. This research shows how educational technology is not neutral; it participates in education, thus changing it – including some (the students in the room who

Figure 20.1 The materiality of distributed medical education

would ask questions after the lecture) and excluding others (those distant who did not want to be exposed by pressing a button to ask). Whilst the intention of introducing videoconferencing technology to a rural site is one of equity, a wider focus on what student-materials actually do showed how *exclusion* was constituted through the assemblage.

Examples of research and synthesis of underpinning principles

While there is significant diversity across sociomaterial theories and approaches, they are united by common 'sensitivities' as articulated by Nicolini.[4] Sociomaterial studies would generally promote:

1. **activity** as the central unit of analysis;
2. the critical role of **bodies and materials**;
3. the **agency** of individuals and materials (but not an unlimited agency);
4. the **situatedness of knowledge** in practice; and
5. the **power, conflict and politics** that constitute social life.

These are not dealt with or defined in the same way in various sociomaterial theories, but they are generally significant elements in the research. Because there is no unified theory of practice[4] we cannot offer concrete definitions of terms. Instead, we draw on three studies to show that these principles do undergird all sociomaterial research, but differently, depending on the theoretical perspective adopted.

We start with the problem of the intensive labour within OSCE implementation, which might be seen as matters of cost or logistics but appears differently when using a sociomaterial approach. Framed by Schatzki's practice theory, Bearman and colleagues[10] examined implementing OSCES across three different countries. By investigating what administrators and academics reported *doing*, including the material demands of individual stations, they surfaced hidden emotional and physical labours. Analysis identified the labour-intensive workarounds (and guilt) of ensuring standardisation. This study has clear sociomaterial sensitivities: it takes activity as the unit of analysis; it looks to how administrators and educators agentically employ materials in implementing stations; and it comes to the politics of labour. Thus, it directly concerns the vignette that we open this chapter with. This study underlines how fixing an OSCE station does not necessarily concern a better checklist. Rather, holistic challenges are surfaced: the ideals of standardisation are entangled with a narrow understanding of validity and a deep desire for good healthcare. As a consequence of their study, the authors call for an emphasis on *coordinating* OSCE stations. By removing the focus on standardisation, they suggest it may be possible to prevent a vicious cycle of increasingly reductive bureaucracies which aim for the impossible (and indeed undesirable) standardisation by removing all local context.

In another example of interprofessional care, which has been widely studied as a human–human phenomenon, Burm *et al*.[11] studied the sociomaterial assemblages shaping team-based interprofessional patient care. Drawing on Actor-Network Theory (ANT), the researchers traced the sociomaterial dynamics configuring the acute care setting using ethnographic observation, field notes and interviews. Once they decentred the human from collaborative care – which may seem counterintuitive – it became apparent how infrequently it was occurring due to gaps in systems (e.g., scheduling, data metrics such as length of stay), teamwork (e.g., electronic and written notes, pager interruptions fragmenting communication) and individuals (e.g., bodies, competing priorities). They showed how labour intensive workarounds were needed to overcome these obstacles and deliver successful outcomes (e.g., timely discharge) but these were neither sustainable nor ensured patient safety. They note: 'A sociomaterial approach entails a particular way of viewing the world; one that moves away from exploring social and cultural factors in isolation towards examining their entanglement with human and non-human actors. Over time, it is these assemblages that generate what we come to understand as "patient care", "collaboration" and "communication"'[11] (p. 161). What this research shows is the messiness of interprofessional practice; this is not a problem of human training, but one of complexity that cannot simply be fixed and one that renders patients' safety at risk.

Interprofessional collaboration in simulation has also been explored. Using Schatzki's practice theory, Nyström *et al*.[12] studied what actually takes place as medical and nursing students collaborate in a simulated setting. By analysing videos of simulation, the researchers showed how students related to the mannikin as a technical body, as they performed assessments; a physical body as they performed their medical knowing, such as following a resuscitation protocol; and a human body, caring for them as a real person, such as tucking their feet under the blanket to keep them warm. This research might help us see the mannikin differently, and to question the concept of fidelity. The materiality of the manikin – its rigid lifelessness and vacant stare – works against our social, educational endeavours to create

Figure 20.2 The mannikin – technical, physical and human

a high-fidelity learning experience (see Figure 20.2). Here researchers are sensitive to the situatedness of knowledge, and to bodies, particularly, how those of the human and mannikin interrelate.

Sociomaterial theories

Having introduced sociomaterial 'sensitivities' earlier, we now delve more deeply into three significant theories to illustrate some of the variability in theoretical approaches and their implications for research. We discuss practice theories, Actor-Network Theory (ANT) and agential realism.

Practice theories

Sociomaterial work attunes to practices: everyday sayings, doings and relations with objects that make up what people do in their everyday lives.[13] What does this mean? Our lives are full of practices – those familiar activities in which we engage each day. They range from very simple, (e.g., turning on our computer), to extremely complex (e.g., preparing a research grant proposal). When we take a sociomaterial perspective, and attempt to break a practice into component parts, or, in practice-oriented language, *unravel* them, the extent of their complexity comes to light. Even the simple task of turning on our computer is profoundly complex when we examine the details; all the component pieces of the computer must be correctly assembled before it can be turned on, it needs to be connected to a source of electricity, it needs access to WiFi, and so on. In order to understand particular practices, then, a sociomaterially informed researcher works to carefully unravel tangles of actors – both social and material – that assemble to give meaning to human activity.[14] Effectively studying practices requires embracing, and then digging into, their inherent messiness. In other words, a researcher studying practice does not attempt to impose structure on the scenario under study. Instead, the primary task is to produce an ontologically rich description, which is no small task.

One of the most noteworthy features of studying practice is its requirement to move beyond traditionally human-centred methods, like interviews or focus groups. Instead, the role of nonhuman elements in reproducing practice is highlighted. Such an approach allows researchers to understand how mundane actions and taken for granted objects are of central importance. For example, Cameron and colleagues[15] demonstrated that the technologies of videoconferencing, which are ostensibly designed to connect people across geographical borders, may serve to reinforce distance. In deliberately attuning to networks of buttons, microphones, cameras and screens that connected two distributed medical school campuses, the researchers demonstrated that the tools of connection complicated cross-campus communication.

Actor-Network Theory

There is overlap between a practice theories approach and Actor-Network Theory (ANT); however, it is generally seen that ANT is most radical in its removal of the human. While practice theories tend to emphasise human practices as a core phenomenon, ANT is firmly focused on foregrounding the material.

ANT's best-known theorist is Bruno Latour, who is regarded as one of the most significant figures in the area of Science and Technology Studies. He challenged the distinction between nature and culture, or between science and culture.[16] His phrase 'the parliament of things' expresses that we need to include things (materiality) in our thinking and decision-making. Latour was critical of granting all agencies to humans as separate and of greater importance than matter, nature and technology (leading to endless destruction and exertion of power over others). It became a moral question to rethink the relationship between humans and things to attune to the embeddedness of humans in the world.[17,18]

ANT, therefore, has materials and materiality as its central concern. While ANT has evolved into a multiplicity of different approaches since its first appearance over 30 years ago, all privilege spaces and objects. Fenwick and Edwards[19] have detailed the historical evolution of ANT for those wanting to pursue this approach. At a general level, we can think about health professions education as an assemblage of people, buildings, technologies, values and so on – without the distinction between these being clear-cut. Common concepts that tie the various ANT approaches are *emergence, agency of materials* and *symmetry*.

ANT researchers do not consider objects, people and practices as distinct, pre-formed entities; rather, these things are *emergent* through gatherings of natural, technological, human and nonhuman actors. In other words, all things – human, nonhuman or hybrid – are performed into existence, emerging as the result of activity and connections between people and things. In the context of health professions education, this means that rather than conceptualising teaching and learning as a distinct, individualised action or act of cognition, we focus instead on tracing the tangle of elements that are bringing about the activity, action or phenomenon under study. This latter emphasis is why ANT is sometimes categorised as a practice theory. However, as mentioned, ANT takes the most radical stance in its decentring of the human.

A tenet of ANT is that *agency* is not limited to humans. Rather, agency is considered distributed and relational.[20] This means that nonhumans have agency; that is, they are productive, they *cause* things to happen. An example, perhaps familiar to all of us now, are the stickers on the floor that tell you where to stand/queue to maintain social distancing. These are not just the backdrop against which human activity takes place, they force activity – that is, they are agentic. The relationality of humans and stickers is not only about behaviours but affect too – the stickers give rise to fear, a constant reminder of the pandemic even in the most mundane – grocery shopping.[21] Some ANT theorists argue that ANT can inform research on subjectivities, or human experience, but the research is embodied and configured through human and nonhuman participants, recognising that agency is distributed and maintaining the notion of symmetry in the analysis.[17]

Given the focus on nonhuman agency, it follows that ANT considers nonhumans equally as productive and consequential as humans. We refer to this position as *symmetry*. Therefore, research needs to attune to the human and nonhuman elements that are assembling to produce the phenomenon under study. Because materiality is not neutral, any material way in which we organise health professions education has consequences. Curriculum, assessments, clinical experiences and their interactions shape students in ways that have both desirable and undesirable outcomes.

Agential realism

Karen Barad's agential realism is a highly influential sociomaterial theory, which both parallels and contrasts with the previous examples. Agential realism challenges the permanence of subject/object and the division between conceptual/material.[22] Barad, who is a physicist as well as a feminist philosopher, draws from quantum mechanics; her theorising sits at the nexus between philosophy and science. This is not light reading: Barad explores notions of being, knowledge and matter. For health professions education, a noteworthy facet of Barad's work is her inherent focus on ethics and ethical actions. This is because at heart, agential realism is concerned with inclusion and exclusion of beings, things and ideas.

As with many other sociomaterial approaches, Barad focusses on doings and relationships that unfold, rather than a constant, stable reality. One of the key concepts in agential realism is the idea of *cutting together/apart*.[23] That is, any differentiating entities must always entail bringing together – as difference must also require a relationship between entities (otherwise they cannot be distinguished from each other). Barad describes the *agential cut*: the agentic act of allowing possibility to others and things, which momentarily defines both the actor and the acted upon through their distinctions. Thus, in surgery, the scalpel and the surgical trainee are different but part of a whole. Within this relationship, possibilities for learning emerge. Similarly, in the OSCE, the checklist and the assessor work together: both exerting possibility upon each other as the checklist constrains but the assessor fills out the form.

This constant act of inclusion/exclusion means that all actions carry ethical weight: we are always part of an unfolding process of differentiating and togethering. Significantly, Barad does not distinguish between discursive concepts and material objects: everything is embodied. She dismisses the notion of representationalism, the idea that words mediate the outside world to an interior consciousness. Thus, agential realism provides useful means of understanding why certain practices, including associated discourses, proscribe or permit possibilities of thinking and doing.

Barad's work is the least well known in health professions education of the approaches that we describe. However, when it is invoked, it is potent. For example, in a study of gynaecological simulation, Johnson[24] identifies that simulators are conceived of as representing female bodies, but she comes to the understanding that it is 'phenomena of knowledge that are being simulated' (p. 123). Thus, she notes, there is a: 'political implication to constructing simulators that recreate and represent certain practices as medical norms' (p. 123). From this perspective, any person's action (which must necessarily include conceptualisations), determines possibilities. Thus, Barad suggests we are always accountable for what we produce. The material simulator affords a particular way of working and knowing female anatomy that excludes the patient experience of being examined. Therefore, when students learn gynaecological exams with this simulator, working with women's bodies is differentiated from interacting with women themselves. Agential realism prompts us to consider how health professions education separates emotions from cognition, student from teacher, international from local, and how these ideas themselves are embodied and thus open or closed possibilities of actions for others.

Research approaches

To investigate research phenomena from a sociomaterial perspective, we need to explore how different and dispersed ways of knowing in practice work together. We must change our unit of analysis from individuals to practices and their relationships. Thus, research may seek to trace the arrangements, stabilities and unpredictabilities that produce the educational phenomenon under study.[15] For example, we might use methods that allow us to follow the negotiations, compromises and adaptations that come together, and fall apart, as they produce health professions education – things like learners, clinical practice guidelines, classrooms, simulation suites, texts, pedagogies and an infinite array of others. Rather than accepting these things as standalone categories, we instead trace them as effects of sociomaterial relations.[20] Methods need to be carefully designed with this in mind.

The remainder of this chapter outlines processes involved in sociomaterial research. We introduce an overall framing of researching sociomateriality from a post-qualitative perspective, which specifically embraces a post-human sensibility as a foundation. We then describe common approaches and methods: sociomaterial ethnography; the role of interviews; the role of materials such as photos and documents; analytic methods; and, finally, the role of the researchers themselves.

Post-qualitative research

The post-qualitative movement builds on the key works of St Pierre,[25–27] in response to a growing disillusionment with conventional humanist qualitative research; particularly, its 'residual objectivism' and the centrality of language for understanding the world.[28] Post-qualitative researchers critique the narrowing impact of qualitative research to generating sets of rules and strategies to represent 'participant voice'. Instead, post-qualitative researchers, argue against methodological rigidity, rather advocating for less linear and more creative approaches that enable a reshaping of practice.[27] Hence, post-qualitative researchers, claim to build on deep theoretical foundations that are not rule-bound and that seek to de-centre the human and recognise the fundamental and active role of researchers within the research process and outcomes. Employing methods that embrace subjectivity and reject linearity of research design and process[29] are claimed as means for achieving these outcomes.

Post-qualitative research is fundamentally driven by theory, eschewing textbooks and methodology for philosophical texts. St Pierre argues that researchers give too much credence to data, often backgrounding theory which is necessary for thinking and sense making. Certainly, it is necessary to trouble the lack of theory in the conduct of qualitative research and researchers' scripted use of concepts such as saturation, triangulation, bias or generalisability for example (e.g., [30, 31]). However, critics of post-qualitative research argue that the inability to define post-qualitative research renders it ambiguous and amorphous.[28] Further, centring theory rather than data, can lead to a deprivileging of data collection that 'seems to flush out the empirical baby with the positivist bathwater'[28] (p. 6). The point we make here is that theory is important – not just as a footnote but throughout the research process. Thinking and analysing with theory is necessary for sociomaterial research, whether or not a post-qualitative approach is adopted. Theory influences what we see, which questions we ask and what ultimately stands forth in our data as particularly significant'[25] (p. 7). In the next section, we outline a specific methodology, sociomaterial ethnography; however, as mentioned, this is not intended to be prescriptive.

Sociomaterial ethnography

Ethnographic approaches, modified to reflect sociomaterial sensibilities, are commonly used in sociomaterial studies. This means that well-recognised principles of ethnographic work including long-term data collection, naturalistic settings, participant observation and engagement in the field, and using a wide range of data collection tools[32] can be modified and employed to fit the needs of the particular theoretical approach.

In terms of process, sociomaterial ethnography layers data collection strategies to build a rich description of the phenomenon under study, typically this includes observation, interviewing and artefact analysis. In keeping with traditional ethnographic work, sociomaterial approaches foreground observation; however, the focus of observation is distinct. Rather than focusing explicitly on human activity, sociomaterially oriented observation instead highlights materiality. This approach does not overlook or ignore human activity, because sociomaterialists are concerned with people *and* things. However, this type of observation makes an explicit effort to attune to materiality.

Sociomaterialists are interested in understanding the processes of the world, rather than discrete events. Observation from a sociomaterial perspective, then, focuses on the ways in which people and things assemble, fall apart and then reassemble in different combinations. Field notes would account for the configuration of the situation from time, space, objects, bodily positioning, etc. An ethnographer follows actants of interests, observing and documenting their unique translations and reconfigurations. This is no small feat, as sociomaterialists believe that each action reconfigures the world. It can be particularly challenging to observe and document the constantly evolving nature of the world rather than static representations of it. In order to accomplish this, it is important to follow meaningful actors (human or nonhuman) across the assemblage and accepting that we as researchers are part of the process, shaping and influencing it as it unfolds.[33]

Sociomaterial ethnographic work, with its focus on observation, abjures precise analytic categories instead, embraces the messiness and contingency; acknowledges that the practices we observe are both social and material; and thus focuses on producing detailed description of what is *actually* happening in the field. Sociomaterially-oriented researchers may develop tools to support them in their observational work. This might include observational guides or templates that deliberately act against our tendency to centre human activity, reminding researchers to attune to nonhuman elements in the field.

What is the role of interviews?

Interviews can also play a part in sociomaterial research. Field interviews or brief informal conversations are commonly enacted in sociomaterial ethnographies. While there are limitations of relying on interviews alone for unpacking practice, open interviews that elicit thick description of doings (not intentions, but what actually happens) are valuable. Access to relationalities between participants and spaces, places and objects is possible through walking interviews.[34] The dangers and possibilities of the interview are illustrated in the following description of a practice-oriented technique called Interview To The Double (ITTD).[35]

ITTD is a longstanding means of examining labour and is very useful for sociomaterial research. In this, an interviewee is asked to describe what would happen if a 'double' had to go to work the next day and precisely enact what the interviewee would do.[35] This includes how the person interacts with spaces, tools and co-workers. The idea here is that in prompting an interviewee to report exactly how a doppelganger would undertake a task, the practice will be described. However, Nicolini warns about the interpretive layer provided by the interviewee, suggesting that such a technique should be included in an ethnographic toolkit rather than standalone. His concern is the mediation of the experience by the interviewee and their tendency to idealise practice; therefore, interviews such as ITTD can be used to understand not so much what people do but what *they wish they did*. This expression of the normative can be valuable. He writes: ITTD 'provides a rare insight into the modes of justification and rhetorical resources'.[35] In other words, ITTD, like other interviews, links the discursive to the practice. Thus interviews, as long as they are understood to be discursive acts as much as representative ones, offer valuable data to sociomaterial investigations.

Document analysis and interview-adjacent methods

Document analysis and visual materials may be used alongside other data collection methods including photo-box and longitudinal multimodal journalling. For example, digital 'postcards' have been used to good effect to represent study environments.[36] Rose[37] argues that 'participant-generated visual materials are particularly helpful in exploring the taken-for-granted things in their research participants' lives. Asking them to take photographs of that life, and then to talk about the photos, involves the participants reflecting on their activities in a way that is not usually done; it gives them a distance from what they are usually immersed in and allows them to articulate thoughts and feelings that usually remain implicit' (p. 28). Video-footage may also be used. Visual methodologies are considered to lead to deep and personalised forms of engagement and a sense of control of self-representation over time as well as insight into the human-material connections.[38] This also applies to artefacts that participants may bring in.

Analytic methods

As you can imagine, analytic methods vary. The act of analysis is itself a sociomaterial practice. Being clear about defining your sensitivities as per the theoretical framework and research phenomenon is important. Nicolini[39] distinguishes between weak sociomaterial research that adopts an often vague perception of theory resulting in mere reporting of 'what people do'. Such studies are often limited to naming, describing and listing practices. The impression left with the reader, he reports, is a puzzling 'so what?' However, strong theoretically grounded research seeks to explain how practices create the social world and how these practices are assembled sociomaterially, their emergence, change and disappearance.[38] This distinction is useful for orienting towards analysis and the role of theory within it. One analytic approach that may support this goal of explanation of the social, is a metaphorical movement of zooming in and zooming out of practices.[13] The researcher zooms in to the real-time practices to analyse their local accomplishments and zooms out to analyse the relationships in space and time of the practice with other near and more distant practices (or nexuses of practice).

The role of the researcher in sociomaterial research

Sociomaterial researchers are entangled in the assemblages/practices/networks (depending on theoretical orientation) throughout the research process. This is why phrases such as 'themes emerged' or 'data revealed' are not meaningful within a sociomaterial frame. As with other research, reflexivity matters – but it is a form of embodied reflexivity – an accounting of affect, bodily senses and mind through journalling or discussion, for example. As researchers, we would also note how the materials of the research, such as the field notes templates, interview guides etc., are shaping the research.[33]

Conclusion

Sociomaterial research in health professions education grants us new ways of framing phenomena, for asking questions and attunes us to practices rather than individuals. It comes with a host of new languages that can be daunting and transformative of worldview with a relational and performative ontology. Even in this chapter, for example, we have used words such as sensibilities or sensitivities, this is intentional and not used to elide. This is because sociomaterial theories cannot be 'applied', instead they offer 'a way to sense and draw (nearer to) a phenomenon'.[19] To do justice to sociomaterial research, theory must drive forward every decision in the research, in collaboration with empirical data. Importantly, researchers cannot and should not be deleted, they are part of the research assemblage and bear responsibility. The value of decentring the human is to make visible the layers of complexity, and thus perhaps disrupt the endless cycles of training humans in the desire to fix complex systems that cannot be permanently fixed. We think this a worthy endeavour for the field.

Practice points

- Sociomaterial approaches to research fundamentally change the types of research questions that can be asked, and the location of the phenomenon.
- It requires attuning to both human and non-human elements of the research field.
- Research design is theoretically driven.
- Knowing is a continuous enactment performed though assemblages that are more-than-human.[14]
- Sociomaterial researchers are actively entangled in the research.

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21 Social cognitive theory: thinking and learning in social settings

Dario Torre and Steven J. Durning

JS is a new staff physician (attending physician) in internal medicine. This is his first day working with his team, which consists of two interns (doctors in the first-year post-qualification), a resident (registrar) and two third-year medical students. He would like to provide bedside instruction to the team and is very interested in cardiac disorders, in particular congestive heart failure (CHF). The service is busy with a high number of patients on the team, and JS wonders how much sleep his team members have had recently. There are two patients on the team with a diagnosis of CHF and both may be discharged home later today. He is used to giving lectures to students, but has not had the opportunity to provide bedside instruction. Given the aforementioned factors, what should JS consider when planning a bedside teaching opportunity in CHF?

Social cognitive theory refers to a group (or family) of theories that consider learning and performance as inherently social. This means that individuals, the environment and interactions between individuals and the environment matter in learning and performance situations. Furthermore, social cognitive theories argue that the uniqueness that each situation brings (in terms of the environment, participants and their interactions) can often lead to different learning and performance experiences and outcomes.

These ideas are distinguished from traditional individual cognitive theories (such as information processing theory or IPT) that pervade health professions education nowadays. IPTs, such as cognitive load theory (see the chapter by van Gog and colleagues in this book), have historically assumed that learning and performance are primarily, if not solely, determined by knowledge acquisition and organisation. While leading to critically important advances in our understanding of cognition (e.g., decision making),[1] IPTs often downplay (or ignore) the possible contribution of other participants, the environment (setting) and the interaction between individuals and the environment in learning and performance. From social cognitive theories (SCTs) perspective, on the other hand, there are a number of other factors that are likely to contribute to learning in addition to knowledge – the environment, the participants and their interactions – and all these factors would be considered in planning the bedside teaching.

In this chapter, we describe selected SCTs that we believe apply to health professions education today. We will begin with the historical development and theoretical foundations of this family of theories. Next, we discuss five different theoretical lenses that fall within the family of SCTs: situated cognition, distributed cognition, ecological psychology, situated learning and landscapes of practice. In the last section, we provide some of the applications of these theories, and indicate future research and practice directions. At the end of this chapter, the reader should be able to list underpinnings and key historical developments of SCTs, describe examples of SCTs and their application in health professions education and be aware of some of the future directions for SCT research and teaching.

Theoretical foundations of SCT

Bandura: behaviouralism and triadic reciprocity

When Bandura[2] championed SCT, behaviouralism was arguably the prevailing theory of learning. The goal of behaviourism was to 'condition' desirable responses in educational programmes, much like Pavlov's dog in the classic example of this theory. SCTs made a notable separation from this theory by, first, placing an important role on processes such as goal setting, judging outcomes, emotions and reflection, and, second, arguing that although much learning occurs by doing, we also learn by observing others. From the SCT perspective, a medical student could learn from observing JS perform a

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history and physical examination of the patient with heart failure. This notion of learning through observation is also in line with the neuroscience of learning.[3]

Finally, from an SCT perspective, whether we ever perform what we have learnt depends upon a variety of factors present in the situation at hand (individuals, the environment and their interactions). This situational notion to performance is in line with the finding of context specificity in medicine, meaning that a physician can see two patients with the same (or nearly identical) history, physical examination, laboratories and diagnosis and yet come to two different diagnostic decisions.[4,5] Something beyond the 'facts' needed to establish the diagnosis is therefore impacting the physician's decision. SCT's situation-based nature to cognition, learning and performance raises challenges for assessment of learning and transfer, which we will discuss later.

A key development in SCT arose when Bandura[2] introduced the concept of human behaviour as occurring within the framework of *triadic reciprocality* (Figure 21.1). Human behaviour is viewed as being caused by the interaction of three main sets of determinants: personal factors (which include cognition, affective and biological events), behaviour (e.g., choice of tasks, persistence and self-efficacy) and the environment (which can be imposed, selected and/or constructed).

In this work of Bandura,[2,6–8] we begin to see the interaction of cognition and the context in which it occurs, with an emphasis on the social process of learning. From a social cognitive view, all human ability is mediated by the interaction of people with the environment, which includes their motivational and cognitive abilities. To return to our example at the beginning of this chapter, merely providing the 'stimulus' of content is not sufficient for optimising learning. Personal factors (such as how well rested the team is), behaviour (is there a patient on the team with CHF who would serve as a prompt, or interest in learning) and the environment (is the room conducive to bedside rounds, etc.) would all be considered important for teaching bedside rounds.

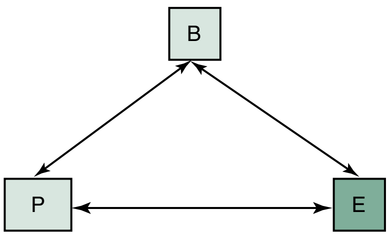

Figure 21.1 The schematisation of the reciprocal interactions among the three determinants: B =behaviour; P, C =personal and cognitive factors and E = environment

An important element of behaviour in triadic reciprocality is the concept of self-efficacy. (Note that self-efficacy plays a key role in several other theories described in this book, such as self-regulation and motivation and emotion theories – see chapters by Artino and colleagues, and McConnell and Eva). Self-efficacy is the belief in one's capabilities to exercise control over one's level of functioning and execute courses of action to obtain a given goal.[9] Self-efficacy is believed to be a major determinant in how people think, feel and act. From an SCT perspective, self-efficacy mediates cognitive development and functioning in three ways: cognitive, motivational and affective.[10] In the cognitive area, a higher level of self-efficacy allows for more thoughtful decision making. This is believed to occur through enhanced integration of self-appraisal, planning, time management and performance feedback.

Self-efficacy has important motivational effects: Bandura states that 'self-efficacy has its most powerful effects thought the process of cognized goals'[6] (p. 56). The setting of high goals derived from high self-efficacy can provide direction, self-management and positive expectations through evaluating and judging the adequacy and effectiveness of one's effort to achieve his/her goals.[6] Learners who have a high sense of self-efficacy can also provide positive supports for performance and less self-doubt in achieving their goals.[11] Furthermore, two people with the same knowledge and skills (e.g. teaching bedside rounds) may perform differently based on differences in their self-efficacy beliefs.

Bruner: culture is an important element in SCT

While Bandura emphasises the role of the environment as a crucial determinant of the reciprocality of learning, Bruner[12] takes this concept further, recognising that the construction of meaning is deeply entrenched in culture.

In Bruner's view, learning and thinking are always situated in a cultural setting, and their meaning has its origins in the culture in which they are generated. In the culturalist approach, education is part of the large world of culture and is shaped by the role it plays in the environment, group and/or community.[13] Culturalism has two interdependent dimensions: one dimension looks at the culture as system of values and opportunities (or affordances, see the chapter by Billett, Sweet and Noble in this book) and the other dimension entails the educational demands that the cultural setting has on the individuals within that setting. For example, the meaning of being knowledgeable in a surgical team might be different than that in a general medical team, because the meaning of the event (e.g., working in an operating room or team bedside rounds) and how the individuals should interact within the event are situated in different cultural settings.

While Bruner emphasises the role that culture plays in making meaning within communities, Lave and Wenger take this further by relating learning through participation in *communities of practice* (CoPs) and subsequently *landscapes of practice*.

Lave and Wenger: learning is social and collaborative

Lave and Wenger[14] underscore the role of learning as a social, collaborative and interactive process through posing the theory of situated learning and its core component parts: CoPs[15] and legitimate peripheral participation (LPP).

Learning takes place (e.g., is situated) in a CoP. The CoP develops around mutual goals and interests over time, such as caring for the patients on a ward team as in our original example. A CoP develops methods, ideas, knowledge and practices to solve common problems in the community. Thus, CoPs can become self-organised and self-sustained entities that share practices and models of approaching a problem among members.

In such CoPs, there are core members, who have more experience, are more familiar with the practices, history and culture of that community and there are more peripheral members who are newer to the community and who are trying to advance their learning and practice through a greater involvement in the community through LPP. In our example at the outset of this chapter, the ward resident (registrar) could be considered to be a more core member, whereas a medical student would be a more peripheral member.

LPP is an important aspect to the development of a CoP. In LPP, learning involves a process of participation, and is built upon previous learning in a social context. This participation creates relationships and mutual experiences and leads to new and meaningful learning. From our initial example, LPP is manifest by the different responsibilities of the different educational 'levels' of the ward team (students, resident or registrar and the attending physician). Peripheral members (e.g., students) are typically given increasing responsibility (thus becoming more 'central members of the community') as they participate in daily rounds, working and communicating with the patients, nursing staff and other parts of the healthcare team. Peripherality, therefore, is a dynamic concept, that when enabled is 'a way of gaining access to sources for understanding through growing involvement'[14] (p. 37).

LPP is the way to become an integral part of a CoP, where learning occurs not within individual masters or experts but is rather situated in the organisation, structure and culture of a community.

Situated cognition, distributed cognition, ecological psychology, situated learning and landscapes of practice: theory and principles

Each of these five SCTs – situated cognition, distributed cognition, ecological psychology, situated learning and landscapes of practice – encompasses a situation-specific social approach to understanding thinking, learning, performance and identity. The first three theories focus on thinking (cognition): the theory of distributed cognition places greater emphasis on how collective cognition (a team, or a group) occurs and how information is processed conjointly to perform a task; in situated cognition the focus is more on how individual cognition is embedded and situated in the environment. Ecological psychology focuses on the affordances and effectivities provided by the context. Situated learning, which is sometimes confused with situated cognition, places special emphasis on experiential learning (rather than cognition in general) in a social context. Landscapes of practice contends that learning is a form of trajectory across the sociocultural milieu of a complex system of communities of practice or landscape. (Readers are also encouraged to refer to chapters by MacLeod, Burm and Mann on social constructivism and that from Artino and colleagues on self-regulation for more details about other SCTs.)

Situated cognition

Situated cognition theory is based on the idea that thinking (as well as performance) is situated (or located) in the specifics of an event. Often the specifics of the situation are divided into components (or factors) that are believed to interact. Thus, from this theoretical viewpoint, cognition emerges from relationships among participants (e.g., teachers, learners and patients) and relationships with specific properties of the environment.[16–20] Situated cognition theory allows for 'unification of the world, the individual and the relations among these reciprocal components'[21] (p. 360). In our introductory example, one could consider the following components for beside teaching rounds: teacher (e.g., his knowledge, experience and wellbeing), the learners (their sleepiness, knowledge, interest in subject and self-efficacy), the patient (e.g., her/his health literacy, education and acuity of illness) and the environment (e.g., lighting, ambient noise and space). These factors (and their component parts, some listed as 'examples' above) are believed to interact and, from this, the outcome (e.g., learning) emerges. We will discuss this in more detail in the following sections.

Historically, situated cognition draws upon the work of leaders such as Dewey,[22] Vygotsky[23] and Greeno.[24] For the purposes of this chapter, we will discuss both situated cognition (or thinking) and situated learning, to help in terms of distinguishing between the two approaches.

In situated cognition, the primary goal of cognition (thinking) is to describe the thinking of a professional in a given context.[25] This theory shifts the focus from the individual participant to the social and cultural activity in which the participant interacts, and places important emphasis on these interactions. Situated cognition not only acknowledges the interplay between participants and the environment, it puts *equal emphasis* on these two components.[26] This assumption, in fact, builds upon the cognitivist approach of a participant *in* environment to participant *and* environment.[16] In addition, all individuals (and the environment) are potentially changed by this interplay. The numerous participants, social settings, cultures and interactions (and emergence of these interactions) can necessitate non-linear and/or multi-level approaches to analysing what occurs (which we will return to later in the implications section below). The focus of learning from a situated cognition perspective is on having the learner move towards expertise in authentic and potentially complex experiences. Such a learning goal is potentially useful for health professions educational research, especially in situations where there are multiple participants and the activity is authentic (e.g., clinical education).

Key assumptions of situated cognition include those listed in Box 21.1. Unlike IPT (see earlier), from a situated cognition perspective, knowledge is not an inert, self-sufficient, abstract, self-contained, symbolic 'substance' independent of the *situations* in which it is learnt and used. Instead, knowledge is akin to a tool[27,28] and using the tool helps build an increasingly rich understanding of how and when the tool use is appropriate and, further, how both the tool and the world change as a result of its use. Think of how an internist and a surgeon might approach the use of a scalpel – the internist would typically tend to avoid its use and when needing to use a scalpel in the care of a patient (e.g., dermatologic procedure), tend to approach its use more slowly and perhaps timidly; while the surgeon's use of the scalpel is second nature. In other words, the tool, the participant(s) using the tool, the environment, the specific context and the culture are all *interdependent* – situated cognition would argue that one cannot meaningfully understand one of these components without understanding the others; they are situated. By using the theoretical framework of situated cognition, one is able design experiments that look at more than the facts and also how the participants interact (e.g., physician and patient) with the environment.[29–31] This theoretical framework has helped with proposing mechanisms (such as cognitive load) through which these dynamic interactions and subsequent performance emerge.[29–31]

BOX 21.1 Situated cognition key assumptions

- Human thinking is situated (or located) in and shaped by the environment.
- The actions of individuals and the situations in which they operate are not separable.
- Knowledge is a tool (vs a static object) that is accrued through lived practices and engagement.
- Performance emerges through interactions between participants and the environment.
- Situated cognition puts equal emphasis on the importance of participants and the environment in a situation.

Distributed cognition

The second social cognitive theory is distributed cognition. Distributed cognition seeks to understand 'the organisation of cognitive systems'[32] (p. 175) as opposed to individuals. Distributed cognition extends beyond the cognition of the individual 'to encompass interactions between people and resources and material in the environment'[32] (p. 175).

Distributed cognition rests on two basic theoretical principles. First, as opposed to the traditional views of cognition where the unit of analysis is the individual's thinking, here, like situated cognition, the unit of analysis is the entire system. This system is comprised of (numerous) individuals and the environment in which they operate and perform. For example, in our bedside rounds example, the unit of analysis would be each individual team member, the patient and the environment or artefacts provided by the specific social setting. Besides the individual cognitive properties of each individual ward team member, there is, therefore, a new, larger cognitive unit of analysis, consisting of the ward team and the instrumentation together, whose cognitive properties are crucial to care for a patient with CHF. The cognitive process that occurs in a distributed cognition system is created by a number of functional relationships among its elements. In our example, this would be the interactions and coordination among the team members, the patient and the ward room that allow the accomplishment of learning and patient care.

Second, in distributed cognition, there is a broader range of mechanisms that occur, compared to individual cognitive events. For example, in our bedside teaching example, there is a rich interaction among the internal cognitive processes of each member which collectively lead to action. In this model, cognition is better understood as a social phenomenon as opposed to one localised at the individual level.

The concept of distributed cognition may involve three kinds of distribution of cognitive processes:

- Cognitive processes that may be distributed among members of a group (for example, the diverse cognitive properties of each member of the medical team described in the vignette).
- Cognitive processes distributed in such a way that involves the coordination between members of the medical team and the surrounding environment (for example, the medical team making a decision and entering an order in the electronic medical record, or the medical team working in the emergency room while admitting a patient or conducting bedside rounds).
- Cognitive processes that may be 'distributed through time in such a way that the products of earlier events can transform the nature of later events'[32] (p. 1) (for example, the cognitive actions performed by the medical team about the choice of a treatment plan at admission for a patient with CHF that results in subsequent actions based on the outcome of the treatment implemented).

Distributed cognition takes advantage of the cognitive diversity of individuals which allows, though interaction, the pulling together a variety of cognitive resources that may be needed to accomplish complex tasks. An example from Hutchins[33] is related to the cognitive processes that occur when steering a ship into a harbour. The distributed cognition approach needed to coordinate and analyse this task stems from the interactions among all the different components of the system. This includes individual members of the navigation team with different levels of skills and experience, the environment in which the action is situated and the effect that time has on the sequence and coordination of thinking and performance related to the event. It is the coordination and interaction of the diverse cognitive abilities of each individual that allows successful completion of a challenging task, such as steering a large ship into a harbour. In addition, there is an emphasis on the situated distribution of cognition across individuals, within a context, and over time.

Ecological psychology

Within the gamut of social cognitive theories, we briefly mention one other theory that is connected to the theories above: ecological psychology.[34]

Ecological psychology emphasises the role of affordances and effectivities.[35] Affordances are what the environment provides to individuals to create opportunities for action; effectivities are the abilities of the individual to act on an affordance. Affordances and effectivities are not separate concepts: they are interconnected. For example, an electronic medical record (affordance) helps in the care of a patient only if the individual possesses the ability to use it (effectivity). In ecological psychology, all components of the environment are conceived as potential affordances and effectivities in relationship to how they can affect performance of individuals with specific abilities. Thus, thinking and learning are determined by the properties of specific environments in which the learner acts as a detector of all potential learning opportunities that are inherently present within the social, cultural and physical context. For further information and details about these theories, we encourage the reader to refer to the reference section at the end of this chapter.

Situated learning

Situated learning is characterised by grounding of learning in real experiences of daily living, creating opportunities for learners to live and learn in the social contexts where experiences occur.[36,37] In other words, social interaction takes a predominant role where the individual becomes part of a community of practice in which the culture and beliefs of the group shape the learning process of newcomers as they move from a peripheral role in terms of participation towards a more central role (from beginner to a more expert member). The individual both shapes and is shaped by practice within the community.

Involvement and participation in activities will influence situated learning, thereby enhancing knowledge and understanding by new group members, allowing them to move to full participation, which, when coupled with increased identity and motivation, creates learning. For example, in our opening vignette, the students at the bedside will engage in the discussion about the patient, will ask questions and enhance their understanding about CHF for that particular patient. They will read about the disease and begin practising maneuvers to elicit physical findings; in the next session, they may bring to the group new evidence from the literature, bring to the attention of the resident or faculty possible changes in the patient's physical examination and report and interpret pertinent laboratory values or imaging, thus assuming a more credible role within the group. As time progresses, students may begin developing stronger social ties among themselves. They will begin to develop a sense of legitimacy as members of the team, with a greater sense of identity, and develop new motivations to continue to grow within the group, moving their participation to a more central position. In short, as the students find themselves embedded into the social interactions of the team, the culture of the team and the hospital, their level of participation further increases.[38] Through the process of LPP, knowledge can, in fact, be seen as identity as opposed to acquisition of static symbols. This has important implications that we will discuss later.

Landscapes of practice

The final theory of social cognition introduced in this chapter is landscapes of practice. Wenger[39] expands the concept of communities of practice to argue that a profession relates to a complex system of different communities of practice: a landscape of practice. As learners begin their professional journey navigating through multiple communities, their professional identity is built within landscapes of practice. Wenger contends that the body of knowledge of a profession is not limited to single community, but is more a complex landscape (e.g., a complex system of communities of practice). The landscape of practice consists of different communities of practice that have their own dimensions, regulations and associations.

As CoPs are dynamic entities that evolve, split or engage with other communities, the landscape of practice may expand and change as new connections are developed within or across the individual communities of practice. Learning becomes a form of trajectory across a landscape of practice. The journey across the landscape, through experiences, formative events, engagement with other people and practices shapes professional identity (Figure 21.2). For Wenger the notion of knowledgeability is an important concept in this context. Throughout the journey across the landscape, knowledgeability acts as a modulator of identification. For Wenger, knowledgeability refers to a person who has the ability to translate their experience in the landscape into a meaningful engagement in practice. For example, a physician taking care of a heart failure patient should be able to bring to the situation a set of practices, experiences and evidence that are within the landscape of their profession. A knowledgeable professional is someone who is not only competent in their own community of practice, but also understands the boundaries of the community of practice and has insight into relevant practices that may impact their own area of specialised competence within the landscape. During the trajectory of the person through the landscape there are moments of identification and misidentification that take place as the person travels through the different contexts of the landscape. As a professional navigates the landscape and experiences the challenge of multiple forms of identification across the complexity of the landscape, knowledgeability can modulate this process of identification. Knowledgeability allows an individual to combine, connect and ultimately modulate identification and misidentification that that may at times coexist or conflict with one another as the individual travels across the landscape. The ultimate goal is for the learner or professional to develop and achieve an identity of knowledgeability in a landscape of practice.[39]

Examples of applying SCT in healthcare professions education

The components of social cognitive theory serve as a catalyst for a number of potential applications in healthcare professions education: the role of self-efficacy in the educational process, cognitive apprenticeship as form of participation, situated cognition as a way to diagnose a social situation, distributed cognition in educational methods and in the workplace involving groups and the strategic development of CoPs in health professions education. These are discussed as follows.

Self-efficacy

Beliefs about personal self-efficacy can affect learning. A high sense of personal efficacy can exert influence over learning and in particular can help individuals regulate their own motivation and behaviour in order to affect change. In the past decade there have been several studies about the role

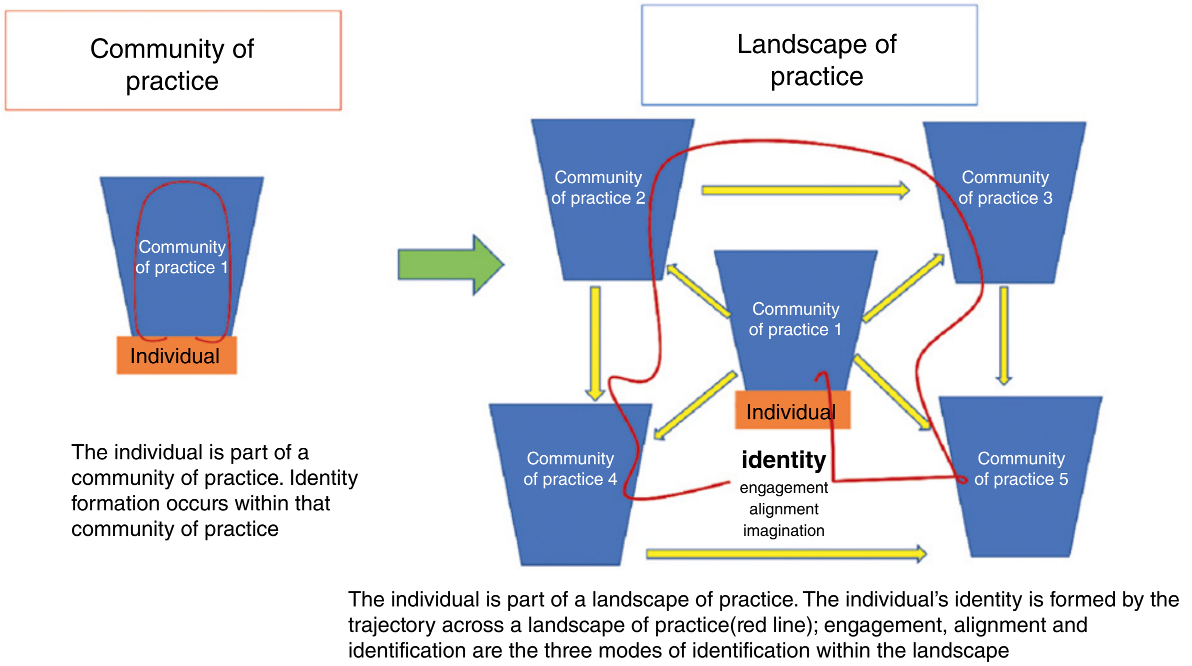

Figure 21.2 Individual and identity formation in a community of practice and in a landscape of practice

of self-efficacy in medical students' education. Here are few examples. Self-efficacy was found to be inversely related to anxiety among second-year medical students[40] and struggling medical students reported lower beliefs of self-efficacy.[41] In another study, medical students' research self-efficacy perceptions were used to evaluate a research curriculum designed for potential future physician investigators. Students' ratings of confidence in performing research-related activities were higher among graduating students exposed to the curriculum compared to matriculating students.[42] The relationship between feedback and self-efficacy has also been an object of interest. Van de Ridder *et al*.[43] showed that receiving positively framed feedback vs negatively framed feedback led to an increase and decrease, respectively, of self-efficacy scores among medical students performing a physical exam task. Similarly, negative corrective feedback was associated with a decrease in self-efficacy among students engaged in diagnostic reasoning.[44] Finally, a recent review confirmed a growing number of self-efficacy studies in medical students in the last decades; however, nearly half of the studies used measures that were incongruent with self-efficacy theory and construct.[45] Future research should implement designs and use measurements that are better aligned with the theoretical and conceptual tenets of the self-efficacy construct.

Communities of practice

A CoP framework may provide a useful lens to facilitating performance in complex systems such as residency and fellowship education, which are made of many interconnected parts. Green *et al*. describe the effort of an internal medicine community of practice to develop a framework based on ACGME competencies of developmental milestones.[46] In addition, a community of practice can be created to foster research skills in medical students. MacDougal and Riley[47] gathered information from research supervisors about identifying key factors in the creation of a CoP among students involved in research during their undergraduate medical school curriculum. Supervisors reported that connecting students with others and fostering self-efficacy in research skills were critical in initiating students into a CoP, where research skills and the practice of research were the main 'craft' of that community along with the culture, the activities, the social interactions and the environment of that community. Thus, mutual engagement, participation and mutual accountability are essential for the integration of students into such CoPs.

Another application of CoP relates to the use of technology to support and sustain such CoPs. Hoadley and Kilner[48] identified four techniques by which technology can support these communities: linking members who share similar practice, providing access to a common repository of information, supporting synchronous and asynchronous conversations within the community and providing the context of shared information resources. For example, educators and students with different levels of experience from different institutions can connect, communicate and learn from each other about shared practices through the use of technology. Technology can help shape the CoP in which knowledge is utilised by groups in shared practices.

Landscapes of practice

Given the continuum of the education process, and the variety of different contexts in which physicians train and operate over time, landscapes of practice provides an important lens to explore and further understand professional identity formation.[49,50] The construction of identity reflects the journey across the landscape and, eventually, 'our identities come to embody the landscape through our experience of it'[39] (p. 20).

There are three modes of identification within a landscape of practice:

1. engagement in the community and exploration of boundaries;
2. imagination, a process to understand who we are in the landscape and who we could be in the future; and
3. alignment which entails identification with the key community they are in (e.g., healthcare, education community), and also with relevant yet more distant communities within the landscape.

For example, Marie is a medical student starting a new rotation in an inpatient setting. She begins to engage in the practice by gathering a history and physical exam data from patients, interacting with teaching faculty, communicating with nurses, discussing patients with other members of the inpatient team. She then uses her imagination to create an image of who she is within that setting, thinking about other students in the same setting, observing faculty role models, sharing stories of previous educational experiences with peers, thus visualising not only who she is now, but also who she might become several years from now at the end of her training.[51] This process can be supported by a series of artifacts such as stories of cases, pictures of health professionals and role models that she can find in the world around her. However, Marie's engagement and imagination into the practice can't fully occur without alignment with the context. Marie understands the unwritten rules of being a medical student within the system, is aware of her position in the hierarchical structure of the unit and is cognisant of a moral code that extends beyond the specific inpatient setting she is part of it. These three modes of identification can potentially all contribute to the formation of Marie's identity in the landscape of practice in which she operates.

Balmer *et al*.[52] described how physicians enrolled in a master education programme navigated landscapes of practice. The authors found that learners navigated their landscape of practice by shifting the three modes of identification over time: alignment with educators outside their community of practice, imagination of who they were going to be in the future and engagement with multiple educational communities allow them to navigate and find their learning trajectory through landscapes of practice. In another study of medical students, Adema[53] found that engagement was the predominant mode of identification among medical students in the process of identity formation through landscape of practice. Engagement in practical tasks related to patient care while interacting with physicians, and peers, was critical in the formation of professional identity. In today's complex, multi-faceted and constantly evolving healthcare and health professions education settings, the theoretical tenets of landscape of practice can inform the research and shape the process of professional identity formation of future physicians.

Distributed cognition in group learning, technology and decision-making processes

Distributed cognition can be applied to a number of healthcare education topics: learning methods, such as problem-based learning (PBL) where the cognition is distributed among the students of the PBL group; distributed cognition to help better understand the interaction between teachers and/or students and technology; and cognitive processes distributed across physicians, nurses and other staff.

In PBL, cognitive properties of distributed cognition can be found in different steps of the PBL process: the activation of prior knowledge by each individual, the setting of objectives in relation to the problem involves the sharing as well as the coordination and interaction of each individual cognitive property with the context in which they operate. The self-directed study followed by the report to the group is another activity where the individuals bring to the group their own knowledge and skills and their own interpretations of experiences, which can contribute to create a system of distributed cognition aimed at problem-solving.[54]

Because one of the tenets of distributed cognition is that cognition is embedded in the environment and involves the coordination between internal (e.g., attention, memory) and external (e.g., objects, material) structures, technology can play an important role in a distributed cognition approach. For example, the use of Electronic Medical Records (EMR) may be important to foster coordination among team members, create automated checks for errors, share and distribute information and help in the flow of information to develop a system of distributed cognition that may ultimately enhance system-based practice and provide better care for patients. The support of technology can help identify breakdown or problems within a system of practices of an engineering company.[55,56] A similar approach could be used to examine the medical practices of a clinical and educational system (e.g., entire medical school or an intensive care unit).

Conclusion

Social cognitive theory allows a better understanding of individual and distributed cognitive processes linked with the numerous components provided by the social context. It emphasises the importance of situatedness, or the location of thinking and learning in the specifics of a given event to include culture, the community and interactions with others and the environment. Being familiar with the features of SCT can therefore help educators and their learners gain a better understanding of how to think, teach and learn in such complex environment. Future research may focus on deepening our understanding of what and how sociocultural factors play a role in the cognitive processes that affect learning, teaching and performance in the healthcare professions.

Practice points

- Social cognitive theories (SCTs) propose that learning and performance are social and are influenced by reciprocal interactions between persons, behaviours and environments.
- Bandura championed SCT with his framework of triadic reciprocality – the interactions between behaviours, personal factors and the environment – which underpins many SCTs.
- A landscape of practice consists of a complex system of communities of practice, that shapes professional identify formation.
- SCTs differ from individual cognitive theories such as information processing theory through emphasising the importance of the environment and social interactions in addition to the individual (e.g., physician).
- SCTs provide a framework for understanding and to study cognitive processes that occur in the various social, cultural, material and historical contexts of healthcare professions education nowadays.

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22 Learning and participatory practices at work: understanding and appraising learning through workplace experiences

Stephen Billett, Linda Sweet and Christy Noble

Jack (a final-year medical student) reflected on his experience of learning in clinical settings: 'depending on the team you're connected to, the medical students can have zero role or you can start to provide some input'. He identified one surgical team as exemplary: 'With that team, the good thing was that they were really quite accommodating, much more than any other team that I've experienced throughout my two years of clinical years . . . I was able to go up to more of an intern position. I was able to write the notes, prepare the notes, ready for the actual ward round, and I was also able to look through the notes a little bit quicker than what they can do on the big screen and just get the information. The beauty of that was also because it was so comfortable in there, I was able to actually speak up and provide some input as well. Which is actually – I haven't done too many times.'

Learning through healthcare practice is as longstanding as healthcare occupations themselves.[1] However, the risk is that this process becomes taken for granted, and not considered and enacted in ways to optimise its potential. To address this concern and to enhance these processes of learning and working, in this chapter we exercise the concept of participatory practices at work. This conceptualisation offers an explanatory account of the interdependence between working and learning, the contributions of workplace activities and interaction and how their efficacy for learning can be realised through clinical work. It is founded on the duality between what the physical and social contributions of clinical settings afford in terms of opportunities for working and learning, on the one hand, and how students and healthcare workers take up that opportunity, on the other.

After explaining this concept, we illuminate and elaborate on its enactment through two case studies exploring: 1) pharmacists and doctors co-working and learning, and 2) final-year midwifery students employed as undergraduate student employees.

Exploring practices from this theoretical perspective assists identifying how to enhance the educational potential of clinical experiences. In all, the intention of this chapter is to enable the readers to:

- conceptualise learning through work as a duality between what is afforded by clinical settings and individuals' engagement with them;
- evaluate how the kinds and qualities of experiences being provided shape that learning and is influenced by their learning;
- identify how individuals' engagement with affordances shapes the qualities of working and learning; and
- apply these concepts to curriculum development and educational research.

Key conceps, definitions and distinctions

Participatory practices at work refers to the duality between what experiences are afforded by social institutions (e.g., hospitals) and practices (e.g., specialities, professions) and how individuals elect to engage in, and learn through, those practices.[2] Here, the focus is clinical settings as sites of working and learning, yet it can extend to other places where students and clinicians come to engage in healthcare activities and interactions. Individuals' engagement in these activities and interactions is premised on their readiness (i.e., clinical knowledge), subjectivities (i.e., how they view themselves), their intentions (i.e., how they direct their cognition) and what they value about what is afforded to them. So, whilst affordances such as workplace activities and interactions can be viewed as invitations to participate and learn, they are not objective or fixed. There is no guarantee that these invitations will be engaged with uniformly by those learners, nor that they will take up the invitation as intended.

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Indeed, what is encountered in an educational programme will be construed quite differently and with distinct learning outcomes depending on individuals' capacities, intentions and interests, all of which shape their process of experiencing (i.e., how individuals construe and construct what they experience).[2,3] Those invitations (i.e., affordances) can variously be welcoming and engaging, or restrictive, resisting or excluding individuals' participation. Experiences perceived to be uninviting can lead learners to not participate fully. They might 'hover in the background' or 'go to the library for independent study', while positive invitations can encourage effective learner engagement. So, what one individual might perceive as being helpful supervision, another might view as interference, and a lack of close supervision might be viewed as abandonment by one trainee, but an opportunity to practise independently by another. Therefore, the construal and constructions of what is afforded is, in part, premised on personal bases and factors. On the other hand, each clinical setting has situationally specific practices and affords particular kinds of experiences with which individuals engage and enact. That engagement is central to sustaining the practices of the healthcare setting and/or transforming them as/when circumstances change.[4] Hence, there is an interdependence between individuals' learning in and through those experiences and those practices needed for that learning to sustain and advance them.

Emphasising this interdependence and its relational qualities is important, as many contemporary conceptualisations about clinical learning privilege the contributions afforded by the immediate physical and social environment in which learners come to think and act, over those of individuals (e.g., students, healthcare practitioners) who are the meaning-makers. This privileging has predominated through conceptions such as communities of practice,[5] situated cognition[6] and activity systems.[7] (See also chapters by Torre and Durning, Johnston and Reid in this book.) These perspectives have as their starting point the social world, its suggestions and impact on thinking and acting. Yet, by degree, these perspectives have not accommodated human subjectivities and intentionalities as mediating what the social world suggests, including its rebuttal.[8] However, other perspectives, such as those from cultural psychology,[9] emphasise reciprocity between social and personal contributions to human learning and cultural development, and its relational qualities. They acknowledge reciprocity between social institutions and the knowledge they generate and project and the means of those affordances, on the one hand, and individuals taking up, construing, constructing, using and extending this knowledge, on the other. It is this duality between what the social world affords and individuals' engagement with it that is so central to the concept of participatory practice as a basis to understand the relations between work and learning.[10] This is viewed as the active re-making and transformation of culturally derived practices, such as medicine, midwifery and pharmacy, through individuals' participation and learning. Indeed, the existence and continuity of social institutions (e.g., hospitals) or socially derived practices (e.g., medical work), and how they evolve over time, are premised upon individuals' engagement in re-making and transforming occupational practice through their work. Furthermore, reciprocally, learning contributes to the trajectory of workplace practices. Hence, these social and individual contributions cannot be considered in isolation.

It follows that what constitutes healthcare practice requires the active engagement in re-making and transformation of those practices through individuals' engagements with them. These processes will not be enacted uniformly as they differ due to circumstantial factors and also how these factors are projected by the social world, as this is rarely unequivocal, without ambiguity or even uniformly projected.[11] Importantly, individuals' experience (i.e., their construal and construction of what they experience) is a product of individuals' unique personal histories,[10] the legacies of which are their personal epistemologies (i.e., what they know, can do, value and how these are exercised). These personal epistemologies are described in more detail in Box 22.1.

BOX 22.1 Personal epistemologies

Central to understanding how individuals engage with the world 'beyond the skin' and learn is the concept of personal epistemologies. This comprises the basis for how individuals come to construe and construct knowledge from what they experience.[12] It comprises what they know (i.e., conceptual), can do (i.e., procedures) and value (i.e., dispositions), and how this is exercised (i.e., intentionality). There can be no certainty that experiences that are the product of social suggestions (e.g., healthcare norms, forms and practices) will generate a uniform response or outcome from those experiencing them. For instance, in one study, many medical students reported finding the clinical experience with orthopaedic surgeons to be confronting, difficult and demeaning.[13] Most students reported that they perceived that these surgeons wanted to make life difficult for the students and dissuade them from considering surgery as a specialisation. However, one student – a mature female – while conceding that the surgical environment could be potentially difficult, noted that not all students were adequately prepared, careful, nor considered in their engagement in operating theatres and with surgeons. Therefore, while there was evidence of a common or potentially objective experience, it was not uniform across the student cohort. This illustrates that it is the interplay between the social world affordances and individuals' engagement with these that is central to understanding learning in clinical practice and its re-making.

Drawing on interview data from two Australian studies including: 1) doctors and pharmacists and 2) midwifery students, the concept of participatory practice is used to illuminate, elaborate and appraise the processes of engaging in education programmes, learning through participating in those programmes and the kinds of learning arising through clinical experiences. Some learners' experiences and accounts of the consequences of these experiences for their learning are elaborated in this chapter, interpreted through the lens of participatory practices. We start by outlining the salience of learning through clinical work.

Learning through clinical practice

Healthcare education has always included extensive periods of clinical practice,[14,15] hence it is helpful to understand their potential to support learning and also the development of healthcare practices. As far back as Hellenic Greece, medical students were positioned as assistants caring for patients[16] and learnt through an apprenticeship model.[17] These clinical experiences are central to initial preparation of healthcare practitioners and in assisting them to identify the preferred specialisation they would pursue and their preparation for it.[18]

Most of the knowledge required by healthcare practitioners arises from the social world (i.e., history, culture, interactions between people, etc.) as is its manifestation in the specific requirements of healthcare settings.[19] Acquiring this knowledge, therefore, necessitates engagement with socially derived sources beyond the individual, such as exposure to and engagement with occupational norms, forms and practices.[20] These can be accessed through texts, such as policies and practice guidelines, observing the behaviours of other practitioners and students (e.g., how tasks are distributed), or through communications and handover of care.[21] It is the contribution of these kinds of participatory practices that can make accessible the occupational knowledge novices need to acquire via observation, imitation and practice, referred to as mimetic learning.[22] The contributions of these practices arise from them being seen as institutional or social facts[23] and derive historically from healthcare disciplines whose starting point is the social world and its contributions, as manifested in the specific circumstances of their practice (e.g., patients, conditions and facilities) and participatory practices (i.e., activities and interactions). Together, these contributions comprise the suggestions or affordances of the social world that are important to explain the experiencing and learning of the canonical knowledge (i.e., that knowledge all healthcare practitioners would be expected to possess to practise their occupation), and the specific manifestations of how this knowledge is practised, understood and valued situationally.

These premises have, more broadly, led to theorising about the contributions to individuals' learning from the activities and interactions provided by educational programmes, including in clinical settings. Hence, considerations of these contributions and how individuals can access and engage with them have become a focus for improving educational practices, and the importance of practice-based experiences.[24,25] This is linked with an increased emphasis on quality assurance throughout healthcare education over recent decades.[26,27]

So going beyond taken-for-granted experiences to enhance the quality of educative experiences in clinical settings, it is important to identity what kinds of experiences contribute to the development of occupational competence and situational expertise. Experiences such as engaging in clinical activities (e.g., ward rounds, bedside teaching, meetings with experts and peers) can be considered in terms of how and what they afford learners and on what basis they can and do engage. In other words, how they welcome or conversely exclude and marginalise learners, and play out in person-dependent ways. Individual characteristics such as gender, class and ethnicity may play roles in the opportunities afforded to learners,[28,29] but other bases of engagement are those associated with how individuals elect to take up the invitation(s) that is afforded them.[13] That engagement might vary from being wholehearted participation, or selective, or doing so in superficial ways to meet the needs of compliance (such as attending a lecture because attendance was compulsory, but spending the session checking email).

Wertsch[30] differentiates the types of engagement as mastery and appropriation. 'Mastery', used in this context, refers to mastery of a skill or task without appropriating it into one's professional practice and sense of self. Indeed, mastery is a process of superficial engagement to meet the demands of others, while not believing that such demands are worthwhile. The legacy here is learning outcomes that are superficial that would not be exercised outside of circumstances of close supervision. 'Appropriation', on the other hand, is the effortful engagement by individuals, because what is being experienced or suggested is taken to be important and worthwhile. Wertsch's[30] construct of appropriation refers to acceptance, and even embodiment of a skill or task into one's professional practice and self. Engagement, which results in appropriation and accepted internalisation by learners, is likely to lead to more focused learning outcomes because it is underpinned by personal commitment. The example of handwashing is illustrative here. Healthcare workers who have appropriated the importance of regular and thorough handwashing are more likely to engage in this task without the need for reminders or monitoring. However, workers who do not really believe it is important – who have mastered (but not appropriated) the requirement to wash their hands, may be less likely to do so unless they are being prompted or monitored. Therefore, it is individuals who elect whether they engage in mastery or appropriation, based upon what they know, can do and value, with distinct and personally premised consequences for their decision making and learning.

Yet, as with affordance, the personal process of mastery and appropriation is conditional and can be variously productive or limiting. Individuals might well engage in the mastery of something that would benefit from critical appraisal. Equally, individuals might appropriate knowledge that is flawed or false and then base their practice on incorrect assumptions (e.g., handwashing obviates the need for other preventative measures). To illuminate and elaborate participatory practices at work in healthcare settings we provide examples and cases.

Investigating participatory practices in healthcare

The data described and analysed in the following case studies were secured as part of two qualitative projects that captured data about 1) junior doctors, consultants and pharmacists co-working, and 2) midwifery students' perceptions of their learning experiences on traditional placements, and those when employed as undergraduate students of midwifery. Qualitative approaches, study designs and data collection methods (see chapter by Cleland) were adopted to explore students' motivations, actions and strategies in relation to particular aspects of learning, and to engage with these learners' narratives to secure validated knowledge of their experiences and learning. Ethical approvals for these studies were secured from host universities.

Case study 1: junior doctors and pharmacists' co-working and learning

In this case study, we explore pharmacists' and doctors' participatory practices related to prescribing. In hospital settings, pharmacists and doctors routinely work together to ensure safe prescribing. The prescription is the common artefact (see chapter by Johnston and Reid also). Doctors tend to write the prescription and pharmacists tend to review the prescription (e.g., hardcopy medication chart or e-prescription) to ensure it is appropriate for the patient. For junior doctors entering new clinical settings, mastering the art of safe and effective prescribing is challenging. They often feel underprepared for the task and so prescribing errors can be frequent (e.g., incorrect dosing, contraindications).[13,31]

Strategies to support junior doctors learning about prescribing tend to use formal education processes (e.g., e-learning modules; teaching sessions).[32] Given the complex nature of prescribing practices, we explored participatory practices related to prescribing to identify ways to enrich junior doctor prescribing learning. To achieve our aim, we interviewed key stakeholders including consultants, junior doctors and pharmacists, and based on these findings, identified strategies to enhance prescribing learning.[33,34] A key strategy identified was interprofessional co-supervision, whereby the supervision of and facilitation of prescribing learning was shared between consultants and pharmacists (i.e., co-working and learning).

In the following sections we outline the key findings from these interviews including:

- existing prescribing practices, and
- strategies to remake and transform prescribing practices.

Existing prescribing practices

By interviewing the key stakeholders involved in prescribing practices, using participatory practice as a theoretical lens, we identified the ways each stakeholder group engaged with the practice and the affordances of this practice. For the junior doctors, we found they were learning to prescribe by being actively engaged (e.g., writing up prescriptions). Yet they were largely being told what to prescribe by the consultants and registrars. Over time, they mimicked the consultant's preferences for medications, and adopted these as part of their routine prescribing practice (i.e., mimetic learning).[22] There were few opportunities for them to make independent prescribing decisions. For example, '*. . . sometimes I still feel that at the level of internship when you're fairly heavily supervised and a lot of prescribing is decided upon by someone else and you're just carrying out the prescribing, that you don't necessarily learn as much as if you were making the decisions yourself*' (Junior doctor 10). The risk with this form of engagement was that junior doctors' understanding of prescribing practices was superficial and reliant on close supervision (i.e., mastery engagement rather than appropriation).

The consultant participants confirmed that they lead the prescribing decisions and reviewed prescribing by checking the medication charts whilst on ward rounds. Some consultant participants indicated that prescribing supervision was not ideal as they were focused on clinical decision making and were not reviewing other aspects of prescribing, such as legal and funding matters and other prescriptions, such as discharge prescriptions. For these aspects, they were very reliant on the pharmacists' supervision and review.

Several consultants noted that they assumed that the junior doctors would ask for help if required. In contrast, the junior doctors indicated that asking for help with prescribing within the medical hierarchy was challenging. For example, they did not want to bother time-pressured consultants and found it difficult to admit they did not know something. All junior doctor participants stated that they sought advice from the pharmacists when prescribing.

For the pharmacists, they engaged with prescribing practices by reviewing prescriptions and would interact with the junior doctors when they identified a prescribing error. In the main, the consultants were not aware of these interactions. Pharmacists acknowledged that they were supervising aspects of prescribing not supervised by the consultants (i.e., the legal and funding aspects along with the discharge prescriptions). Overall, the pharmacists' development of junior doctors' prescribing skills was not systematic or planned. For example, '*. . . it's [prescribing supervision] often very much on an ad hoc basis on the go, because it's often just because something was done incorrectly that you're then having to go and fix the error and explain the reason why it has to be like this or that*' (Pharmacist 1).

Both junior doctors and consultants acknowledged the pharmacists' contributions to medication safety yet lacked an understanding of their role. One explained, '*I think our pharmacists – behind the scenes they go and see every patient that we admit, then they have a chat to them. I assume if we do everything pretty well, they don't really come to you with many problems [sic]*' (Junior doctor 5). Because of this lack of understanding, junior staff sometimes felt that they were bothering the pharmacists when they asked for help even though all the pharmacist participants indicated that this was part of their role to support the junior doctors in their prescribing. One junior doctor explained,

> *I like the help they're [pharmacist] giving at the moment, but for me, I feel like I'm bothering them and taking them away from their actual role. I feel like [pharmacist name] is almost babysitting us a little bit with our scripts, particularly initially; not so much now. I felt a bit bad that I was dragging him away from his jobs and slowing him down and him having to come back and say look, X, Y, Z probably need to be changed. So, I think if I knew that there was a part of their role like that, I'd feel more comfortable. (Junior doctor 2)*

In summary, prescribing practices were somewhat fragmented with consultants not being aware of communication between pharmacists and junior doctors. The contributions pharmacists made to supervising junior doctor prescribing were valued; however, they tended to be reactive and not focused on progressively supporting prescribing learning, as in scaffolding.[35]

Strategies to remake and transform prescribing practices

With these considerations in mind, participants then explored a model of interprofessional co-supervision (i.e., pharmacists and consultants) with the goal of collaboratively developing junior doctors' prescribing learning. It was found that formalisation of pharmacists' supervisory role would allow them to shift from reacting to errors to one focused on facilitating junior doctors' prescribing learning. However, all groups, including the pharmacists, reported that pharmacists should remain within their scope of practice (e.g., reviewing prescribing and not assessing diagnostic ability).

The participants all indicated that the underpinning philosophy of practice for this interprofessional co-supervisory model should be focused on improving patient and medication safety through supporting junior doctor development as prescribers rather than being assessment focused. Pharmacist 7 said, '*Yeah I think in a supervisory role it's a little bit different because you're helping that person to sort of engage and learn how to do it on their own and then have them hopefully teach others those good behaviours as well.*'

It was reported that this approach would assure a unified and collaborative purpose. For example, '*If it's – like, ultimately we're talking about patient safety. So, if it's going to be helping patient safety, well, then ego should never get in the way. . . Say it's just part of patient safety. I think ultimately – I would rather a pharmacist tell me that my handwriting was a bit illegible, or I wrote the wrong dose, or whatever, than have someone die from it*' (Junior doctor 4).

In terms of how the interprofessional supervisory model should look, all participants reported that the role should be taken on by senior pharmacists. That is, those who had established their own professional identities and expertise within a particular clinical setting. These pharmacists should have a strong and collaborative working relationship with the consultant team, that is, already accepted into the clinical team. The consultants should introduce the concept to the medical team to assure junior doctor buy-in.

It was acknowledged by all participants that work patterns should be examined to ensure that pharmacists were able to attend ward rounds, as this was when decisions were made about prescribing. Previously, pharmacists were not consistently attending ward rounds, and this was felt to be impeding active engagement with the clinical team and, thus, supervisory opportunities and responsibilities, whilst also not being part of the decision-making aspect of the prescribing process. Finally, given the hierarchical nature of prescribing, the junior doctors were concerned that they could potentially be 'assessed' by the pharmacists on decisions which had been made by the more senior medical team and reported that this needed to be addressed when implementing the co-supervision model.

The detailed exploration into prescribing participatory practices allowed us to understand how the key stakeholders engage with prescribing in different ways as well as the invitational qualities of the practice. Importantly, these perspectives allowed us to find ways to enhance the engagement of pharmacists through a model of co-supervision whilst enhancing the invitational qualities of the practice for junior doctors.

Case study 2: midwifery students' clinical learning

Australian midwifery students, regardless of their entry-to-practice programme (i.e., through Bachelor, Graduate Diploma or Masters degree) are required to undertake clinical placement to meet the minimum practice experiences as set out in the national standards. Students are required to undertake clinical placements and engage with a minimum of 10 pregnant women for Continuity of Care Experiences from early pregnancy to postpartum.[36] Whilst for most midwifery programmes, students are supernumerary during their clinical placement, there are a small number of Graduate Diploma programmes for Registered Nurse (RN) entrants where they can be employed as a midwifery student in some clinical areas and become supernumerary for others. In 2021, a trial of employing Undergraduate Registered Students of Midwifery (RUSOM) was undertaken in a large Australian tertiary hospital. RUSOMs are required to be final year (non-RN) midwifery students and are employed on a part-time contract of a minimum of 6 hours per week. They are allocated to specific wards, with nominated unit managers and clinical midwife educators for support. All students were required to apply for leave from university commitments so that this employment did not affect their studies. During their shifts, RUSOMs are not allocated specific women, but are rather a roving assistant able to provide care to any woman or assist any midwife and have a fixed list of tasks they are permitted to undertake.

A mixed methods study was undertaken to evaluate the RUSOM role, how it was experienced by staff and women, and its impact on quality of care. Nine qualitative focus groups (n = 41) and three descriptive surveys (n = 135) were conducted. This case study presents the qualitative accounts of learning through participatory practices, affordances and engagement between traditional clinical learning and learning as a RUSOM and highlights similar findings in relation to mastery and appropriation as demonstrated in Case Study 1.

Clinical placements

The RUSOM employees reported applying for these positions to secure '*extra experience*', to help make them more '*job ready*' and '*employable*' upon graduation, assuming the '*extra experience will be invaluable for sure*'. As one student explained in her programme, '*I find it so hard going back to [midwifery] placement, like I don't have any placement work for a year*.' Similarly, another student stated, '*I find that with placements, you do a placement and then you're back in the university again and you're doing all the theory stuff, and then you feel a little bit removed from the hospital environment. So, I thought this would be good to have the continuity as well during the year*.' Continuity of education (or lack thereof)[37] in traditional placements was recognised as a reason for becoming a

RUSOM, as one said, '*I find on placement it's a different midwife every day so you're back to the start of being like what your role and capability is as a student*.' When achieved, continuity of education on traditional placements was reported as providing positive affordances, as one RUSOM said, '*some of the staff . . . they know me, so it's more like . . . "oh I know you can do that so its fine you can go off and do it"*'. Continuity of education during clinical placements is not common in midwifery programmes, but may offer enhanced clinical affordances, which can engage students more actively in their learning.

During their course-organised placements, the RUSOMs reported they did nothing other than '*follow the midwife around*', learning new skills and rushing from one task to another, with a midwife '*looking over their shoulder*' all the time, ensuring they performed in the manner of the midwife – suggestive of mimetic learning.[22] At times, students described only being allowed to observe the midwifes' practice. The focus of these placements was achieving the required minimum amount of clinical experience. Yet, students who undertook the RUSOM role reported that learning in this role was productive and very rewarding.

RUSOM learning experiences

Midwifery students spoke of the conceptions of appropriation in their RUSOM role, predominantly as they were afforded the opportunity to provide care independently under indirect supervision of the midwives. As they were not allocated individual women to care for, they could choose tasks within their scope and offer to assist women and midwives as available, problem-solving and reporting concerns to the midwives. One said, '*I just kind of assumed that it would be like placement, but we're more of an independent practitioner*', and furthermore, '*I think the difference is that we can work independently. Whereas, as a student you need like almost that constant supervision*.' The RUSOM role enabled them to build their confidence; '*definitely, so far as building that confidence, and I've even found just even responding to buzzers on the ward, going in, you just feel so much more confident in the ability to kind of build that rapport with the women quite quickly I think*.'

The RUSOMs recognised that their role enabled them to hone key midwifery skills such as breastfeeding support, baby bathing, parent education and communication skills as they often repeated these tasks with different women and families, as they had more time with women than afforded on their placements. Having a defined task list was also supportive, and the midwife and RUSOM knew their scope of practice. One said, '*the midwives have really understood our role and everything we're capable of, like the breastfeeding support, formula demos, stuff like that . . . [which] helps us with our skills communicating, just having that extra time as a RUSOM because you don't have that client load waiting*'.

The social norm of wearing staff uniform in place of their student uniform was also reported as being affirmative of their role in the team. One explained, '*I feel really appreciated in my role, it's a very different feeling from being on placement as a student, you feel wanted, and needed . . . I felt very welcomed and part of the team*.' Similarly, '*I have never felt so wanted by midwives as compared to being on placement as a student. I feel good when I am able to help out as it's really rewarding*.' The sense of belonging and being valued increased their engagement with the clinical affordances, even though they were limited in scope compared to when on placement as a student.

As the role continued over time, RUSOMs reflected that having continuity of their work experience in comparison to short blocks of student placement allowed them to develop and refine their skills. One said, '*I think it does come back to that continuity as well. . . I feel [as students] we do get plenty of experience, but it's all bunched together and then you've got a big break in between, so this allows us to maintain our skills throughout the year*.' The RUSOMs acknowledged the support they received from midwives, educators and managers. They also reported that they were always responsive to their questions and helped them to understand the requirements of their roles and supported their learning.

The RUSOM role was seen as having reciprocal benefit for the students, midwives and the birthing women in their care. The students explained that having time with these women was one of the greatest benefits of the role, giving them further opportunities for learning, developing their skills of communication, education and empathy. It offered them the opportunity to provide women with extensive emotional support and fully experience the midwifery philosophy of 'being with woman'. Building confidence and developing a sense of professional identity were outcomes of engaging in the RUSOM role. That confidence building was facilitated by perceiving that they were part of the team and were able to practise autonomously. The sense of appreciation from staff and women and the provision of support from managers helped to build their confidence. One student said, '*I think something that I've learnt is just how to be an independent practitioner, and it's very different to being on placement where you're constantly under the watch and supervision of somebody else . . . I actually think I work better, and*

I interact better with women when I don't feel the pressure of eyes constantly on me.'

What has been discussed above is the salience of student readiness for learning and the affordances provided. Offering some opportunities for independent practice within the learners' scope of practice promotes appropriation and deep learning whereby they embody the profession within themself. This can be achieved with continuity of education through familiar contexts of practice or familiar supervision, or by continuous exposure to the workplace, such as in the RUSOM role.

Advances, cautions and limitations

A focus on participatory practices in clinical work brings with it limitations and strengths. In terms of learning through participation in social practices, albeit in the clinical or educational settings, there will always be the risk that what is observed, engaged with and practised can lead to the reproduction of inappropriate, dangerous or unhelpful practices. Incidents in the United Kingdom (for instance,[38]) demonstrate that when poor practices become the norm, these can easily become replicated across the workforce and over extended periods of time. Yet, even in these situations, those who are learning and participating make decisions about how they progress, and when confronted with some behaviours and practices, may well reject them. But the influence of organisational culture has an important influence on outcomes here.

Importantly, much of what is proposed here in terms of participatory practices is that which occurs through the everyday activities within healthcare settings. In other words, things have not changed much since the times of William Osler, who believed strongly that much of medical education occurred within and through authentic instances of healthcare practice. Here, rather than taking them for granted, an attempt has been made to explain, elaborate and illustrate the duality, which comprises the process of learning to be a healthcare practitioner through a consideration of participatory practices that are both interdependent and relational.

Finally, methodological advances such as video reflexive ethnography (VRE) offer a way to illuminate and optimise 'taken for granted' participatory practices.[39–42] VRE – a collaborative visual research approach – assists practitioners to learn about and change practice. It is conducted in three phases: 1) field observations; 2) video recording of practice and 3) reflexive sessions with participants viewing edited footage. The value of VRE is that it begins to capture the duality and offers a fresh perspective for practitioners to deliberate on and find ways to move forwards.

Conclusion

From the accounts presented and discussed above, what constitutes these medical and pharmacist practitioners' and midwifery students' working and learning in and through clinical settings experiences can be understood in terms of what they were afforded, on the one hand, and how they responded to them (their engagement) as participatory practices, on the other. These findings offer explanatory bases for considering the impact and outcomes of the experiences that constitute the curriculum of education programmes and learners' readiness to participate. Understanding the totality of these experiences in clinical settings, how learning arises from them and how those practices are themselves re-made and transformed, is premised on the interactions between the learners and affordances in the social world. Consideration of curriculum within participatory practices includes the ordering and enactment of experiences. All this leads to practical considerations about the organisation and enactment of learning experiences, and how these can be enriched and augmented through pedagogic practices, including the importance of preparing learners for, supporting their engagement in, and the helpful reconciliation of, what they experience in their practice settings.

These considerations include the following:

- Gauging the learners' levels of readiness to participate in practice-based activities and supporting that progressive engagement with close guidance.
- Optimising individuals' access to and engagement in authentic workplace activities based on their readiness to engage and learn productively within them.
- Providing opportunities for learners to engage in clinical practice incrementally based on their readiness, including clinical decision making and the ability to monitor outcomes of those decisions.
- The provision of opportunities to practise, refine and hone what has been observed and enacted.
- Progressive engagement in tasks of increasing complexity, with an adequate provision for practice and feedback.

Practice points

- Authentic learning experiences go beyond placing students in work settings; they also need to engage authentically in that practice in an appropriate way depending on their stage of training.
- It is important to consider the entire range of experiences that healthcare practitioners and students access and how their particular contributions can be effectively utilised in developing healthcare expertise.
- Even the most adept learners may need to be assisted in learning how to actively engage and learn during their practice-based experiences.
- Learners need some occupational capacities (e.g., skills) to be able to effectively engage in workplace tasks and active learning.
- Organising and enacting learning experiences requires considering both the kind of activities and interactions which are on offer (afforded to) learners, and the readiness of the individual learner to engage effectively.

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23 Health behaviour theories: a conceptual lens to explore behaviour change

Francois Cilliers, Christina St-Onge and Cees van der Vleuten

Consider the following scenarios.

1 *There have been several incidents of unprofessional practice by undergraduate students in your faculty, suggesting that the teaching of professionalism is not optimal. How would you evaluate and revise the teaching of professionalism to change student behaviour?*

2 *While you instituted a system for registrars to give feedback to consultants on their teaching two years ago, they complain that nothing has changed. When you meet with them, they give disturbing examples of consultants with approaches to teaching that are not helpful and whose behaviour has not changed despite feedback. How do you design an intervention to ensure that consultants respond to feedback from registrars?*

3 *Despite a strong antibiotic stewardship programme at your medical school and widely distributed practice guidelines, a recent study has revealed that only a small proportion of clinicians are following these guidelines. How would you design a continuing professional development (CPD) intervention to enhance the utilisation of guidelines in practice?*

Many researchers in health professions education (HPE) aim to understand and subsequently change human behaviour. However, human behaviour is the result of a complex interaction between personal factors and contextual factors and is not easy to change. Researchers in health behaviour have been exploring how these factors interact and lead to behavioural changes (or not). In this chapter we propose that a rich family of theories can be used by HPE researchers to understand behaviour and promote behavioural change.

What health behaviour theories offer to HPE research

Educational practice, faculty development and continuing professional development (CPD) aim to change behaviour, whether of students, faculty or practitioners in the field. In order to design interventions that reliably result in behaviour change, it is necessary to first identify determinants of behaviour change to understand *how* intervention I could cause outcome O.[1] Health behaviour theories (HBTs) incorporate causal elements that can be applied in HPE research to inform the development of research questions, to plan interventions to change behaviour, to interpret and explain observed behaviours and to evaluate interventions. A strength of these theories is that they have been used extensively to understand and influence human behaviour, providing a rich tradition of theory building and applied research to draw on, albeit not in the HPE field.

The origins of health behaviour theories

The application of behavioural science theory to health behaviour change dates back to the 1950s. Behavioural science theory harks from work on the psychology of human behaviour. HBTs have traditionally drawn heavily on this, while more recently incorporating insights from sociology. HBTs typically focus on the triadic relationship between intra- and interpersonal factors and the behaviour of interest, with or without consideration of the influence of the context, comprising concentric levels of environmental influence (Figure 23.1). HBT has since evolved into a broad set of theories (one review identified 82 theories[1]) focused at different levels: individual theories, interpersonal theories, organisation level theories and community level theories.[2,3] Some theories were developed to explain behaviour e.g., the theory of planned behaviour, others to guide behavioural interventions e.g., the transtheoretical model. Constructs used in each theory may be seen in other theories. What is specific to a theory is the set of constructs and their interrelations. HBTs started finding their way into HPE research in the 1980s (e.g., Montaño *et al.*[4]) but it was only after 2000 that increasing numbers of

Researching Medical Education, Second Edition. Edited by Jennifer Cleland and Steven J. Durning.

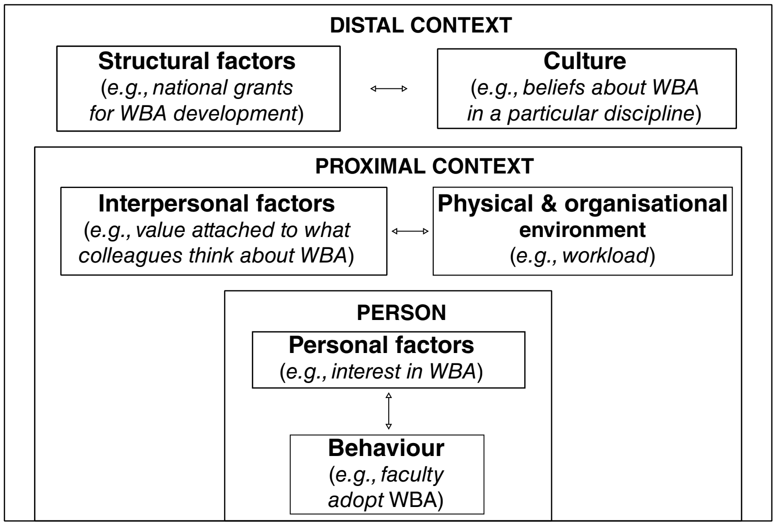

Figure 23.1 Framework for organising the relationship between factors at various levels that impact on behaviour. *Source:* Adapted from Eaton *et al*.[60] *For the purposes of illustration, examples are given in this and other figures and tables of how constructs might relate to a theoretical example of a project to research the adoption of workplace-based assessment (WBA) by faculty.*

researchers started turning to these theories. Various reviews now synthesise validity evidence for and critique different theories.[5–10]

Other fields also offer theories addressing human behaviour. From industrial psychology, transfer of training theory has to do with factors influencing whether people transfer what they learn in a training context to the workplace.[11] Triandis' model of social behaviour addresses factors such as habit, intention, motivation and facilitating conditions.[12] Critical realism offers a sociological perspective on human behaviour in context.[13] Game theory, developed in economics, has to do with decision making in conditions of interaction.[14]

For the purposes of illustration, five theories about individual behaviour and one example of eclectic use of theory have been selected to examine this further. Sections from the readings at the end of this chapter deal with a wide range of individual-level HBTs.[2,3,15] Self-regulation perspectives and social cognitive theory have also been used to explain health behaviour but are covered elsewhere in this volume (see chapters by Artino and colleagues, as well as Torre and Durning).

How HBT has informed HPE research

For each theory, a brief overview will be given (more detailed descriptions of the theories and their constructs are available in suggested readings at the end of this chapter). Examples of how the theory has been used in HPE research then follow. To illustrate how different theories can illuminate an issue in different ways, the figure illustrating each theory includes examples of how constructs might relate to a theoretical example of a project to research the adoption of workplace-based assessment (WBA) by faculty.

We begin with a theory that is conceptually more parsimonious and so simpler to operationalise than others.

Health belief model (HBM)

The HBM (Figure 23.2) conceives of individual behaviour resulting from the interaction between a person's perceptions of a threat to self, beliefs about the net gain to be had from behaviour that would obviate that threat and cues to action.[3,16,17] The level of *perceived threat* derives from the perception of *vulnerability* to an outcome and the perceived *severity* of that outcome. The expected *net benefit* of the behaviour has to do with the perceived benefits of the behaviour and perceived barriers to performing the behaviour. *Self-efficacy* has latterly also been incorporated by some as a construct in the model.[9, 6,17] It has also been suggested that there are various modifying factors affecting behaviour, including age, gender, educational attainment etc., but the influence of these factors has not been well characterised.[16]

The HBM was used to explore decisions about childbearing during residency[18] and was selected

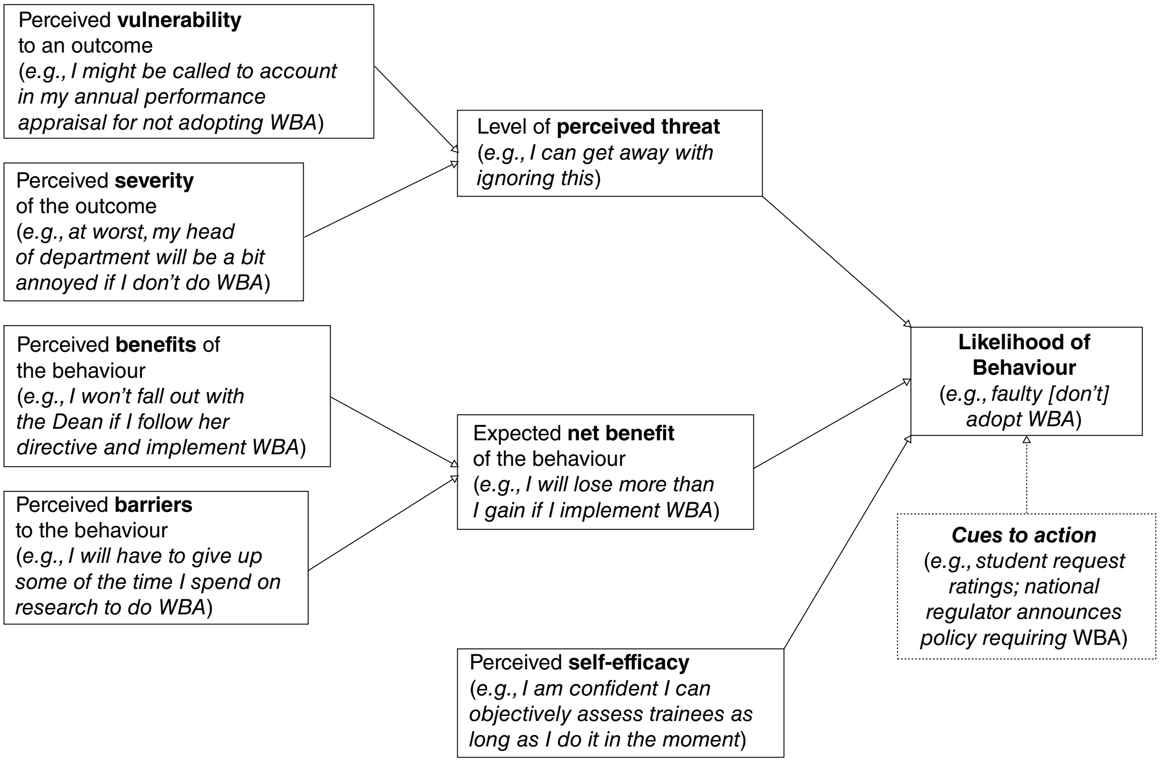

Figure 23.2 Health belief model. *Source*: Adapted from Skinner *et al*.[16] and Salazar *et al*.[17] and Prestwich *et al*.[15]

because pregnancy – planning to have children – was framed as a perceived career threat. The model was used to explain behaviour and as a framework to design a data collection instrument for a cross-sectional survey. Perceived susceptibility was largely considered to be the susceptibility to adverse career-related outcomes, such as an extended period of training, the inability to get a fellowship position or other adverse effects on the respondent's career. Potentially adverse pregnancy outcomes at a higher childbearing age were also included. Knowledge about the behaviour was considered to be knowledge about the relationship between age and pregnancy. Cues to action included awareness of certification requirements of medical boards and the leave policies of the residency programme. Using this model, it was demonstrated that two-thirds of the difference between the intention of women and men to have children during residency was mediated by the perceived threat to their career, much of which related to the possibility (threat) of increased residency duration. Given the complexities of human behaviour, a model that explains two-thirds of a difference is impressive.[19–22] These researchers also demonstrated that women registrars underestimated their susceptibility to subfertility and involuntary childlessness. The results are of value for those providing career counselling about residencies, offering the possibility of theory-based gender-differentiated counselling.

The HBM has also been used to explore the (lack of) use of frailty assessment by trauma providers.[23] The challenge being addressed was the lack of a widely adopted definition of and approach to assessing frailty. A researcher-designed questionnaire with quantitative and qualitative items informed by the HBM was used to explore how better to implement frailty assessments. Impact appraisal centred around the likelihood of working with a frail patient and the severity of the impact of frailty, while barriers included the material and psychological costs of implementing frailty assessments. Burdensome assessment tools were found to be a key barrier as was self-efficacy in the diagnosis of frailty, while awareness of the prevalence and severity of impact of frailty were not. The resultant discussion proposed that the implementation of screening by experienced employees other than physicians, like that done for alcohol use disorders, would appropriately address the challenge under investigation.

The HBM is best suited to issues where there is an element of perceived threat. We now turn to a group of theories that represent a progressively comprehensive evolution of ideas over time and which incorporate interpersonal and environmental factors not usually included with the HBM.

Theory of reasoned action (TRA), theory of planned behaviour (TPB), integrated behavioural model (IBM) and reasoned action approach (RAA)

This family of theories – and specifically the TPB – have been widely used in HPE research. The intention–behaviour nexus is a key relationship of the TPB, on the basis that intention is the best, albeit not great, predictor of behaviour. While a detailed consideration of the intention–behaviour nexus is beyond the scope of this chapter, there are reviews worth consulting.[15,20] *Attitudes towards the behaviour*, *normative beliefs* and *perceived agency* converge on and moderate *intention* (Figure 23.3). In the integrated behavioural model, additional factors such as knowledge and skills to perform the behaviour, the salience of the behaviour, environmental constraint and habit are also invoked.

The TPB was used to explore direct observation of trainees which, while an important component of clinical training, remains poorly utilised.[24] The focus on pre-behavioural intention is justified citing studies that correlate intention with behaviour. A rigorous five-step methodology tailored to the TPB was deployed, to conceptualise and operationalise the research. This included using guidance specific to item development for TPB, something typically approached more haphazardly in HPE research than in health behaviour research. The researchers did not allow themselves to be blinkered by the tenets of the theory, however, and made the case for including social pressure, modelling and past behaviour measures. They also drew on Bandura's work on self-efficacy to operationalise control beliefs. These decisions align with calls for more eclectic and

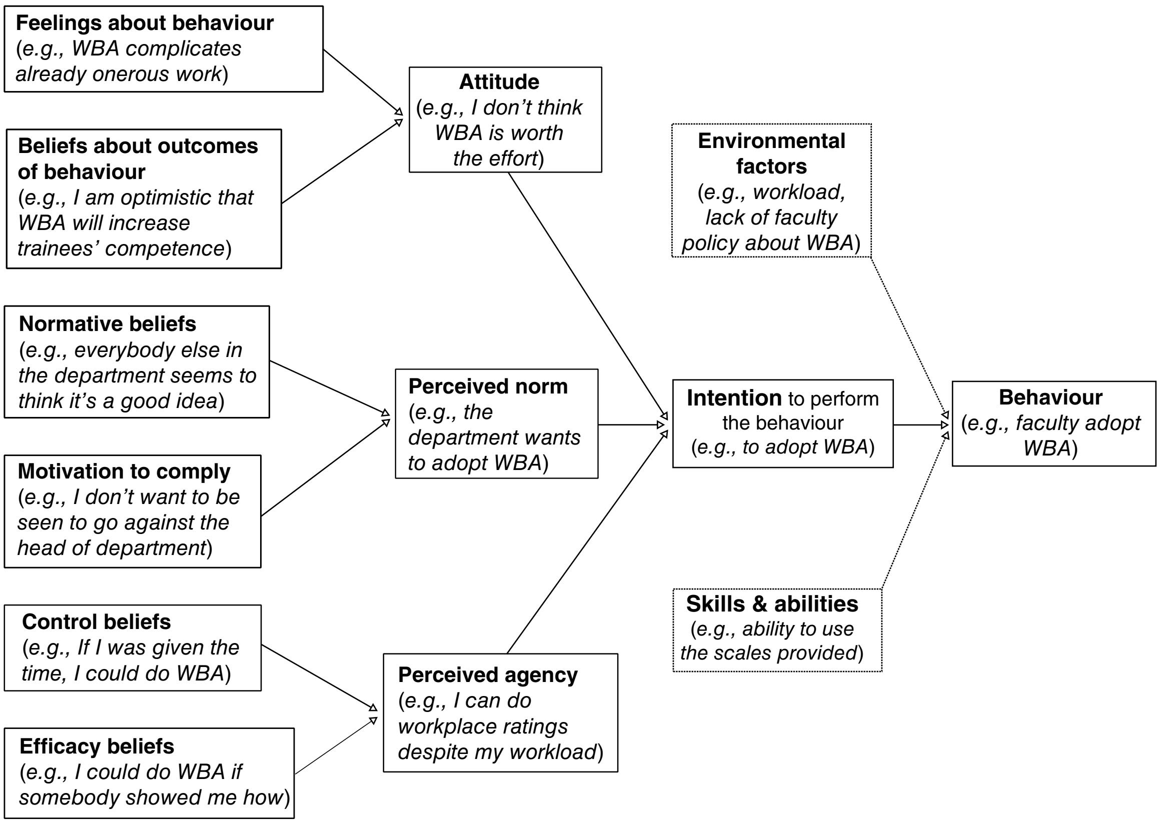

Figure 23.3 Theory of planned behaviour. Dashed lines illustrate some additional factors included in the integrated behavioural model. Adapted from Montaño and Kasprzyk.[61]

integrated use of theories.[2,3,15] The resulting model explained 45% of the variance in the behavioural intentions of supervisors. The researcher's extension of the model was justified by finding that in addition to normative beliefs (expectations of trainees, institute, co-workers, patients and fellow supervisors), past behaviour (how often their latest trainee was observed) was a significant factor in predicting intention to perform direct observation of a trainee.

The TPB was also used to study interprofessional education and shared decision making.[25] The focus was again on intention-formation, specifically intention to utilise shared decision making. In this case, an existing questionnaire based on the TPB was used as part of a mixed-methods study exploring the effectiveness of an intervention to enhance intention-formation. We mention this study because while most use of HBT in HPE research is sporadic, this study is one of a series of studies by a network of authors using different HBTs[26–32] to explore issues as diverse as research transfer, curriculum change and CPD for depression management and interprofessional practice.

The TPB is particularly useful when studying constructs that are 'hidden in the heads' of students or clinicians but underlie behaviour manifestation. The TPB offers an approach to understanding how these constructs interact and manifest in (more or less desirable) behaviour, through the formation and enactment of an intention. While the nature and manifestation of these hidden constructs must always be inferred from observed behaviour, basing these inferences on theoretical assumptions, like those of the TPB, is preferable to making inferences in a conceptual vacuum.

We turn now to the transtheoretical model, one of the so-called stages of change models. In contrast to the previous two models that aim to predict behaviour, the transtheoretical model was developed to guide behavioural interventions.

Transtheoretical model (TTM)

The model comprises four sets of constructs (Figure 23.4): *stages of change*, *processes of change*, *self-efficacy* and *decisional balance*. Behaviour change is envisioned as unfolding through a sequence of stages over time until, in some instances, a stage of termination is reached where the new behaviour is entrenched and relapse unlikely. However, progression is neither linear nor inevitable and relapse is contemplated by the model. Using the TTM, interventions aimed at particular processes of change can, for example, be tailored to the different stages of change that groups in the target population find themselves in.

Responsiveness to feedback – how and why consultants do or do not adapt their teaching in response to feedback from registrars – has been explored using the TTM.[33] The model was used to formulate the research question. Deductive analysis of data was then undertaken using a coding framework based on the TTM: for coding, the researchers composed a version of each component of the four constructs in the TTM applied to the responsiveness of consultants.

The results illustrated how different consultants were at different stages of change; for example, the stage of precontemplation: 'I can imagine that residents perceive me as scary sometimes, but there is not something I can do about it, that's just how it is'; in contrast to the stage of action: 'So after the feedback I started paying attention to my teaching and evaluating situations as learning opportunities for residents. And instead of preparing everything I now let residents think about the case and the possible diagnosis and treatment options. Yes, I involve them more in the decision-making process.'[33] The results also illustrated how the various processes of change and the self-efficacy and decisional balance constructs could be related to where different consultants found themselves in the stages of change. Two factors were found to be associated with progression through the stages of change to the stages of maintenance and termination, that is, the point of having new, established teaching behaviours. These were experiencing negative emotions through not acting on feedback (related to TTM process environmental re-evaluation) and making a strong commitment to change (related to TTM process self-liberation).

This study again illustrates how an abstract theory is rigorously operationalised. It also illustrates how theory-based questions for future research arise, like how best to help recipients of feedback deal with negative emotions. The study is also an example, though, of how often research using HBT as a conceptual framework is sporadic. An example of where the baton of theory has been passed from hand to hand within a group of researchers over time is where the TTM has been used to address various issues, initially CPD about depression[27–29] and later interprofessional practice.[31,32] As is often the case with research using the TTM, though, only one of the four components of the model, stages of change, is used. These studies mostly adopt a simplified version of stages of change.[26] The advantage of this approach

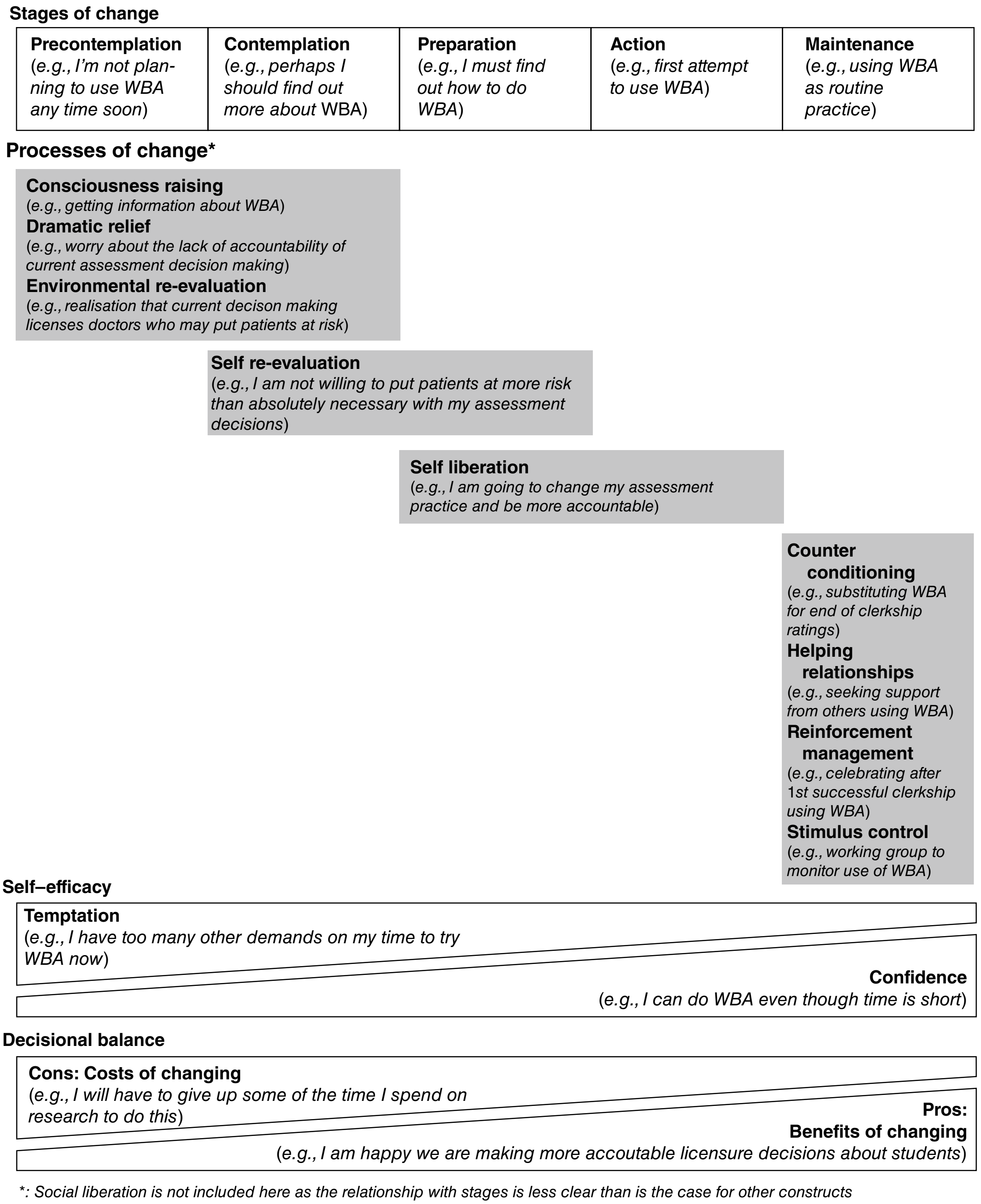

Figure 23.4 Transtheoretical model (Adapted from[62,63]), approximating the relationship between components of each of the four constructs in the model.

is that it simplifies research design. The more constructs and relationships being explored, the more complex, time-consuming and expensive data collection and analysis is going to be. The drawback is that the other components of the model are not incorporated over time, losing the richness that the model offers to explain or influence the complex phenomenon of behaviour change.

The next example of the application of a HBT in HPE research is the PRECEDE-PROCEED model.

PRECEDE-PROCEED model

This model differs from the previous three discussed in that it offers a comprehensive framework with which to contemplate causal assessment, intervention planning and evaluation together.[34] The PRECEDE model (Predisposing, Reinforcing and Enabling Constructs in Educational/Environmental Diagnosis and Evaluation) (Figure 23.5) was the initial conceptualisation that was subsequently expanded to develop the PRECEDE-PROCEED model (Policy, Regulatory and Organisational Constructs in Educational and Environmental Development). Often, as for the TTM, only one component of the PRECEDE model is utilised – the educational and ecological evaluation (EEA) comprising predisposing, reinforcing and enabling factors.

These factors were used as an organising framework for a literature review concerned with decreasing inequity in clinical care by exploring factors associated with trans-positive clinical behaviour change.[35] Having conceptualised trans-positive care as the issue of interest, the researchers justify the adoption of the EEA as a mechanism to influence both change and maintenance of individual clinical behaviour. Predisposing factors were grouped as the role of clinical habit and preventive medicine, the recognition of trans persons in healthcare settings and depathologisation of trans identity. Reinforcing factors were grouped as increasing trans visibility and trans-positive healthcare provider norms. Enabling factors were grouped as trans health education and growing trans health research and resources. The researchers acknowledged in the discussion that this represents but one step in the process of developing trans-positive interventions but, as so often happens with the use of HBT, do not seem to have pursued this theory in service of that end.

The EEA has also been utilised to inform the design of an intervention, a two-year CPD programme to improve the management of chronic heart failure.[36] The 23 activities in the programme were designed to address a predefined set of learning outcomes using the three components of the EEA. Predisposing activities aimed to create teachable moments using online articles and activities. Enabling activities aimed to create opportunities to practise using the knowledge in authentic settings, with live sessions for health professionals and sessions for patients and caregivers. Reinforcing activities aimed to support performance with online and print materials and activities. The model was also used to an extent to inform the evaluation of the programme, aiming to explore quality of life changes in the form of (participant-reported) improved patient outcomes.

These two studies illustrate how theory can be used to guide the design of a comprehensive approach to change the practice of clinicians. The resultant proposal in one case and intervention in another were not simple but were theory-based and structured differently to what would have been proposed had a typical situational analysis been the point of departure. The full PRECEDE-PROCEED model also offers guidance on the design of intervention evaluation that goes beyond the mere documentation of participant satisfaction.

A fifth example of a HBT, the theoretical domains framework, represents the result of efforts to collate various constructs relevant to behaviour change.

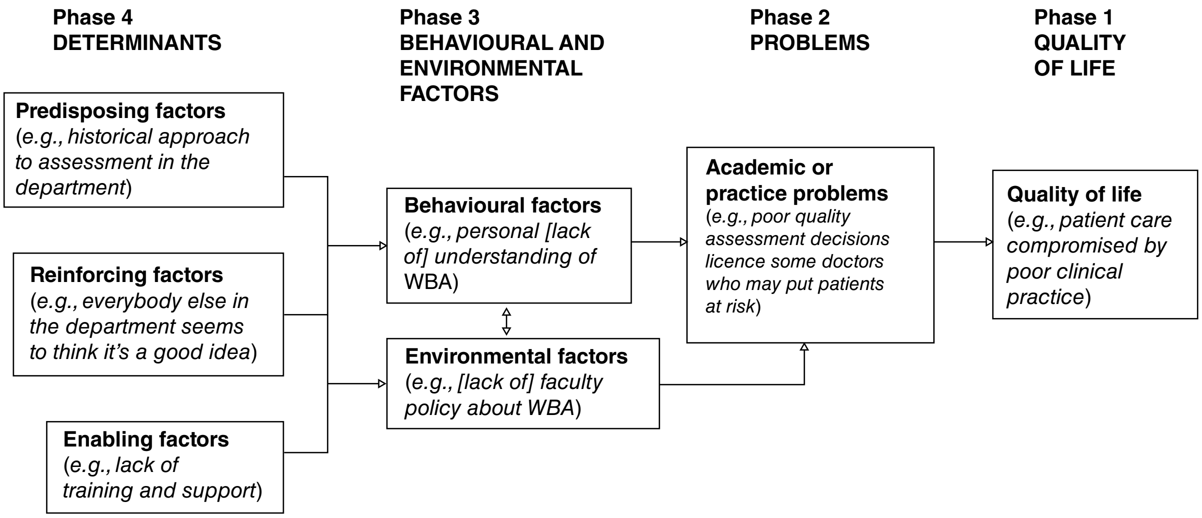

Figure 23.5 The PRECEDE model. Adapted from[62,63]

Theoretical domains framework

The theoretical domains framework (TDF) synthesises and streamlines the vast literature of theories and theoretical constructs about behaviour and behavioural change.[37] It builds on theories such as the TRA and TPB previously described and was developed through a consensus method with experts in health psychology theories and health services.[37] It was recently refined and validated.[8] The initial model was expanded to 14 domains (knowledge, skills, social/professional role and identity, beliefs about capabilities, optimism, beliefs about consequences, reinforcement, intentions, goals, memory, attention and decision processes, environmental context and resources, social influences, emotions and behavioural regulation) and 84 component constructs[8] believed to be associated with behaviour change (Table 23.1). TDF-informed studies can use individual interviews, focus groups, surveys, and be used to develop tailored and theory-driven interventions that aim to change behaviour.[38] Not surprisingly, the use of the TDF to identify determinants to behavioural change is trickling into HPE research.

One application of TDF in HPE research is by Cheung *et al*.[39] Their purpose was to document barriers and facilitators to the direct observation of trainees' clinical performance using individual interviews. Cheung *et al*. offer a convincing justification for using the TDF and an explicit description of its application in their study. Their interview guide was comprised of questions that informed the 84 constructs distributed within the 14 TDF domains. The authors used direct content analysis of the data to categorise responses into key concepts. Those data were used to generate a list of specific beliefs per domain. The authors were able to identify the ten relevant and four non-relevant domains through a saliency analysis; i.e., they identified the domains that would likely yield (or not) behavioural changes if acted upon by considering specific belief frequency, variations in beliefs and the potential to influence behavioural change.[38] For example, they observed a clash between faculties' favourable intention to observe residents' clinical performance and their belief that residents are responsible to solicit direct observation of their own clinical performance. We can posit that this clash would need to be addressed in an intervention that aims to change faculties' behaviour, that is, their observation of trainees' clinical performance.

St-Onge *et al*.[40] were interested in the implementation of a novel operationalisation of WBA; that is, longitudinal assessment (LA; e.g., Milestones and EPAs). They solicited four different stakeholder groups' perceived barriers and facilitators to the use of LA. Interestingly, the top three salient domains were identical for all stakeholder groups, albeit it not always in the same rank order. These results should be used to develop tailored and theory-informed interventions. A first step could be to bring together accreditation institutions driving the implementation of LA and other stakeholders to brainstorm about intervention strategies to increase knowledge, reduce potential negative consequences and barriers, while maintaining the potential positive consequences.

While the use of TDF in HPE research is somewhat novel, there is a strong body of literature to support the use of the TDF in health behaviour research. As illustrated above, the TDF can be used to identify behavioural determinants of change, and also to inform the development of tailored and theory informed interventions. Notwithstanding these benefits, application of the TDF in HPE research comes with certain challenges, namely identifying and delimiting the behaviour of interest. The use of TDF stems from research that aims to identify barriers and facilitators to the uptake of clinical behaviour, such as the use of clinical guidelines. In the examples above, the authors tackle more complex behaviour than the adoption of a clinical guideline. Moving forward, researchers in HPE that aim to apply the TDF may consider making explicit the behaviour of interest to ensure that the results can align with a clear and common understanding of a given behaviour.

Eclectic approaches

HBTs only ever partially explain a behaviour of interest[19–22] prompting calls to combine theories to capitalise on different strengths of each[2,3,15] and efforts to synthesise constructs across different HBTs.[8,41] In the examples cited in this chapter, different authors have used different theories to study the same issue – clinical practice using HBM[23] and the PRECEDE model;[35] supervisor–trainee interactions using TPB,[24] the TTM[33] and the TDF;[39,40] CPD using the TTM[27–29] and the PRECEDE model.[36] One group of authors studied the same issue – interprofessional education and collaboration – using different theories.[25,31,32] As a final example, we now proceed to examine an example of research that did not draw exclusively on any one particular theory.

The issue that Cilliers *et al*. were concerned with was the assessment-related learning behaviour of students.[42,43] The goal of the research was originally

Table 23.1 Theoretical domains framework, applied to adoption of WBA as behaviour. This table has been adapted from Atkins *et al.*[38] under Creative Commons Attribution 4.0 International License (http://creativecommons.org/licenses/by/4.0/). Application to adoption of WBA has been added.

Domain (definition)	Constructs	Application to adoption of WBA
1. Knowledge (An awareness of the existence of something)	Knowledge (including knowledge of condition/scientific rationale) Procedural knowledge Knowledge of task environment	e.g., I think WBA is about observing in an authentic context.
2. Skills (An ability or proficiency acquired through practice)	Skills Skills development Competence Ability Interpersonal skills Practice Skill assessment	e.g., I am really good at observing a trainee in clinic.
3. Social/professional role and identity (A coherent set of behaviours and displayed personal qualities of an individual in a social or work setting)	Professional identity Professional role Social identity Identity Professional boundaries Professional confidence Group identity Leadership Organisational commitment	e.g., WBA is part of the expectations for my faculty position.
4. Beliefs about capabilities (Acceptance of the truth, reality or validity about an ability, talent or facility that a person can put to constructive use)	Self-confidence Perceived competence Self-efficacy Perceived behavioural control Beliefs Self-esteem Empowerment Professional confidence	e.g., I can objectively assess trainees as long as I do it in the moment.
5. Optimism (The confidence that things will happen for the best or that desired goals will be attained)	Optimism Pessimism Unrealistic optimism Identity	e.g., I am very optimistic that WBA will increase trainees' competence.
6. Beliefs about consequences (Acceptance of the truth, reality, or validity about outcomes of a behaviour in a given situation)	Beliefs Outcome expectancies Characteristics of outcome expectancies Anticipated regret Consequents	e.g., Doing WBA it will contribute to trainees' development.
7. Reinforcement (Increasing the probability of a response by arranging a dependent relationship, or contingency, between the response and a given stimulus)	Rewards (proximal/distal, valued/not valued, probable/improbable) Incentives Punishment Consequents Reinforcement Contingencies Sanctions	e.g., It could enhance the reputation of the school if we do WBA.
8. Intentions (A conscious decision to perform a behaviour or a resolve to act in a certain way)	Stability of intentions Stages of change model Transtheoretical model and stages of change	e.g., I don't do WBA, I wait for trainees to ask me to do it.
9. Goals (Mental representations of outcomes or end states that an individual wants to achieve)	Goals (distal/proximal) Goal priority Goal/target setting Goals (autonomous/controlled) Action planning Implementation intention	e.g., I do WBA because my goal is to train competent trainees.

(*Continued*)

Table 23.1 (Continued)

Domain (definition)	Constructs	Application to adoption of WBA
10. Memory, attention and decision processes (The ability to retain information, focus selectively on aspects of the environment and choose between two or more alternatives)	Memory Attention Attention control Decision making Cognitive overload/tiredness	e.g., I need to keep in mind trainees' level and appropriate benchmarks to do WBA.
11. Environmental context and resources (Any circumstance of a person's situation or environment that discourages or encourages the development of skills and abilities, independence, social competence and adaptive behaviour)	Environmental stressors Resources/material resources Organisational culture/climate Salient events/critical incidents Person × environment interaction Barriers and facilitators	e.g., lack of faculty policy about WBA.
12. Social influences (Those interpersonal processes that can cause individuals to change their thoughts, feelings, or behaviours)	Social pressure Social norms Group conformity Social comparisons Group norms Social support Power Intergroup conflict Alienation Group identity Modelling	e.g., everybody else in the department seems to think it's a good idea.
13. Emotion (A complex reaction pattern, involving experiential, behavioural and physiological elements, by which the individual attempts to deal with a personally significant matter or event)	Fear Anxiety Affect Stress Depression Positive/negative affect Burn-out	e.g., I feel anxious about assessing trainees in clinic.
14. Behavioural regulation (Anything aimed at managing or changing objectively observed or measured actions)	Self-monitoring Breaking habit Action planning	e.g., I talk with the trainees at the beginning of the day to identify specific aspects they would like feedback on.

to devise interventions that used assessment to drive student learning in desirable ways and so contribute to the creation of powerful learning environments. To their surprise, the researchers discovered that less was known about how assessment drove learning than received wisdom would suggest and, therefore, they adopted a grounded theory approach to explore medical students' lived experience of summative assessment.

Initial inductive analysis revealed a strong role for various constructs related to motivation and emotion. Developing a grounded theory based on these proved difficult, however, not least because a considerable amount of the data could not be related to these constructs. Serendipitously, one of the group was also working on faculty development at the time and exploring HBT as an approach to understanding faculty participation in and utilisation of faculty development. From that emerged the (perhaps retrospectively self-evident!) realisation that student learning behaviours – in this case related to assessment – were nothing other than human behaviour. HBT was utilised, with constructs drawn eclectically from different HBTs resulting in the development of a model that incorporated, but extended beyond, motivation and emotion.

The model proposes that for any given student in any given assessment situation, one or more assessment factors result in one or more learning effects and that this relationship is mediated by one or more mechanism factors. The mechanism factors (Figure 23.6), derived from HBT, lie at the heart of the model.

The proposal of this model has shed new light on the relationship between assessment factors, mechanism factors and learning effects. The research also opened a range of new avenues for researching the pre-assessment learning effects of assessment, ranging from research necessary to validate the model to the exploration of the relative impact of a large range of assessment factor–mechanism factor–learning effect relationships, some well described in the literature, others less so.

(a) PERSONAL FACTORS

IMPACT APPRAISAL

- **impact likelihood:**
  how likely consequences are to accrue
- **impact magnitude:**
  what the magnitude of consequences (negative or positive) is likely to be

RESPONSE APPRAISAL

- **response efficacy:**
  the perceived efficacy of any given learning response in achieving a particular outcome
- **response costs:**
  the costs of any given learning response; costs can be incurred by responding, or not, to assessment, and can be internal or external to the student
- **response value:**
  the value of any given learning response as measured against the student's personal goals and their conceptions of success and wellness

PERCEIVED AGENCY

- the perception of being able to exert some control over a situation, even in the face of adversity

(b) INTERPERSONAL FACTORS

- **normative beliefs:**
  the beliefs of referents (people whose opinion a student values) against which a student can calibrate her/his behaviour
  (i) of lecturers
  (ii) of other students
- **motivation to comply:**
  student's motivation to comply with normative beliefs
  (i) of lecturers
  (ii) of other students

Figure 23.6 The mechanism factors mediating the relationship between assessment factors and learning effects. Adapted from[42]

Practical and research implications of using HBTs

There has been a recent call for evidence and theory informed innovations in HPE.[44] For high quality research to impact on educational systems and practice, it must be adopted by practitioners and policy makers. Generically, broaching the research–practice gap in education presents a significant challenge,[45–47] despite ongoing attempts to outline how to approach this.[48–51] Irrespective of how it happens, adoption of what research suggests is sound practice takes a long time. In clinical medicine, it can take over a decade for a research-based innovation to be widely adopted in practice.[52] This is notwithstanding the fact that many such innovations are 'context free'; i.e., if you use this drug in this way for this clinical problem, the outcome will be better than an existing practice. There is little reason to assume this would happen more rapidly in HPE, where innovations are typically more complex, context-bound and rooted in social and behavioural sciences than 'simple' clinical interventions.

HBTs may offer an approach to promoting behavioural changes. So, what do we learn from these studies? The examples discussed illustrate how HBT has a role to play in illuminating, explaining and changing behaviour in teaching–learning settings, whether campus-based or practice-based. These theories may productively be used to plan studies, to analyse findings and, potentially, to relate findings from different studies. The potential for the latter is limited when comparing studies using different HBTs, though, as the multiple theories overlap only partially as noted above.

Utilisation of a HBT does not imply unquestioning acceptance of the tenets of that theory. There is a reciprocal relationship between research and theory. While a HBT may illuminate the findings of a study, the findings should in turn lend support to or question the contentions of the theory.[53] The use of theory should generate new avenues for research, but avenues that are conceptually related to and built on prior research. Each study using a theory offers the opportunity to interrogate and advance the theory and to build the validity argument[1,7] for that theory.

HBTs are rich and varied and offer a theoretical perspective with which to approach complex behavioural challenges in an ordered fashion. However, researchers contemplating the use of a HBT should be cognisant of the limitations of the theories. Behaviour, whether in health or in education, often seems intractable. Theory must be utilised thoughtfully and matched to a clearly specified behaviour of interest to meaningfully explain behaviour or achieve change[34,54,55] but even under the best circumstances, it is a given that none of these theories provide a complete explanation of behaviour.[19–22] Equally, inasmuch as each theory tends to have its active proponents, HBTs are also not without their critics. There are general criticisms about the utility of specific models.[55,56] There are also criticisms of the specific assumptions underlying theories. One such criticism is that the theories tend to assume that behaviour is volitional, the result of conscious decision making, and to discount the role of factors such as habit and emotion. The role of habit has been addressed by dual process theories that account for impulsive (automatic) and reflective (motivational and volitional) processes.[15] The conception of behaviour as an individual act has also been critiqued, given that some behaviours are social practices that occur and vary across time and places;[54] some models have been expanded to incorporate interpersonal and contextual factors theories to create integrated models. Finally, while intention and behaviour are without doubt related, gaps remain in our understanding of how to bridge the gap between the two.[15]

As discussed earlier in this chapter and elsewhere in this book, theories help inform the development of research questions and for this it is important to select the theoretical lenses well. There is no guidebook or algorithm that will help the researcher in this. Systems theory[57,58] suggests – amongst others – to allow for a sweeping-in phase during which the researcher produces a 'map' of the theoretical world related to his/her domain of interest and proceeds with including theoretical stances until saturation is reached. This is, of course, a judgement call and it typically resembles the saturation of information approach in qualitative methodology – or the efficient diagnostic approach in clinical medicine. If for some time reading about new theories has not shed a fundamental new light on the research, then the researcher can decide to stop including new theories and proceed to matching and selecting the theoretical frameworks that would best illuminate the scientific issue. This decision will again call for a judgement as to which theories will help formulate the clearest research questions and will help to make most sense of the outcomes of the study. Checkland[57] refers to the boundary decision; basically a 'when enough-is-enough' decision. The studies that have been discussed illustrate how it is not necessary to be wed to one particular theoretical framework. However, once the decision has been made to use a framework, this should be rigorously followed through as illustrated by some of the papers discussed.[24,33,39,40]

Committing to a theory creates a pitfall of confirmation bias, however. The researcher can be led to interpret data only in the light of the theory used. Paraphrasing from the literature on psychoanalysis, exhortations to 'hold theory lightly'[59] and so not be blinkered by theory during data analysis are worth heeding. Researchers should remain open to the use of alternative theoretical frameworks in the discussion or re-analysis of findings. In Cilliers *et al.*'s first study,[42] the straightforward behaviouristic theory of stimulus and response did not suffice to make sense of the results. It did not produce sufficient data 'fit' – there was too much informative text that could not be coded using a simple theoretical model. Instead, when they revisited the literature and selected more helpful HBTs to explain the data, it produced a more valid model of how assessment drives the constructions that students use to self-regulate their own learning. The pivotal difference has been the change in stance between seeing the students as passive receptors of reinforcement and punishment to constructivist agents of their own learning activities.

Conclusion

There are many studies that invoke HBT in passing, but few that substantively engage with these theories to inform or understand the work done. Rigorously interrogating and applying these theories has much to offer HPE research, given how much of HPE research is focused on understanding or trying to change human behaviour. Given the complexity of human behaviour and the relationships that has with environmental variables, HBT has much to offer researchers and to help ensure that small, incremental advances can be conceptually linked to enhance both understanding and practice.

Practice points

- Health behaviour theory offers an ordered approach to researching complex human behaviour in a range of teaching–learning contexts.
- There are a range of theories to draw on, each offering a somewhat different perspective on behaviour; therefore, an appropriate type of theory can be selected to match the demands of a range of research questions.
- While HBTs are rich and complex, none of these theories provide a complete explanation of behaviour.
- Researchers wishing to utilise health behaviour theory do not have to draw solely on one theory, especially given the overlap that exists between theories.
- The use of health behaviour theory allows the design of conceptually strong research.
- Different pieces of research based on health behaviour theory can be conceptually linked to build stronger bodies of research on a topic.

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24 Self-regulated learning in health profession education: theoretical perspectives and research methods

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Consider Mary, a third-year medical student on a surgery rotation. For as long as she can remember, Mary has wanted to become a general surgeon, and her current goal is to learn more about a particular surgical procedure. Mary decides to design her own learning plan: she spends extra time reviewing the literature, practising her suturing skills and carefully observing the surgical residents. She also sets several short-term goals, such as observing at least five procedures in a week and studying her surgery text at least two hours every night. To stay motivated, Mary periodically reminds herself of what she is trying to accomplish as she works towards each short-term goal. Whenever she receives feedback from her clinical teachers, she reflects on that input and adapts her learning plans and strategies accordingly. At the end of her surgery clerkship, Mary is at the top of her class and much closer to her goal of beginning surgical residency. By acting on her longstanding interest in surgery, and actively regulating her learning activities, Mary bolstered her knowledge and skills in surgery and further strengthened her self-efficacy as a learner.

This chapter is about the learning processes of Mary, who in this instance demonstrates high motivation and effective self-regulated learning (SRL). Our purpose is to introduce SRL theories to health professions education (HPE) researchers, particularly those who might be interested in applying SRL frameworks to study and improve HPE. To achieve this purpose, we first provide a broad definition of SRL, followed by a review of the common assumptions that underlie SRL theories. We then discuss in more detail two influential frameworks and describe several research methods to explore SRL in various HPE contexts. We end with a look into the future of SRL research in HPE.

Defining self-regulation and self-regulated learning

The study of self-regulation has a long history in the fields of psychology, education and medicine. Broadly speaking, self-regulation can be defined as the processes that individuals use to guide their goal-directed activities by controlling and managing their cognition, affect, behaviour and environment.[1] Simply stated, individuals must regulate their thoughts, feelings, actions and relationships to achieve their goals. Theories of self-regulation have been used to explain how and why individuals put forth effort to achieve a variety of life goals, from losing weight and quitting smoking to learning to play the guitar and gaining expertise in medicine. As Sitzmann and Ely[1] (p. 421) observed, ‘self-regulation enables people to function effectively in their personal lives as well as to acquire the knowledge and skills needed to succeed in higher education and the workforce’. In this way, many scholars believe that self-regulation is an essential component of life success.

SRL is a subset of the broader concept of self-regulation. SRL is a multi-dimensional construct that includes a number of core *processes* that learners use to turn their mental abilities into academic skill and lasting performance.[2] Thus, SRL is not a mental ability or aptitude, such as intelligence, nor is it an academic skill, such as reading proficiency; instead it is a set of processes requiring a proactive learner. Viewed this way, learning is not something that happens to individuals who self-regulate, rather it is an activity that individuals initiate, manage and adapt to achieve their goals.[3]

Notably, SRL is not an all-or-nothing phenomenon. Individuals are self-regulated to the extent that they are cognitively, motivationally and behaviourally involved in their own learning activities.[4]

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Moreover, SRL is domain-specific and individuals self-regulate at varying levels across different contexts. For example, a graduate nursing student, who is part of a research interest group, might engage in much more focused and effortful study during her research methods course compared to a leadership course that she has dreaded for personal reasons. In other words, educators cannot assume that learners will be effective or ineffective self-regulators at all times and across domains; rather, learners will likely demonstrate variable levels of self-regulatory effectiveness at different times and in relation to different learning and performance tasks. Further, SRL does not equate with independent learning. Instead, learners self-regulate whenever they pursue a learning goal, whether they are at home studying, working on a group project, or listening to a lecture. In these varying situations, learners can set adaptive goals (e.g., 'I want to deeply understand this textbook chapter by reading and then testing myself') or maladaptive goals (e.g., 'I want to read this textbook chapter as quickly as possible'), and then make strategic choices (e.g., whether and how to take notes) commensurate with their goals.

Core assumptions and common features of SRL theories

The psychology and education literatures describe many different theories of SRL, all of which propose slightly different features and processes (for a review, see Panadero[5] and Sitzmann and Ely[1]). Despite this theoretical diversity, most models of SRL have in common several core features (see Table 24.1). First, self-regulating learners are described as setting a *goal*, criterion or standard against which their academic progress can be compared.[6] Learners' goals represent the *what* of SRL (i.e., the aim of self-regulatory actions). Conceptually, goals help learners to gauge their progress, determine whether their approach is working and make appropriate changes.

Table 24.1 Four core features of SRL theories

Core feature	Description
Goal setting	Individuals who self-regulate have some type of goal, criterion or standard against which their academic progress can be compared.
Motivation	SRL theories address why learners choose to initiate and sustain their goal-directed actions.
Self-monitoring	Self-monitoring is the mechanism self-regulating learners use to keep track of how they are doing.
Feedback loop	Self-regulated learning employs cyclical processes and subprocesses for the purpose of monitoring the effectiveness of learning activities and responding to feedback.

Second, self-regulating learners are described as possessing *motivation* or *an energetic force that instigates and sustains their goal-directed action*. If learners' goals represent the *what* of SRL, then motivation reflects *why* they choose to use (or not use) various learning strategies. Motivation is not only a precursor to self-regulated action, it is also a beneficial outcome. That is, the consequences of selecting a successful study strategy might be both enhanced learning *and* more intrinsic motivation to engage in the activity in the future.[6]

Third, self-regulating learners are described as engaging in 'self-monitoring [which] acts as a core feedback mechanism in SRL models because it is through this process that individuals increase their self-awareness and gather the requisite information to effectively evaluate how they performed on a particular task'.[7] Self-monitoring is a mechanism that self-regulating learners use to keep track of *how* they are doing. For example, a trainee practising a procedure may track the number of errors he/she makes along with the potential ways he/she might improve. Self-monitoring can also involve monitoring of one's own cognition and cognitive processes through metacognition (thinking about one's thinking). Conceptually, accurate self-monitoring improves SRL by helping learners understand how their strategies to achieve their goals are unfolding, and whether they need to adapt their efforts to improve future learning and performance.[1]

Fourth, self-regulating learners are described as working through a self-oriented feedback loop composed of multiple processes and subprocesses.[7] Learners employ these cyclical processes to monitor the effectiveness of their activities and respond to both self-generated and other-generated feedback. Explanations of how learners respond to feedback and which processes and subprocesses are most important differentiate the various theoretical perspectives. Self-monitoring and adapting one's approach to learning in response to feedback both reflect the *how* of SRL.

Related concepts in HPE

HPE researchers often fail to make useful distinctions among theoretical frameworks. The result is conceptual confusion, with researchers intentionally or unintentionally blurring important differences among terms and definitions.[8] In HPE, constructs related to

SRL include metacognition, self-assessment, self-directed learning (SDL) and reflection, to name just a few. Even though it is beyond the scope of this chapter to compare and contrast all of these related constructs, below we briefly describe one major conflated term, SDL (for a more complete analysis, see Loyens *et al*.[8] and Lajoie[9]).

Medical educators often use SDL interchangeably with SRL. A key difference between the two constructs is that theories of SDL emerged from adult learning theory whereas theories of SRL developed primarily from educational psychology. Knowles,[10] (p. 18) a well-known adult learning theorist, defined SDL as 'a process in which individuals take the initiative, with or without the help from others, in diagnosing their learning needs, formulating goals, identifying human and material resources, choosing and implementing appropriate learning strategies and evaluating learning outcomes'. This definition has led many medical educators to invoke SDL when describing problem-based learning.

Notably, while SDL includes the subprocess of identifying learning needs and making choices about how to address those needs, SRL theories note that a learning task does not need to be self-selected for SRL to occur. In fact, much of the research on SRL has been conducted in educational settings where students are assigned learning tasks. Because SDL involves the choice of what to learn, its application is more relevant in some contexts (e.g., continuing professional education) than in others (e.g., contexts where learning objectives and resources are well specified). Further, the assumption that learners can self-assess their own learning needs, which is inherent to SDL (but not SRL), has been problematised in the HPE literature.[11] In sum, although SDL and SRL are closely related ideas, they have emerged from different literatures. What is more, we would argue that SRL has a much richer theoretical and empirical foundation.

Two influential SRL perspectives

The academic study of SRL and related constructs has been an area of inquiry across a diverse range of research disciplines. From computer engineering to clinical psychology to childhood development, researchers have developed models and theories aimed at clarifying how individuals learn to manage, control and adapt their learning. At present, two of the best resources for in-depth descriptions of those theories are Schunk and Zimmerman's[6] handbook on SRL theoretical perspectives and a recent systematic review and meta-analysis of SRL theories.[5,6] Covering all of the theories in the depth they deserve would span more pages than this textbook. Hence, we only discuss the fundamental principles of two influential theoretical perspectives: social-cognitive theory (see also the chapter by Torre and Durning in this book) and social-constructivist theory (see MacLeod, Burm and Mann's chapter also).

Social-cognitive model of SRL

Evolving from his seminal work on self-efficacy, Bandura's[12] social-cognitive theory has influenced several productive researchers. His key idea of 'reciprocal determinism' is that a learner's behaviour is determined by the interactions between personal factors (i.e., cognitive, affective and biological processes) and environmental factors (i.e., social and physical surroundings). A change in any of these three systems – behavioural, personal and environmental – will influence the others in a constantly evolving and reciprocal manner.

Social-cognitive theorists encourage researchers to consider the bidirectional transaction between social and cognitive events and depict self-regulatory competence as developing initially from social influences, which eventually shift to self-influences over four non-linear levels.[13] *Observational learning* is the first level, where social influences are strongest and derive from learners watching others perform the task (i.e., task-modelling). Second, learners are in the *emulative level* when they can imitate the observed performance. While learners are internalising observed tasks or strategies, this internalisation relies on exposure to social/environmental cues and thus levels one and two are socially dependent.[14] The third level is called *self-control*, the hallmark being learners' ability to use the acquired skill or strategy independently during performance. While the internalisation process is nearly complete, learners' task representations are still heavily reliant on the observed general pattern of performance.[13] Learners achieve the fourth level when they become *self-regulated* and able to systematically adapt skills and strategies to any changes in personal, behavioural and/or environmental conditions.[14] Key to the social-cognitive model is that, while social influences diminish, they do not disappear with advancing skill acquisition. Thus, a learner who fails to capitalise on feedback available from the social environment may fail to acquire a critical skill needed when self-teaching methods are insufficient.

Researchers have used this model to produce evidence on many 'core processes' thought to be enacted during a three-phase self-regulation cycle: forethought, performance and self-reflection (see Figure 24.1).[15] During forethought, learners will enact self-efficacy and may use their observations of a social model to develop goals and assess value as they prepare to learn.[16] During performance, learners will enact task strategies for learning, such as using self-monitoring to compare themselves to social standards and judge progress towards goals. Finally, self-reflection occurs after performance and involves processes such as self-evaluation and learners making causal attributions about the results of their performance (e.g., attributing poor performance to insufficient effort rather than to a limit in one's abilities). Beyond serving as a helpful model for describing and explaining SRL, this cycle has also spawned a methodology called SRL microanalysis (see Cleary *et al*.[16]). In fact, SRL microanalysis has been used increasingly in HPE to study medical trainees' self-regulation of skills including venipuncture[17] and clinical reasoning skills[18] (see description of SRL microanalysis below).

The social-cognitive perspective has also spawned a focus on motivational regulation, understood as a cyclical process of monitoring one's motivation and applying strategies to control motivation and persist towards one's goals.[19] Strategies that learners in the health professions have reported using to enhance their motivation during learning tasks include self-consequating (e.g., saying to themselves that they can only hang out with friends after they complete two textbook chapters), environmental restructuring (e.g., moving from a noisy study hall to a quieter room) and task restructuring (e.g., breaking down a larger task into chunks to make accomplishing the task seem more feasible), among others.[20] Similar to the metacognitive regulation of learning strategies, learners can engage in metamotivational regulation by monitoring their use of motivation strategies before and during a learning task.[21] Research conducted among learners outside of HPE suggests that some strategies are more effective than others, consistent with predictions from theories of motivation like achievement goal theory, expectancy-value theory and self-determination theory.[22] Research that builds an understanding of what strategies are more effective than others will help health professions educators support learners' motivational regulation by increasing their metamotivational knowledge of effective strategies.[23]

Social constructivist models of SRL

Under most models of constructivism (see MacLeod, Burm and Mann's chapter in this book), learning is regarded as situated in social and historical contexts, meaning learners' SRL behaviours are malleable and

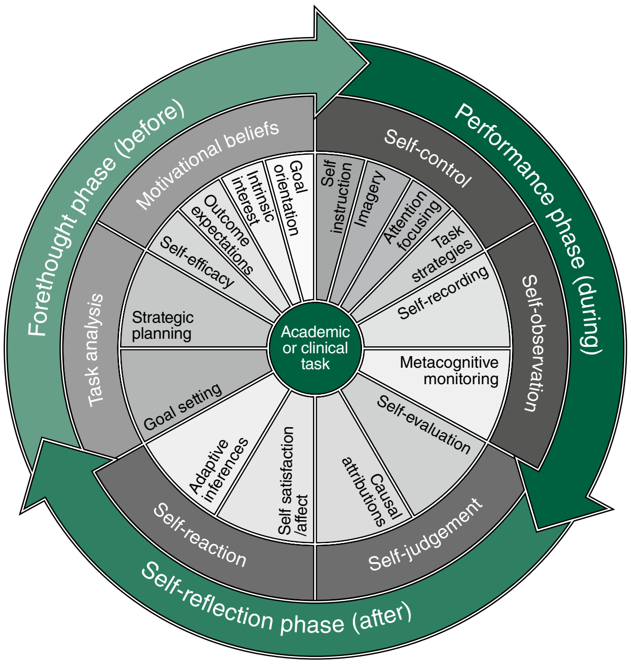

Figure 24.1 A three-phase, cyclical model of SRL. This model is adapted from Zimmerman,[15] and depicts three sequential phases of SRL: forethought (before), performance (during) and self-reflection (after). The model also shows, within each phase, the subprocesses of SRL. *Source:* Artino, A.R., & Jones, K.D. (2013) Last Page: Self-regulated learning: A dynamic, cyclical perspective. *Academic Medicine*, **88**, 1048. Reproduced with permission of Wolters Kluwer Health.

often shaped by their prior history and knowledge, their social roles and the sociocultural climate of the learning situation.[24] Research on this process of 'enculturation' has shown that novices learn the practices, values and customs of a community, such as how to behave in the classroom context.[25,26] As learners evolve their identity and sense of group membership, they actively co-construct their self-image and self-regulatory practices with members of the social groups they are joining. Researchers have conceptualised these relationships between learners and others as 'co-regulated learning' (CoRL; reciprocal and interdependent regulation; for example, between educator and learner or between peers) and 'socially-shared regulation of learning' (SSRL; further interdependence/collective regulation of learning amongst members of a group).[27] In response, medical educators have argued for expanding beyond social-cognitive models to consider all conceptualisations – SRL, Co-RL and SSRL – especially given how much healthcare practice involves collaborating and negotiating with others.[28,29]

Fundamental to constructivism is the proposal that learners' beliefs and desires provide the motivation for them to construct certain theories that they use to justify their behaviours. The historical and situated nature of these theories is key, as learners may shift them in response to the experiences they accrue over time, across multiple situations.[30] Hence, the constructivist view firmly situates SRL in the context in which it develops and unfolds, providing a useful lens for inspecting how the complex web of individual, social and situational factors influence how learning is self-, co- and socially-regulated.[31]

Many theories of SRL have emerged from the social-constructivist perspective. For example, the situated[32] and situative[31] models encourage study of the interactions between what individuals bring to a learning context (e.g., beliefs, knowledge, personal theories and cognitive schemas), and features of that specific learning environment (e.g., design of activities, levels of support provided by teacher), in order to understand how learners' appraisals of the situation and its features continually mediate their self-regulation.[30] These models emphasise that educators and researchers should strive to identify environmental and social supports that will help learners construct the metacognitive knowledge and positive self-perceptions required for them to engage in sustained, iterative cycles of goal-directed learning.[33] In expanding these ideas and applying them to collaborative, group learning contexts,[34] researchers and educators must attend to each individual's 'cognitive angle' (i.e., their cognitions, metacognitions and interpretations) as well as the 'situative angle' (e.g., how groups create affordances and constraints for individual and group involvement). Further, many studies have emphasised the value in tracking how these 'angles' interact and evolve over time, especially in computer-supported learning environments, where data sources (e.g., chat logs) can be programmed, collected and tracked over time.[35] Applying such models would require that researchers study SRL as situated and unique in every different context within which learners work.

Summary

A common thread across these two theoretical perspectives is that SRL is viewed as a cyclical process that learners are aware of through active self-monitoring. A key difference among the two theories is the source of information used to drive that cycle – social-cognitivists believe it is self-judgements and causal attributions and social-constructivists believe it is an analysis of the interaction between cognitive and socially situative angles. Rather than emphasise these divergences, instead we suggest readers consider this brief summary alongside more comprehensive reviews[1,5] to see how each perspective makes its own unique contribution to a robust overall understanding of SRL. As readers develop their own understandings of the nature of knowledge,[36] they will find that each theoretical perspective represents a tool for clarifying the different ways that healthcare professionals learn to manage their own learning in complex training and practice contexts.

Methods for studying SRL in HPE

The preceding sections provide some guidance for the researcher to identify key constructs in the study of SRL and frameworks for making predictions and hypotheses. However, translating these theoretical questions into research requires careful thought about the methods to be used. Although some methods are closely associated with certain theories, we argue there is considerable room (and need) for innovation in designing research studies in diverse educational settings. What follows are descriptions of several methods that have been used to study SRL in HPE contexts. In addition, Table 24.2 summarises the strengths and weaknesses of each method.

Questionnaires

Questionnaires and similar self-report methods (e.g., interviews[37] and focus groups[38]) account for the majority of studies of SRL. In addition to study-specific questionnaires, several instruments have been proposed for broad use in studying SRL; these include the Student Learning Survey,[39] the Self-Directed Learning Readiness Scale,[40] the Continuous Learning Inventory[41] and the Motivated Strategies for Learning Questionnaire.[42] These methods are frequently used to quantify learner preferences for various SRL activities or strategies,[43] clinical situations that stimulate SRL,[44] obstacles and facilitators of SRL[45] and the adoption of innovations into practice.[46] These questionnaires commonly ask respondents to rate the frequency of their behaviours or the intensity of their attitudes or beliefs on Likert-type scales, which may then be aggregated into subscales that measure underlying constructs. Such questionnaires are almost always reports about oneself and are completed in contexts outside of a specific SRL activity. In this way, questionnaires are often used to understand SRL more generally rather than tying facets of SRL to actual learning behaviours.

As an example, Gruppen *et al.*[47] used two self-report questionnaires in a repeated-measures design to measure self-assessed diagnostic ability and self-directed study time. This study examined medical students' self-regulation decisions related to the allocation of study time to different patient-presenting complaints representative of problems likely to be encountered on an internal medical clerkship. The specific research question focused on the extent to which these medical students used self-identified strengths and weaknesses in diagnostic skills of these complaints to guide their allocation of study time to each complaint. As used in this study, questionnaires allowed students to report on past behaviours and summarise over multiple events and activities. Ostensibly, their answers were less tied to the peculiarities of a single situation and appeared to generalise across settings that require diagnostic skills. The questionnaires also provided access to learner attitudes and beliefs, though an important limitation of this study is that there were no independent data about their actual behaviours (e.g., the amount of time allocated); the researchers only had the students' self-reports to rely on. We summarise the strengths and limitations of questionnaires in Table 24.2.

Table 24.2 Strengths and limitations of four individual methods and one multi-method approach to studying SRL in HPE

	Self-report questionnaires	Case studies	SRL microanalysis	Trace methods	Triangulating multiple methods
Strengths	• Easy to construct, administer and analyse • Very familiar to learners and requires no special training • Can assess a wide range of variables that are not easily obtained by other methods	• Helps develop hypotheses for further study • Provides rich data across multiple sources • Designed to capture the dynamic, situated, context-specific nature of SRL	• Customisable to specific tasks • Designed to capture the dynamic, context-specific nature of SRL • Assessment is closely linked to theoretical framework, thereby making interpretation easier	• Customisable to specific tasks • Designed to capture the dynamic, context-specific nature of SRL • Avoids potential biases associated with self-report • Easy to collect data on large numbers of participants remotely	• Use of different methods to compensate for each individual methods' bias • Provides rich, detailed data • Designed to capture the dynamic, context-specific nature of SRL
Limitations	• Questions may not map accurately to the underlying construct or the learners' experiences • Participants may be prone to recall bias • Less effective at capturing the dynamic, context-specific nature of SRL	• Flexible, iterative nature of data collection and analysis is difficult to master • Relies heavily on researcher's subjective interpretations - requires audit and reflexivity • Difficult to establish that sampled cases are representative of the phenomenon	• Task-specific protocols are time-consuming to construct, administer and analyse • Data gathered are highly specific to situation and likely do not generalise to other activities • Protocol is somewhat intrusive and may interrupt the natural course of the activity	• Often requires validity evidence to support drawing inferences regarding underlying SRL processes	• Need for expertise in collecting and interpreting data using different methods • Cost and time associated with multiple datasets • Conflicting data from different methods can be difficult to interpret
Example HPE studies	Gruppen *et al.*, 2000[47]	Evensen *et al.*, 2001[49]	Artino *et al.*, 2014[18]	Gandomkar *et al.*, 2020[50]	Brydges ***et al.***, 2013[51]

Case studies

A case study is defined as a methodology used to study people, groups or events in order to develop a deep understanding of a phenomenon as it unfolds and is situated in context.[48] A comprehensive discussion of case study methods as they apply to research on SRL can be found elsewhere.[30] In brief, case studies can be used for many purposes, including describing a phenomenon, exploring cases to generate research questions or for theory-building. In studying SRL, Butler[30] describes a flexible case study method, where the research question is central and additional design features are built around it using an iterative, flexible approach. Those additional features include selecting the case (i.e., sampling), collecting data, reducing and interpreting data, warranting assertions and representing findings. Each of these design features are described as fluid and can be returned to and modified as the research project evolves. In choosing cases, for example, case study researchers use 'purposive sampling' to select specific individuals (cases) that will allow them to best answer their research questions.[30]

As an example, Evensen *et al*.[49] used case study methods to investigate first-year medical students' SRL within a problem-based medical education curriculum. One researcher followed six students during their entire 16-week semester, collecting evidence from various contexts (e.g., PBL sessions, performance assessments), using various techniques (e.g., interviews, observational field-notes) and across different time points (i.e., more intensively at first). The researchers collected a rich dataset for each individual and, rather than pool the data across participants, instead analysed each student as a unique unit of analysis. Ultimately, the authors describe a theory of how the students developed different 'stances' (i.e., proactive, reactive, retroactive, interactive and transactive) that governed their behaviours and use of self-regulation when situated in different learning contexts.

As this example demonstrates, case study researchers will draw on multiple data sources in their investigations (e.g., observations, interviews, reports of participants' behaviours, self-reports and performance-based assessments). Having multiple data sources allows researchers to 'triangulate' those sources to develop a robust understanding of the phenomenon under study. As they interpret data and form assertions, researchers often keep an audit trail detailing their rationale for making certain modifications. Originators of the method[52] suggest that researchers might consider each case as an 'independent study', and the analysis of commonalities and discrepancies across cases allows researchers to make coherent assertions about generalisable patterns and theoretical principles that may apply to the particular context under study.

SRL microanalysis

Microanalysis is a broad term that describes a fine-grained form of assessment that targets an individual's thoughts, feelings and actions as they occur in real time.[53] Microanalytic techniques have been used to study SRL in K-12 students, college undergraduates and medical students.[18] Broadly, the technique targets the cyclical-phase processes of SRL as individuals engage in specific tasks. As an assessment methodology, SRL microanalysis involves making several assumptions about student learning and what is needed to effectively evaluate student performance. A critical assumption of SRL microanalysis is that beliefs, emotions and behaviours are dynamic and fluid and thus will often vary across contexts. This assumption of context specificity suggests that SRL assessment tools should be tailored to specific contexts. Microanalytic approaches address this assumption by including standardised questions about specific self-regulatory processes as trainees engage in authentic learning or performance tasks.

Microanalytic assessments are structured interviews with several distinguishing features. First, microanalytic protocols are administered while learners complete a task that has a clear beginning, middle and end.[53] Second, microanalytic protocols include both close-ended (e.g., Likert-type) and open-ended questions that are customised to the characteristics and demands of the task. This feature distinguishes a microanalytic protocol from a questionnaire that might be used to assess SRL across a variety of settings. To work effectively, SRL microanalytic protocols *must* be customised to the task. Finally, microanalytic assessments are based on SRL theory and are temporally sequenced to coincide with the before, during and after phases of an activity. For example, Zimmerman's three-phase cyclical loop[15] includes forethought, performance and reflection processes. Thus, if one were employing Zimmerman's SRL framework, the microanalytic protocol would be structured such that forethought-phase questions are administered before the task, performance-phase questions are administered during the task and reflection-phase questions are administered after the task. Making direct links between SRL theory, the nature of the task and the assessment approach allows the researcher to generate theoretically grounded interpretations about how SRL processes are initiated and adapted during all phases of a task.

In HPE contexts, the use of SRL microanalysis techniques has only just begun. For example, Artino *et al*.[18] used Zimmerman's three-phase cyclical model[15] to create forethought-, performance- and reflection-phase questions (see Figure 24.1). The authors then asked 71 second-year medical students to work through a paper-based, clinical case while administering the SRL microanalysis. Following data collection, the researchers developed a scoring rubric to categorise participants' open-ended responses according to the procedures described by Cleary.[53] The authors found that second-year medical students were very much 'novices' when it came to clinical reasoning. That is, no matter their achievement level, these novices did not perform or reflect in very systematic or strategic ways. However, the authors observed differences in how high and low achievers said they approached the task (i.e., their forethought processes). As this study suggests, microanalytic protocols allow researchers to assess fine-grained changes in an individual's thoughts, feelings and actions across several learning or performance cycles.

Trace methods

Trace methods capture students' SRL processes as they engage in a learning task, without requiring learners' to reconstruct their thoughts in order to respond to a SRL microanalysis question or a questionnaire item.[54] Trace data are described as 'observable indicators about cognition that students create as they engage with a task'.[55] Traces come in many forms, such as the text students choose to highlight and the notes they make while studying.[56] Thus, trace data are a byproduct of students' engagement in a task, rather than an additional source of data they must generate. As such, trace data may serve as more 'authentic' data sources reflecting how students behave when not in a research context.

The use of trace methods is just beginning to emerge in HPE.[50] Outside of HPE, trace methods are frequently tied to studying SRL in computer-based learning environments, which can be programmed to automatically collect trace data, even when students complete a learning task in their natural study environment, such as at the library or at home. This may benefit both feasibility and ecological validity, and holds promise for facilitating research on SRL in the increasing number of technology-enabled learning environments available to medical learners. That said, the potential for trace methods to advance our theoretical understanding of SRL depends on the degree to which a specific trace (e.g., clicking on a drop-down checklist of learning goals) can be inferred as reflecting an underlying SRL process (e.g., monitoring one's progress towards goals).[57] Depending on the existing evidence to support these claims, preliminary data may need to be collected to produce validity evidence that demonstrates a trace reflects an underlying SRL process.[54]

Triangulating multiple methods

As indicated in Table 24.2, there is no perfect research method for studying SRL; each method has its own strengths and limitations. One way to address the limitations of any given method is to employ a multi-method approach. The idea is that researchers can be more confident with a given finding if different methods lead to the same result. For example, Hadwin and colleagues[58] used both 'trace data' and a self-report questionnaire in a computer program called gStudy to document eight participants' (i.e., cases) behaviours as they interacted with the system. The researchers compared these trace data to the questionnaire data (i.e., 10 items from the Motivated Strategies for Learning Questionnaire)[42] and found that participants' self-reported behaviours did not align well with the events traced in the gStudy system. This misalignment between self-reported behaviour and actual behaviour has been documented many times in other disciplines (for a comprehensive review, see Bjork *et al*.[59]).

The performance implications of these misalignments have yet to be fully investigated – hence an area of valuable inquiry is how best to combine and interpret trace data, self-reports and other performance-based assessment data. As an example, one study in HPE aimed to combine those three data sources.[51] Specifically, the researchers studied novice medical students as they practised diagnosing simulated heart murmurs. They recorded how students sequenced their practice of seven murmurs (behavioural trace), their self-reactions to the learning experience (self-reports) and measured their acquisition and retention of diagnostic accuracy skills (performance measure). While participants' self-reports were positive, their behaviours suggested they did not use consistent learning strategies, which may have had negative implications for their performance of murmur diagnosis.

Future directions in SRL theory, research and practice

Using SRL theory and the associated methods described here, we believe researchers and practitioners can move the field of HPE forward. Each of the elements of SRL and the relationships among the elements hold questions that apply to HPE (e.g., context specificity of SRL and consistency in SRL behaviours over time and place). An example study might compare trainees' SRL processes (collected using SRL microanalysis) when learning communication skills in small groups via role play and standardised patients versus when studying for a cardiovascular exam in large groups using a cardiopulmonary simulator. Such research would help clarify the situated nature of SRL, could expand our understanding of how socially shared regulated learning is impacted by situational factors and also might point towards practical interventions for improving the effectiveness and efficiency of learning efforts.

Another line of inquiry involves the development of interventions to improve the SRL process and component skills in healthcare professionals. An example study would be an investigation of trainees' SRL processes as they learn to manage complex virtual patients. The resulting datasets could be mined to identify useful and problematic tactics and strategies that trainees employ. Interventions could subsequently be designed to capitalise on the effective behaviours and provide supports or scaffolds for areas of challenge.

Future research might also seek to uncover links between how learners enact SRL in their classroom and workplace experiences using dynamic assessments, like preparation for future learning (PFL).[60] PFL assessments focus on how learners engage with new learning resources needed to perform on a subsequent test. As an example, a study might aim to clarify how well two different simulation-based SRL interventions prepare learners for a subsequent, one-week delayed workplace-based PFL assessment. As learners work with the new learning materials, researchers could collect trace measures (e.g., their notes), video observations (e.g., tracking certain behaviours), and think-aloud protocols (i.e., reflecting cognitive and metacognitive strategies) as sources of 'learning analytics'. Those analytics could then be related to learners' competency outcomes on the subsequent workplace-based test. Such triangulation of data would yield valuable insights for connecting certain analytics to SRL processes, and for designing training and assessments that impact and measure situated SRL.

A complementary line of investigation relates to the research methods themselves. Clearly, more innovation is needed to improve how we assess relevant SRL processes. The aforementioned methods represent only a few examples. Collaborative work that leads to creative and complementary methods will help us overcome the biases and limitations of current methods as we seek to learn more about SRL in HPE.

Finally, recent research has sought to integrate SRL concepts with other established theories of learning, particularly cognitive load theory[61] and cognitive theory of multi-media learning.[62] These theories share an assumption that human working memory capacity is limited and that, during learning, demands on working memory arise from several difference sources. Therefore, by integrating, for example, cognitive load theory with SRL theory, researchers might deepen our understanding of how learners' self-regulatory actions might affect their cognitive load (and vice versa). For instance, learners can engage with prescribed learning activities (e.g., responding deeply to self-explanation prompts) or might supplement those prescribed activities with their own learning strategies (e.g., writing summaries and drawing concept maps in their notes), but doing so likely demands working memory resources that might interfere with effective cognitive processing, especially when a task is complex.[63] Thus, future research must probe how to support SRL without overloading learners' cognitive capacity.[64]

Conclusion

In summary, we believe that researchers interested in studying the dynamics of learning in the context of HPE should consider adopting SRL theories and associated methods. Doing so provides a functional lens for examining and interpreting the complex interactions between an individual's thoughts, feelings and actions; the educational environment; and the learning and performance outcomes that emerge. Use of this broad perspective will inform medical educators who are looking for ways to support medical trainees' development of necessary knowledge and skills and will also help trainees develop and capitalise on their SRL capabilities to continuously learn and improve their medical practice.

Practice points

- Theories of SRL describe the processes that individuals use to optimise their strategic pursuit of personal learning goals.
- Most theories of SRL depict a self-oriented feedback loop composed of multiple processes that individuals use to plan, monitor, control and manage their thoughts, feelings and actions in service of achieving their learning goals.
- Each SRL perspective has the potential to make its own unique contribution to a robust understanding of the different ways that healthcare professionals learn to manage their own learning in complex training and practice contexts.
- Many different research methods can be used to study SRL in HPE contexts; four contemporary methods are questionnaires, case studies, microanalysis and trace methods.
- Investigations of SRL typically employ a combination of methods to capture and to study the (mis)alignments between how individuals think, feel and act in various learning contexts.

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25 Emotions and learning: cognitive theoretical and methodological approaches to studying the influence of emotions on learning

Meghan McConnell and Kevin W. Eva

A second-year family medicine resident is at the end of a busy shift that involved five vaginal deliveries and two Caesarian sections. At 05:00h, a young woman is admitted; her labour is precipitous, she is fully dilated and is pushing on arrival. Initial foetal heart tones are reassuring but as the vertex becomes visible, there is a deep deceleration with poor recovery. With the next contraction, there is another deceleration without recovery. Alone, the resident decides to try the 'Mighty-Vac', a skill she has done under the watchful eye of the senior obstetrical resident on two other occasions. After the first pull, the handle snaps off. The nurse reports the foetal heart as 60 beats per minute. The resident quickly applies forceps, checks their position and delivers the baby's head with two pulls. However, three loops of the umbilical cord are wrapped tightly around the baby's neck and there is thick meconium. The baby is suctioned on the perineum, delivered and while being transferred to the resuscitation cart, begins to wail to everyone's relief.

This example illustrates the wide range of emotions that can impact healthcare professional trainees. The resident hoped for success, was fearful of failure and felt relief and pride after successfully completing the procedure. These emotions have the potential to strongly influence trainees' learning, motivation, critical thinking, identity development and life-long learning.[1] Having a better understanding of how emotions influence various learning and transfer processes will not only help students respond flexibly to different educational settings, but will also enable educators to deliberately plan their efforts to take advantage of these processes.

To truly understand the influence of emotions on the training and assessment of clinicians, medical educators need to have a strong grasp of the methods and theories underlying emotion research. Cognitive psychologists have a rich history of studying the way in which emotions influence how information is processed within learning environments, how it is organised and retrieved from memory and how it is used to make decisions and inform learners' behaviours and actions.[1,2] In this chapter, we use research from that discipline to (a) highlight some of the theoretical approaches used to explain how emotions modulate learning, (b) describe several methodologies that can be used to elicit and assess emotions in various educational environments and (c) encourage exploration of unanswered research questions regarding the impact of emotions on the training of healthcare professionals. It is our aim that this chapter will not only improve readers' understanding of the role of emotions in training, assessment and performance of clinicians, but will also serve as a reference guide for healthcare professional education researchers embarking on emotion research (see practice points).

Defining the terms

As the medical education community begins to recognise the importance of emotions within the context of learning, it is important for researchers to use consistent conceptualisations and operationalisations of relevant phenomena, including affect, mood and emotion[3] (see Table 25.1).

Affect refers to a broad, inclusive neurophysiological state that typically involves simple, non-reflective feelings.[4] People are continuously in an affective state, although its nature and intensity varies over time. Examples of affect include pleasure, tension, calmness and tiredness. In this way, affect is an umbrella term that includes not only moods and emotions, but constructs such as beliefs, preferences, evaluations and attitudes.

Moods typically refer to free-floating affective states that can last for hours, days or weeks and are

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Table 25.1 Definitions of affect, mood and emotion

Term	Definition	Example
Affect	A neurophysiological state interpreted as a simple, non-reflective feeling	Pleasure, displeasure, tension, calmness, energy and tiredness
Mood	A free-floating affective state that can last for hours, days or weeks and is not associated with a specific object or event	Waking up in an irritable mood, feeling content for no specific reason
Emotion	Psychophysiological changes that occur in response to a given object or event, including behavioural reactions (e.g., actions such as approach or avoidance), expressive responses (e.g., facial and/or vocal expressions), physiological reactions (e.g., neuronal or hormonal) and cognitive appraisals (e.g., subjective evaluations of the situation)	Being irritable in response to an argument, being elated due to a positive performance

not associated with a specific object or event.[5] For example, one may wake up in an irritable mood, a state that could vary in duration and is not linked to a specific event, object or person.

Emotions, in contrast, are associated with a specific event or moment, real or imagined, that can take place in the past, present or future.[3] Examples include being happy about a positive diagnostic outcome or fearful about an upcoming clinical rotation with a particularly difficult supervisor. Within cognitive psychology, emotions are further defined as a series of psychophysiological changes that occur in response to a given object or event. These changes include behavioural reactions (e.g., approach or avoidance), expressive responses (e.g., facial and/or vocal expressions), physiological reactions (e.g., neuronal or hormonal) and cognitive appraisals (e.g., subjective evaluations of the situation).[6] In this way, learners in different emotional states are expected to respond differently to a given educational event. For example, after receiving constructive feedback on a performance evaluation, a learner who is feeling particularly anxious may avoid the preceptor (a behavioural response), become rather quiet (a vocal expression), feel like his heart is racing (a physiological reaction) and perceive the event as quite negative (a cognitive appraisal of the situation).

Conceptual foundations

The structure of emotion

Two broad approaches can be used to classify emotion research: the discrete approach and the dimensional approach.

Researchers espousing *dimensional approaches* view emotions as entities that share a set of underlying dimensions. By way of analogy, specific labels can be put on individual colours, but the spectrum of colours can be defined more succinctly through dimensions of brightness, hue and saturation.[7] The most common dimensional model of emotion, the circumplex model, posits that emotions are defined based on their valence (positive vs. negative) and their level of physiological arousal or activation (high vs. low).[8] In this way, valence and arousal are thought to be orthogonal, bipolar dimensions that enable one to quantify different emotional states.

Others have argued that these dimensions are too simplistic to account for the heterogeneous nature of affect.[7,9] For example, Fontaine *et al*.[7] analysed 24 emotional terms in three European cultures and found that four dimensions were needed to adequately distinguish among these terms – valence, activation, potency-control (e.g., feelings of power or weakness, which differentiate feelings of anger and contempt from feelings of shame and despair) and novelty-unpredictability (e.g., reactions to unexpected events, whereby feelings such as surprise and fear are distinguished from most other emotions). Lovheim,[9] on the other hand, espoused a three-dimensional model, termed the 'cube model of affect', whereby affective states are quantified as a function of three main monoamine neurotransmitters: serotonin, dopamine and noradrenaline.

The debate over the number and nature of the underlying dimensions of affective states is ongoing as researchers have found that different emotions within the same dimensional space can have different effects.[10,11] These researchers have argued for a *discrete states approach*, whereby each emotion is considered to be unique.[7,12] Discrete models of emotion present each emotional state with unique behavioural and cognitive manifestations, somatic and visceral symptoms, expressive behaviours (e.g., facial, postural and vocal expressions), coping responses and so forth. For example, the emotion of anxiety is associated with the presence of an 'uncertain, existential threat';[13] limited attention to peripheral details and avoidance strategies (e.g., specific attention- and action-related biases);[14] increased respiratory rate, heart rate and cardiovascular output (e.g., unique visceral and somatic symptoms)[15] and tense facial, postural and vocal expressions (e.g., expressive behaviours).[16]

While discrete approaches emphasise the unique aspects of different emotions, it is also clear that some emotions closely resemble one another (e.g., shame and guilt, terror and fear, envy and jealousy). Thus, in a variant of the distinct states approach, several researchers have attempted to compose categories of emotions, whereby members of each category closely resemble one another. For example, the category of 'anger' may include rage, wrath and annoyance. The manifestations (behavioural, cognitive, physiological, expressive, etc.) of these emotions are thought to be similar to one another, but different from emotions belonging to other categories, such as those defined by love (e.g., adoration, compassion, affection and tenderness) or fear (e.g., horror, fright, panic and terror).[3] Whether this revision of the discrete states approach blurs the boundaries between it and dimensional approaches or whether some categories simply reflect the existence of synonyms within common language remains to be seen. For now, the best recommendation that can be made for researchers is to make a deliberate choice regarding which model seems most appropriate given the questions and context under study.

Incidental versus integral emotions

Because emotions are thought to arise in response to a specific object or event, they can also be conceptualised based on the focal cause (or source) of the emotion and its relevance to the task at hand. *Incidental* emotions are derived from a source that is unrelated to the task. For example, if one is trying to study the Krebs cycle, incidental emotions can include anger caused by an earlier confrontation with a colleague or frustration caused by an intermittent Internet connection. In contrast, *integral* affective states are directly related to the task – the excitement that arises when a trainee correctly diagnoses a challenging case, or the trepidation that arises the first time a resident intubates a patient without the assistance of a senior physician. In these examples, the affective state is induced by the event and, thus, is integral to the learning experience.

There is evidence that both integral and incidental emotions influence the judgements and choices people make.[10,17] It is reasonable to suspect, however, that incidental and integral affective states can have differential effects on learning, thereby providing further cause to carefully distinguish between sources of emotions. For example, in a review of the literature on the relationship between stress and performance, LeBlanc[18] suggests that when the task being performed is integrally related to the source of stress (e.g., resuscitating a patient), attention will be focused towards the task itself, and performance may be enhanced; however, if the source of stress is incidental to the task being performed (e.g., loud noises and disruptive team members), then attention will be focused away from the task and towards the source of the stress, which should have detrimental effects on performance. Thus, whether or not emotions are induced by the learning event should modulate their influence on learning, knowledge retention and knowledge transfer.

Theoretical approaches

Several theories have been developed to explain the relationship between emotion and cognition. The *affect-as-information* model[19] posits that emotional responses provide physiological and experiential information that subsequently guides individuals' responses to various situations. According to this theory, emotional responses to a particular judgement, object or event signal the overall value (e.g., pleasant/unpleasant and desirable/undesirable) and importance (e.g., urgent/not urgent and important/unimportant) of the situation. Imagine a paramedic treating a critically injured child. In such a case, feelings of anxiety indicate that the stakes are high, that there are significant threats to the child's wellbeing and that time is of the essence.[20] In this way, the affect-as-information account would argue that emotions influence learning by prioritising certain information within the learning environment. This is very much a dimensional approach in that the information gleaned from emotions is a function of valence (e.g., value) and arousal (e.g., importance).

In contrast, researchers adopting a discrete states approach to studying emotions have emphasised the importance of *cognitive appraisals* in defining different emotional states. Appraisal theorists posit that emotional experiences are the result of how individuals interpret, or appraise, a given object, event or situation.[12,21] According to appraisal theories, emotions result from the interpretation of ongoing events and situations;[21] the same situation can produce different emotions in different people based on their appraisal (or interpretation) of the situation. Imagine an instance where a trainee is being harshly criticised by their supervisor for making a mistake that could have had severe consequences for a patient. How the trainee responds depends on how they interpret the situation. The trainee may respond with anger if they believe the criticism is misplaced because others are to blame; or may maintain positive emotions if they believe the best one could do, given the situational demands, was done. Appraisals are important because they mediate the impact of situational factors and can be targeted by educational interventions intended to foster positive emotional development.[22]

More recently, the *control-value theory* of emotions was developed to understand the role emotions play in academic or achievement settings.[22] This theory distinguishes between two types of emotions: activity emotions pertaining to ongoing achievement-related actions and outcome emotions pertaining to the results of these activities.[23] Activity emotions include excitement at the chance to learn something new and anger about a challenging assignment; outcome-related emotions include the joy and pride experienced when academic goals are met.[22] This theory argues that both activity- and outcome-based achievement emotions and the appraisals that accompany them influence learners' academic engagement and performance. Because the control-value theory was developed specifically to examine emotions in achievement settings, it is particularly useful in understanding the effects of emotions on motivation, learning and performance.[24]

Mechanisms of action

Within cognitive psychology, emotions are thought to influence learning and performance along five general routes: cognitive resources, strategies of learning and problem-solving, memory, self-regulation and interest/motivation.[25]

Cognitive resources

Emotions influence the distribution of cognitive resources within working memory. Resource allocation models[26] posit that emotions unrelated to ongoing learning activities (incidental emotions) will consume working memory resources, reducing those resources available for task demands and, thus, negatively impacting performance.[27,28] For example, a student who is anxious about an upcoming certification examination or is saddened by the death of a patient will have fewer cognitive resources available to devote to current learning demands. Fraser and colleagues[29] recently found that (a) cognitive load during simulation training was highest when trainees reported high levels of 'invigoration' and low levels of 'tranquility' and (b) trainees' ability to accurately diagnose a simulated murmur decreased as cognitive load increased. These results are among the first within medical education to demonstrate the impact of emotion and cognitive load on performance.

Most studies in this area, however, have focused predominantly on incidental emotions, whereby participants' emotions are measured (or manipulated) before completing a 'neutral' task. When emotions are integral to the task demand (e.g., responding to emotional words or images), emotions have been shown to facilitate working memory performance,[30] particularly in arousing situations.[31] These results suggest that incidental and integral emotions have differential effects on working memory and, consequently, on learning and performance.

Strategies of learning and problem-solving

Emotions modulate an individual's use of 'cognitive shortcuts', including schemata, attributes, heuristics, stereotypes and rules of thumb. Negative moods are associated with the use of systematic, analytical processes while positive emotions are associated with more creative ways of solving problems.[32] These findings suggest that positive emotions promote the use of flexible learning strategies, such as elaboration and organisation of learning materials, while negative emotions can facilitate the use of more rigid strategies, such as simple rehearsal.[33,34] In this way, emotions influence the way in which learners think during educational activities.

Memory

Highly emotional experiences tend to be well remembered. In general, (a) negative events are more likely to be recalled than positive events[35] and (b) arousing experiences are more easily remembered than less-arousing experiences.[36] When emotions are linked to a specific learning experience, trainees may remember the information gained from the learning event in more detail than non-emotional experiences. However, such emotionally enhanced memory may not be beneficial in cases where emotions are 'carried over' from prior experiences (e.g., are incidental to the current task). For example, imagine Janet, a senior internal medicine resident, who misdiagnosed an anaphylactoid reaction as worsening asthma. Janet experienced severe anxiety, regret and guilt. Several weeks later, a 30-year-old male was admitted onto the internal medicine service with asthma complicated by pneumonia. He was given antibiotics, but 24 hours later, his wheezing became worse and he was having difficulty breathing. Upon hearing this, Janet became incredibly anxious and feared she had made another mistake. In this case, the emotions of the initial event were transferred to a novel situation in a way that can influence how Janet deals with her new patient.

Self-regulation

In educational settings, students must plan, monitor and evaluate their knowledge to adapt their learning strategies to task demands and learning goals.[34] Researchers have shown that emotional states can influence self-regulatory processes: positive, arousing emotions, such as enjoyment of learning, promote self-regulation; negative emotions, such as anxiety or shame, facilitate reliance on external guidance to recognise learning needs.[22,34] Furthermore, research has shown that emotions influence the extent to which individuals monitor and revise educational goals. Richard and Diefendorff[37] found that participants in positive moods are more likely to report higher academic goals (e.g., grades strived for on the next test), while those in negative moods tend to have lower goals. The authors theorised that positive emotions signal to the individual that the likelihood of success is high, whereas negative emotions suggest that the likelihood of success is low.

Interest and motivation

Finally, emotions can impact students' learning and performance by inducing and sustaining interest.[38,39] For example, a medical student with an interest in obstetrics will seek out opportunities to engage in associated activities and such engagement will ideally lead to emotions such as enjoyment or excitement as he expands his knowledge, thus creating more interest. Situational interest is generated by specific environmental stimuli, such as the way educational tasks are organised and presented; it appears to be particularly important when dealing with learners who have no pre-existing interest in the pedagogical activities.[38,39]

Together, these findings demonstrate that emotions influence a variety of cognitive processes involved in learning that should be relevant in medical education. More research is needed to determine the extent to which these findings can be generalised from cognitive psychology laboratories to real-world educational environments. As such, the next section of this chapter will outline common strategies for exploring the influence of emotion on learning prior to offering a brief overview of how these and other techniques have recently been used to conduct research in the field of medical education itself.

Inducing and measuring emotions

Researchers interested in studying emotions experimentally have typically treated affective states both as an independent variable, whereby emotions are manipulated to determine their impact on various phenomena, and an outcome variable, whereby emotions are measured using self-reports, facial or vocal expressions and autonomic or central nervous system activation.

Emotion induction tactics

A number of experimental emotion induction procedures have been developed to provoke transient affective states that theoretically mimic emotions arising in natural situations.[40] These manipulations are most often incidental emotion interventions rather than integral. They include the presentation of evocative film,[41,42] which has the advantages of being readily standardised, involving no deception, having high degree of ecological validity and being dynamic rather than static.[41] Music has similarly been used in a wide variety of experiments.[43] In such studies, participants typically listen to a mood-suggestive piece after being instructed to try to feel the emotive state expressed. Interestingly, while films have been shown to elicit discrete emotional states,[44] research suggests that music may be better suited to manipulate valence and arousal rather than specific emotions.[44]

Two other commonly used mood induction procedures include the Velten method and the autobiographical recall procedure. In the former, participants read 60 self-referential statements and try to feel the emotion described.[45] For example, participants in a positive/aroused condition might read statements such as 'This is great, I feel really good, I am elated about things'. While numerous researchers have used the Velten statements in mood induction studies, there are inconsistencies in the literature regarding its effectiveness.[46,47] During the autobiographical recall procedure, participants are asked to recall one or more emotional life events. For example, individuals may be asked to write about a situation where they felt angry, happy, serene or sad. Autobiographical recall has been associated experimentally with changes in both arousal and valence.[48,49]

Challenges associated with inducing emotions

Emotion researchers are often presented with methodological and ethical challenges when designing and conducting experiments. Foremost among these is that for incidental mood inductions to work, researchers have argued that participants should be unaware that their emotions are being manipulated or measured. Otherwise, participants try to correct for potential affective biases.[50] As such, mood inductions are typically framed as a separate study that is unrelated to the primary task.

In this way, investigating the influences of emotions on learning and performance often requires some form of deception, thereby making it impossible to provide fully informed consent. As a result, it is important to not utilise manipulations that are too extreme to minimise the likelihood of risk to participants. Further, it is essential that emotion researchers fully debrief participants after completion of the study, particularly in cases where participants are induced to experience negative emotional states. It is clearly unethical to create emotions such as anger, fear, sadness or shame without attempting to dissipate such emotions upon completion of the learning experience.

Measuring emotions

Assessing emotions, especially in real-world situations, is a complex, daunting task, but techniques exist to measure both dimensions of emotions and discrete emotional states. Here a distinction needs made between non-verbal and self-report measures.

Non-verbal instruments are not language dependent and, therefore, can be used across different cultures. Such strategies assess either expressive or physiological changes that accompany emotions. Expressive aspects of emotion include facial, vocal and postural changes. Facial expressions are a key component of emotion, with many studies having shown moderate-to-strong correlations with subjective experiences.[51,52] A number of observer-based systems have been developed to measure facial expression, including the Facial Action Coding System (FACS).[53–55] Patterns of vocal cues have similarly been linked to emotions,[56] including average pitch, changes in pitch, intensity, speaking rate, voice quality and articulation. Unfortunately, links to discrete emotional states have proven to be challenging.[57] Physiological components of emotions involve changes in the autonomic nervous system (ANS) and can be measured using a variety of techniques, such as blood pressure responses, heart rate, skin responses and hormonal changes.[15] However, there is still substantial debate among researchers as to whether the relationship between emotions and ANS activation is best understood using dimensional[58] or discrete[59] models, with some arguing that variability in response patterns arises at least partially in response to variability in procedures used to induce emotion.[60]

Table 25.2 Commonly used self-report measures of emotions

Measure	Construct	Description
Feeling scale (FS)[61]	Dimensional approach (valence only)	• Single-item scale • 11-point bipolar scale ranging from –5 to +5, with anchors at all odd integers • Typically used in conjunction with Felt arousal scale (see below)
Felt arousal scale (FAS)[62]	Dimensional approach (arousal only)	• Single-item scale • 6-point bipolar scale, with anchors only present at 1 ('Low Arousal') and 6 ('High Arousal') • Typically used in with Feeling scale (see above)
Circular mood scale (CMS)[63]	Dimensional approach (valence and arousal)	• Single-item scale • Measures arousal and valence • Consists of a circle surrounded by eight emotional states (*active/attentive, euphoric/elated, happy/friendly, calm/relaxed, uninvolved/inactive, bored/sluggish, unhappy/grouchy and alarmed/angry*)
Positive affect and negative affect scale (PANAS)[64]	Dimensional approach (positive vs negative affect)	• Consists of 20 adjectives, 10 representing positive 'activation' and 10 representing negative 'activation' • Each adjective uses a 5-point scale that ranges from 'Very slightly/Not at All' to 'Extremely'
Activation deactivation adjective checklist (AD ACL)[65]	Dimensional approach	• Consists of 20 adjectives • Measures energy, tiredness, tension and calmness • 4-point response scale, ranging from 'definitely feel' to 'definitely do not feel'
Four-dimension mood scale (4DMS)[66]	Dimensional approach	• Measures positive energy, tiredness, negative arousal and relaxation. ***Or*** • Energetic arousal and tense arousal
Profile of mood states (POMS)[67]	Discrete approach	• Measures six distinct states: fatigue-inertia, vigour-activity, tension-anxiety, depression-dejection, anger-hostility and confusion-bewilderment. • Consists of 65 adjectives, each with a 5-point Likert scale
Achievement emotion scale (AEQ)[68]	Discrete approach	• Specific to academic settings • Based on Pekrun's (2006) control-value theory of achievement emotions • Measures enjoyment, hope, pride, relief, anger, anxiety, shame, hopelessness and boredom • Consists of 24 items using a 5-point Likert scale (1 = completely disagree, 5 = completely agree)

While expressive and behavioural components of emotions can be measured in a variety of ways, the assessment of the experiential component of emotion is arguably the most important (given it is the definition of the actual experience). However, such measurements can be considerably more challenging than non-verbal measures of emotions. A wide range of self-report scales exist, all of which claim to measure different aspects of emotions. As such, emotion researchers are faced with the challenge of choosing the most appropriate self-report measures and the decision to use one scale over another is often not well understood or justified. Choosing the appropriate measure from the vast number of self-report tools requires a firm understanding of the underlying theoretical perspectives that preceded this section. At the most basic level is whether the researcher is interested in emotional dimensions (e.g., valence and arousal) or discrete emotional states (e.g., anger and excitement). Table 25.2 highlights some of the most commonly used self-report measures. For an excellent review, see Ekkekakis.[3]

Recent explorations of, and future directions for, emotion in medical education

As alluded to at the beginning of this chapter, medical school is saturated with emotional experiences. As such, understanding the role emotions play in learning and performance has important implications for medical educators. Traditionally, emotions and reason have been viewed as processes that oppose one another, the assumption being that affective processes reduce rationality, cloud judgement and distort reasoning. By viewing emotions as the antithesis of logic and reason, some medical educators have contributed to a culture that implicitly or explicitly encourages students to detach themselves from clinical experiences. This attitude of 'detached concern' and the importance of emotional neutrality may detrimentally impact trainees' ability to apply clinical knowledge to complex real-world environments and their ability to gather support when it is needed. While most medical educators recognise the omnipresence of emotions, little research has been conducted to identify when and how emotions influence learning and practice within clinical settings.[69,70] That is changing though, for the better, given that understanding how emotions influence learning and performance is likely to be vital to developing more effective pedagogical strategy. The research specific to medical education remains by no means extensive, but here we outline two promising recent directions as a means for showing how the field is building on the research summarised above, how cognitive aspects of emotion intertwine with broader issues and to offer promising leads regarding productive paths of inquiry.

Clinical reasoning

Research has suggested that clinical expertise amounts to having many diagnostic strategies available to facilitate problem-solving.[71,72] As a result, it is difficult as of yet to know what implications to draw from observations such as negative emotion being more associated with narrowed attention and lessened influence of holistic impressions relative to positive emotions.[73] Given the centrality of problem solving to clinical expertise, it is no surprise that reasoning has been a dominant area of research in our field. What is surprising, given the volume of work, is that researchers have typically not examined if, when, or how emotions have an influence on learning or performing the tasks required for clinical reasoning.

Kozlowski *et al*.[74] were able to identify 23 papers that examined the influence of emotions on clinical decision-making (the outcome of reasoning). A variety of their results are noteworthy for our purposes. For example, although emotion appeared to be a strong feature of clinical decision making, most of the responses described were negative (e.g., fear, conflict, discomfort, regret). To what extent that is a result of training, frustrations with the health system, negative events being more memorable or the tendency of researchers to focus on 'problems' that need to be solved is unclear. What is clear is that emotion is commonly seen as a problem in that the authors identified several studies that reported clinicians' deliberately attempting to exclude emotion from their clinical decision making. There is some justification for that given McConnell *et al*.'s finding that, during learning, experimental induction of emotion (using the self-referential techniques described above) yielded reduced capacity to transfer basic science concepts students were attempting to learn to clinical cases.[75] That is, relative to a neutral control condition, both positive and negative emotion induction was related to a decrease in diagnostic accuracy. However, it likely underestimates the advantages to which emotion can be used and raises questions of how disadvantages can be minimised given the inevitability of emotion being an important component of practice context. Such questions are prompted in part by Kozlowski *et al*.'s observation of 'interdisciplinary tension' regarding the significance of emotion in clinical decision making. If nurses and doctors, for example, have divergent perspectives on the value of emotion and its role in healthcare, to what extent does that interfere with interprofessional collaboration and how should the role of emotion be featured in interprofessional education?

On another note, if affect is fundamentally intertwined with cognitive load, as supported by McConnell *et al*.'s findings, additional research provides a means through which we can better understand how and why individuals need to be challenged by clinical cases tailored to their level of development for effective learning to occur.[76] At the other end of the continuum, it is worth noting that the more experience a health professional gains the less likely they are to feel anxiety related to their own abilities to address the issue. At what point, however, does the reduction of cognitive load that enables improved learning crossover into being so emotionally deactivating as to prevent the clinician from noticing differences between current cases and previous clinical encounters? That is, how can the boredom derived from having 'seen it all before' be overcome to enable better outcomes for both the current patient and the likelihood that the physician will take steps to direct ongoing professional development? Such questions lead us to broader consideration of what influence emotions hold on the assessment and maintenance of clinical expertise, confidence and professional identity.

Assessment, self-regulation and maintenance of expertise

Medical professionals are required to continuously monitor their performance to identify potential gaps in clinical and/or professional skills, abilities or knowledge that may impact patient safety. As a result, effective self-regulated learning must be nurtured during medical training to ensure it is applied throughout the entirety of one's medical career.[77] External feedback, whether delivered through formal or informal assessments, is critical, but can be threatening in ways that undermine confidence and professional identity;[78] it is, therefore, intrinsically bound to emotion, requiring learners at all stages of the continuum to be aware of how their emotions influence learning processes.[79] We must train physicians to be aware of how emotions may bias perceptions, interpretations and actions, whether those biases prove harmful or beneficial to their assessments of themselves or others.[80] In this regard, the methodological challenge created by participants' capacity to dampen the influence of an intervention if they are aware that emotion is being manipulated offers promise that awareness can be raised as a means to optimise the contributions of emotion to clinical performance.

Emotions tend to be heightened for learners during early clinical experiences.[70,81] As McNaughton[70] eloquently states, 'under great pressure to prove themselves worthy of entering the profession, students are afraid to admit that they have uncomfortable feelings about patients or procedures and hide these feelings behind a cloak of competence' (p. 75). Our efforts, therefore, to engage learners in the behaviours that will be required to effectively self-regulate performance later on may be counterproductive if clinical educators do not take active account of learners' emotional needs, offering support in developing emotionally cognisant, self-regulated learners who understand how affect influences their learning and performance. Indeed, extensive work by Sargeant and colleagues has indicated that emotion plays a fundamental role in the capacity of both trainees and practitioners to learn from feedback that is made available through various constructive processes.[82,83] Exploring emotions during feedback processes was so routinely identified as a critical factor enabling receptivity that it became a fundamental component of the now extensively used R2C2 model, "exploring Reactions" being the second of the two "Rs".[84]

More generally, Ajjawi *et al*.[85] have recently conducted a critical literature review to determine how emotion is used as a construct aimed at enabling feedback practice and research. Their results highlight that emotion is inevitable, not pathological. The discourses observed remind us that the cognitive lens applied in this chapter is but one lens that needs to be considered to enable a full understanding of how emotion influences, for better and worse, the education and practice of healthcare professionals. Emotion is a physiological process and it both influences and is influenced by other cognitive processes; at the same time, however, it is interpersonal and politically forceful. These latter perspectives are beyond the focus of this chapter, but they are mentioned as further evidence that we as a field have only begun to touch the surface on our understanding of emotions' roles and impacts during learning, assessment and remediation.[86]

What we do know, however, leads us to encourage faculty members to facilitate and encourage discussions of the various emotional states faced by trainees without limiting such conversation to negative emotions. Rather, we should highlight the positive emotions that accompany medical training, such as pride, excitement and compassion to enable consideration of how all emotion is a double-edge sword, enabling some good while also creating some risk. For example, positive emotions make one feel better (by definition), thereby maintaining engagement longer; as alluded to above, however, they can also increase the likelihood that one will overlook details that might be important to adequately address a given clinical scenario. To enable meaningful affect awareness, we need to better understand how emotions, whether positive or negative, help, hinder or prove immaterial to physician performance in the broadest possible sense, including not just their cognitive impacts, but how emotion factors into the establishment of efficacious therapeutic relationships between patients and clinicians.[87,88] Given the reality that suboptimal care that leads to review by medical regulatory authorities most commonly involves relationship problems driven by communication skill or professional behaviour issues, it is imperative that we more deeply explore how emotions help or prevent physicians from thriving.

Conclusion

The primary goal of this chapter was to introduce medical educators to several theoretical and methodological approaches to emotion research. While there have been substantial strides made in understanding how emotions influence learning and performance in higher education,[1] less research has examined how emotions influence medical trainees' acquisition and application of knowledge and skills in clinical settings. To paraphrase Artino and Durning,[89] for medical education to advance, it is necessary to broaden what we consider important and begin to explore the role of emotion in learning. Researchers need to examine emotions within medical education settings to understand any number of issues ranging from fundamental learning processes through resilience in medical school to continuing professional development and self-regulated maintenance of competence. Through such research, medical educators can use the link between emotions and learning to determine whether, when and how teachers might modulate emotional environments to optimise learning.

Practice points

- Emotions play a major, but often underappreciated, role in learning and knowledge transfer. Before conducting emotion research, it is important to consider the following:
  - Define your construct. Are you interested in emotions or moods? Do you want to examine integral or incidental affect?
  - Model your construct. Are you conceptualising affective phenomena using a dimensional or discrete approach?
  - Weigh your options for measuring and/or manipulating emotions. Do any of the strategies outlined in the 'Inducing and Measuring Emotions' section of this chapter seem particularly appropriate given the context in which your study is taking place?
- These points should be considered in sequence because the definition and model selected should determine the most appropriate methods to both induce and measure affective states.

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26 Research on instructional design in the health professions: from taxonomies of learning to whole-task models

Jimmy Frerejean, Diana H.J.M. Dolmans and Jeroen J.G. van Merrienboer

Inez Delores became the educational director of an undergraduate programme in health professions education about one year ago. Now, she is confronted for the first time with the results of the regular annual programme evaluation. Students seem to be quite satisfied with the quality of their teachers and courses. That is good news. Yet, what worries her is the common complaint of students that they experience the whole programme as a rather disconnected set of topics and courses, with implicit relationships between them and unclear relevance to their future profession. Moreover, both programme alumni and workplace supervisors report difficulties with applying the acquired knowledge and skills at the workplace. Inez wonders if action needs to be taken and, if so, what she could do about the situation.

This situation is representative of the kinds of problems that are studied in the field of instructional design. This field of study aims to develop guidelines and models for the design of instruction, ranging from the design of particular instructional materials, via lessons and courses, to complete curricula. It covers the entire continuum of education; thus, in health professions education, it includes undergraduate and graduate programmes as well as continuous medical education. The guidelines and models developed in the field of instructional design help educators in health professions education to make instruction more effective, efficient and attractive. Effectiveness relates not only to learning outcomes but also to translational outcomes such as safer patient care and better patient outcomes. Efficiency relates to optimising the balance between outcomes and investments in terms of time, effort and money. And attractiveness relates to increasing students' motivation to learn.

For example, the above-mentioned complaint of the students that they experienced their programme as a disconnected set of topics and courses prompted the initial interest in 'integrative goals'.[1] Such goals are frequently encountered when instruction must reach beyond a single lesson or course; for example, when professional competencies or complex skills are taught. This shift towards integrative goals had important consequences for research on instructional design: 'Whole tasks' rather than distinct learning goals became the basis for the design and development of educational programmes.

The main aim of this chapter is to discuss research themes that are pertinent to the field of instructional design. First, a brief description will be provided of the ADDIE model that characterises the main phases in instructional design: Analysis, Design, Development, Implementation and Evaluation. Second, for the analysis phase, it will be described how research is moving away from an atomistic view that breaks down tasks into individual elements with corresponding learning goals and is moving towards a holistic view that focuses on 'whole tasks' and the relationships between their elements. Third, for the design and development phases, the main research themes for designing components of 'whole' task programmes and the use of media are described. Fourth, for the implementation and evaluation phases, research on how whole-task models affect the preparation of stakeholders and evaluations in educational organisations is described. The chapter ends with a summary of the main conclusions and future research directions.

The ADDIE model

Figure 26.1 presents the five phases in the ADDIE model:[2] (a) the analysis of fixed conditions and desired learning outcomes, (b) the design of instructional strategies, (c) the development of instructional materials, (d) the implementation of the developed instruction in the educational organisation and (e) its evaluation aimed at continuous improvement. Though the model appears to be

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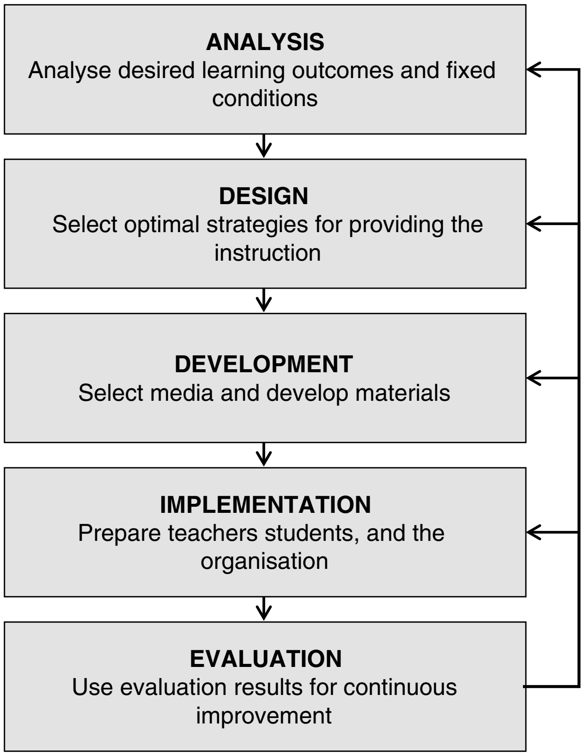

Figure 26.1 The ADDIE model

linear with predefined phases or steps that must always be taken in the same order, it does not have to be followed rigidly. The model may be repeatedly used to develop related units of instruction, phases may be skipped because particular information is already available, or later phases may provide inputs that make it necessary to reconsider earlier phases. It is thus best seen as a project management tool that helps the user to think about the different activities that must be conducted.

In the analysis phase of the ADDIE model, the focus is on the analysis of the *context* (availability of equipment, time and money, culture, setting – such as school or work organisation),[3] the analysis of the *target group* (prior knowledge, general schooling, age, handicaps)[4] and the analysis of *tasks* and *subject matter* (tools and objects required, conditions for performance, risks). Traditionally, desired learning outcomes are expressed as learning goals, but as indicated above, they increasingly take the form of 'integrative goals' such as complex skills or professional competencies (e.g., the CanMeds competencies).[5] For example, Inez Delores from our example cited above might decide to describe the final attainment levels that must be reached by her students, no longer as lists of learning goals but in terms of professional competencies, because these might provide a better basis for integrating the curriculum and preparing the students for the workplace.

In the design phase, instructional strategies are selected that best help to reach the desired outcomes, given the fixed conditions. The basic idea is that both desired outcomes and fixed conditions determine selection of the optimal instructional strategies. For example, if the desired outcome is memorising the names of the bones in the hand, rehearsal with the use of mnemonics is a suitable strategy; but if the desired outcome is reattaching a finger following a traumatic injury, guided practice with feedback on a wide variety of scenarios (simulated or real-life) is a more suitable strategy. Inez Delores might, for instance, conclude that the current curriculum does not provide enough practice opportunities for the development of professional competencies and decide to make more use of simulation-based learning in the future curriculum.

In the development phase, the focus is on the selection of suitable media and the construction of instructional materials. For example, when it is impossible to organise face-to-face meetings, online forms of education may be used. Or when practising particular skills at the workplace is disallowed due to safety issues, simulation-based training may be offered. In our example, Inez Delores may decide to develop role plays with simulated patients and clinical scenarios for simulation-based practice and ask the teachers in her programme to construct these learning tasks and include them in their courses.

In the implementation phase, the focus is on the introduction of the newly developed instruction in the setting in which it will be used and on supporting the actual use of the instructional materials. First, this pertains to teacher-training programmes or full faculty development programmes for preparing teachers and support staff. Second, it pertains to strategies for preparing students. Third, for larger design projects, it may pertain to preparing or changing the educational organisation in such a way that it best sustains the newly developed instruction. Inez Delores may, for instance, quickly find out that it is necessary to start renovations of the building to create spaces where students can meet simulated patients and work on simulation-based scenarios. Furthermore, she might decide to offer a training programme on simulation-based teaching to her staff and form multidisciplinary teams that would be responsible for organising the role plays and running the scenarios.

Finally, in the evaluation phase, a process of quality management is needed to evaluate and continuously improve the instruction. Here, not only student satisfaction must be considered, but also other stakeholders and measurement instruments to evaluate whether applied instructional strategies are apt to reach the desired outcomes given the fixed conditions (context, target group, etc.). Involving stakeholders in educational (re-) design and creating a supportive communication climate about education is crucial to enhance continuous improvement of education.[6]

For this reason, Inez Delores might decide to organise a dialogue with various stakeholders on how various data might inform decisions on how to improve education; for example, by looking at data on student satisfaction but also on student progress throughout the curriculum and data on how well they are doing at their workplaces after graduation.

Instructional design is both a practical field and a research field. Besides helping practitioners in the field of education, such as Inez Dolores, the ADDIE model can also serve as a framework for empirical research. Research is needed to develop methods, strategies and guidelines and to provide empirical support for instructional design models that organise them in a coherent framework. The remainder of this chapter will focus on research themes that are pertinent to each of the five phases of the ADDIE model.

The analysis phase

In the context of the ADDIE model, the analysis phase refers to the analysis of fixed conditions that cannot be altered by the designer (context, target group, tasks and subject matter to be taught) and the analysis of final attainment levels; that is, the specification of what learners will be able to do after they have finished the educational programme. In this chapter, we focus on two approaches for the specification of final attainment levels: the traditional use of taxonomies of learning for setting learning goals and the use of cognitive task analysis for developing *integrative* learning goals.

Taxonomies of learning

Traditional models for task and content analysis describe final attainment levels in terms of learning goals. Typically, tasks and contents that must be mastered by the learners after the instruction are first categorised as belonging to a particular domain of learning, such as the cognitive domain, psychomotor domain or affective domain, roughly corresponding with the triple knowledge, skills and attitudes. For each of these domains, the desired outcomes are then further analysed in terms of distinct learning goals. For example, in the cognitive domain, Bloom's taxonomy makes a further distinction between (a) knowledge, (b) comprehension, (c) application, (d) analysis, (e) synthesis and (f) evaluation (for an updated version of Bloom's original taxonomy, see[7]). In addition to Bloom's, there are several other taxonomies of learning goals.[8,9]

They all provide the input for condition-based instructional design models.[10] These models are based on the idea of the 'conditions of learning',[8] meaning that there are different instructional methods necessary for reaching different goals. For example, the instructional method for teaching the understanding of one or more principles (e.g., comprehending how the heart–lung system works) is different from the instructional method for teaching the use of a procedure (e.g., conducting a hip replacement). Consequently, when designing instruction, the optimal method is chosen for each goal depending on its classification in the taxonomy, the goals are taught according to their preferred method one by one, and the overall educational goal is believed to be met after all separate goals have been taught.

This condition-based approach works very well when there are few relationships between the goals. For example, in the field of nursing, the goals of providing stoma care to patients and the goal of scheduling patient admissions/discharges can be taught apart from each other because no integration of these goals is required. However, it may not work well when learning goals are integrated. For example, when a nurse is delivering stoma care to patients, certain goals are involved that relate to correctly using the necessary instruments, dealing with complications, properly communicating with patients and so forth.[11] All related skills must be performed simultaneously and need to be coordinated to provide good stoma care. An analysis leading to a list of separate learning goals that are then taught one by one is not very helpful in this case: it yields instruction that is experienced by students as fragmented and piecemeal because it does not take the relationships between the goals and their coordination into account. In short, the whole complex skill of providing stoma care is greater than can be expressed in a list of goals because it also includes coordination of the skills related to these goals. For this reason, in the early 1990s, authors in the field of instructional design started to question the value of taxonomies of learning and condition-based models for the teaching of complex skills or professional competencies where 'integrative' goals are at stake.[1]

Amongst other analysis methods, Cognitive Task Analysis (CTA) was put forward as an alternative for using taxonomies of learning, and whole-task instructional design models were put forward as an alternative for condition-based models.[12]

Cognitive task analysis

Almost 100 different approaches to task analysis have been described in the literature.[13] One powerful form of CTA is described by Clark *et al*.[14] and distinguishes three phases: (a) decomposition of the complex skill or the competency underlying expert task performance into its different aspects or constituent skills, (b) analysis of the non-routine aspects of the complex skill and (c) analysis of the routine aspects of the complex skill (see Table 26.1). In the first phase, the complex skill that underlies successful task performance is broken down into its constituent skills in a reiterative process and the interrelationships between constituent skills are identified in a so-called skills hierarchy, where the skills lower in the hierarchy enable the skills higher in the hierarchy (cf. Gagné's learning hierarchy). The distinct constituent skills are classified as 'non-recurrent' when the desired exit performance varies from problem situation to problem situation and is guided by the use of cognitive strategies and mental models. They are classified as 'recurrent' when the desired exit performance is highly similar from problem situation to problem situation and is guided by rules or procedures (i.e., routine aspects).

Figure 26.2 provides a small part of a skills hierarchy that was constructed for performing a nephrostomy.[15] The skills hierarchy guides further knowledge elicitation efforts in phases 2 and 3. In the second phase, non-recurrent aspects of the complex skill are further analysed. Cognitive strategies (how to effectively approach tasks in the domain) can be analysed as Systematic Approaches to Problem-solving or SAPs. They describe a systematic approach to performing particular aspects of the task in terms of subsequent problem-solving phases and rules-of-thumb that may help to successfully complete each phase. For example, a SAP may be developed for introducing the needle, describing the phases to go through and the rules-of-thumb ('tricks of the trade') that may help to deal with complications and successfully complete each phase. In turn, mental models (how is the domain organised?) can be analysed as domain models. They describe the knowledge necessary for successful task performance as conceptual models (how are things named in the domain? e.g., the names of different parts of the renal system such as the cortex, medulla, calyx, pelvis, etc.), structural models (how are things organised in the domain? e.g., the

Table 26.1 Cognitive task analysis

Phase*	Object of analysis		Main question(s)	Analysis results
Phase 1 Skill decomposition	Constituent skills and their interrelationships underlying whole-task performance		• Which constituent skills make up the complex skill? • Which constituent skills enable skills higher in the hierarchy? • What is the temporal relation between constituent skills?	Skills hierarchy
Phase 2 Analysing non-routine aspects of exit performance	Non-recurrent constituent skills	Cognitive strategies	• How do experts systematically approach tasks in the domain? • Which rules of thumb might help to complete the task?	Systematic Approaches to Problem Solving (SAP)
		Mental models	How is the task domain organised?	Domain models: • conceptual • structural • causal
Phase 3 Analysing routine aspects of exit performance	Recurrent constituent skills	Cognitive rules or procedures	Under which conditions are particular actions performed (IF . . . THEN . . .)	Just-in-time information displays
		Prerequisite knowledge	What does the task performer need to know to apply the rule(s) or perform the procedure correctly?	

* Note that for phase 1, techniques such as documentation analysis, observation, and semi-structured interviews are used. Phases 2 and 3 rely on techniques such as think-aloud protocols, document study and interviews.

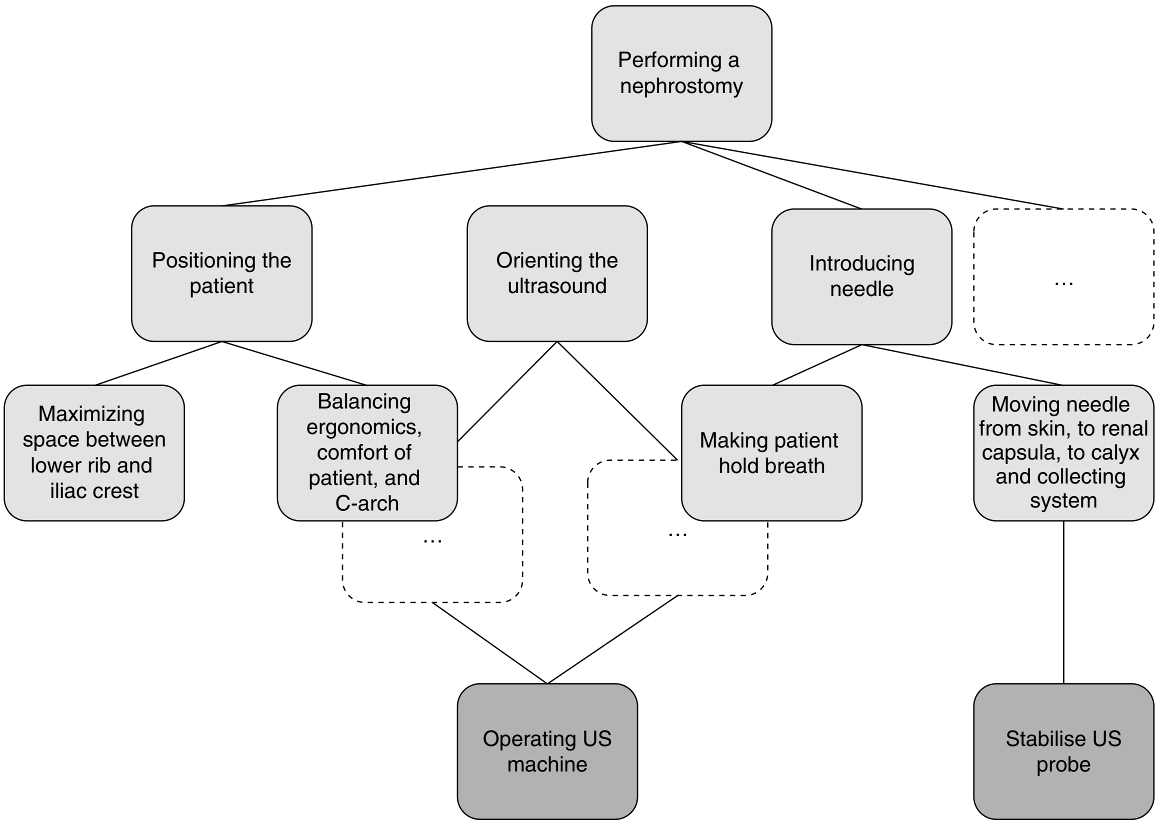

Figure 26.2 Part of a skills hierarchy for performing a nephrostomy (recurrent constituent skills are in the dark gray boxes. Note these are at the bottom of the hierarchy because they involve routine behaviours that are basic to many skills higher in the hierarchy)

structure of the kidney) and causal models (how do things work in the domain? e.g., the working of the renal system).

In the third phase, recurrent aspects of the complex skill are further analysed. Here, analysts first employ process tracing techniques to identify the rules and/or procedures that generate highly specific, algorithmic descriptions of routine aspects of task performance. For example, the analyst may develop rules and procedures for correctly operating the US machine, describing which knobs to turn and which displays to read to reach specific objectives. Next, the prerequisite knowledge required to correctly apply the rules or perform the procedures is identified. For example, when a particular rule specifies 'IF you need to switch on the machine, THEN push the power button', prerequisite knowledge might relate to the exact position and appearance of the power button.

The results of the three phases provide highly detailed information about the constituent skills, cognitive strategies, mental models, rules/procedures and prerequisite knowledge required for successfully performing the complex task. Knowledge and skills are fully integrated in the representation of the complex skill and, if necessary, desirable attitudes can be related to the distinct constituent skills. This makes it clear, for example, that for the complex skill of nephrostomy, it is important to be attentive to patient modesty and comfort while positioning the patient (one particular constituent skill), but not when operating the US machine (another constituent skill for which this particular attitude is not important).

Several studies in the health sciences domain have shown that educational programmes based on CTA are particularly effective.[16] Thus, CTA seems to provide a strong basis for the design of educational programmes, but more research can contribute to improvements of the CTA process and its outcomes for instructional design. For example, the growing prevalence of competency frameworks such as CanMeds or descriptions of Entrustable Professional Activities (i.e., EPAs)[17] introduces new directions for research that investigate how CTA can contribute to the description of

EPAs and professional competency frameworks. Furthermore, new approaches and tools create new opportunities to conduct CTAs. Virtual reality systems and high-fidelity simulations allow analysts to observe professionals in a varied set of realistic professional tasks and carefully study their actions and decisions. Miniature cameras placed in glasses or on equipment can be used to observe professionals and their work context without interfering with the task. Video reflexivity is a relatively new technique to use video recordings to reflect on team task performance.[18] Portable eye-tracking technologies can be used to study the difference between a professional's eye movements and those of novices. Finally, online synchronous collaboration tools make it possible to easily conduct group brainstorms and knowledge elicitations sessions with experts across the globe. Such developments create interesting opportunities to research and improve CTA practices.

The design and development phases

As discussed in the previous section, a distinction can be made between design models that start designing instruction from learning goals (i.e., 'condition-based models'), and design models that start designing instruction from whole, real-life tasks, whose performance can be analysed in a process of CTA. The remainder of this chapter will discuss only whole-task models[19] because, in health professions education, many instructional design projects will deal with the development of professional competencies or complex skills. All whole-task models emphasise the importance of real-life tasks as the basis for the design of learning tasks and, thus, for fruitful learning. Some models limit themselves to one particular type of learning task; for example, 'problems' in problem-based learning (PBL), 'projects' in project-based learning and 'cases' in the Harvard case method. Other whole-task models that are more strongly rooted in an instructional design tradition prescribe or allow for the use of different types of learning tasks in the same educational programme. Examples are Merrill's first principles of instruction;[20] cognitive apprenticeship learning[21] and van Merriënboer's four-component instructional design model (4C/ID).[22]

4C/ID is a popular whole-task model, and its effectiveness has been researched extensively.[23] It claims that educational programmes that support the acquisition of complex skills or professional competencies can always be constructed from four components:

1. *Learning tasks*. Meaningful whole-task experiences that are based on real-life tasks form the 'backbone' of the educational programme.
2. *Supportive information*. Information that is supportive to the learning and performance of non-routine aspects of learning tasks (i.e., problem-solving, decision-making, reasoning).
3. *Procedural information*. Information that is prerequisite to the learning and performance of routine aspects of learning tasks.
4. *Part-task practice*. Additional exercises for routine aspects of learning tasks for which a very high level of automaticity is required after the instruction.

The next four subsections discuss relevant research themes pertaining to the design and development phases of the ADDIE model, using these four components as a structure. First, we discuss research on learning tasks. Second, we discuss research on supportive information. Third, we focus on procedural information and part-task practice. Finally, we discuss research themes in the development phase, that is, the selection of media and the actual construction of instructional materials.

Learning tasks

In whole-task models, all learning tasks provided to students are meaningful, authentic and representative of the tasks that a professional might encounter in the real world. Yet, learning tasks are often not identical to real-life professional tasks because they may contain support and guidance and are carefully designed to optimally support the learning process. Vandewaetere *et al*.[24] describe the development of a large-scale educational programme in general medicine based on 4C/ID. In one of the developed courses, 'Patients with diabetes', learners work on learning tasks both in a simulated task environment (either online or in face-to-face meetings) and in the real task environment, that is, in the doctors' practice. The tasks show high variability of practice and may be of different types (e.g., from systematically observing an expert performing the task to performing the task yourself). Furthermore, the learning tasks are ordered from a low level of complexity to increasingly higher levels of complexity (i.e., a spiral approach): higher levels of complexity make an appeal on additional CanMeds roles, such as acting as a collaborator and communicator (e.g., not only diagnosis and treatment of diabetes but also the management of patients with diabetes). At each level of complexity, scaffolding ensures that learners receive ample support and guidance in the beginning but less support and guidance as their expertise increases; guidance is given by both the teacher and the peer learners.

For the design of learning tasks, relevant research themes concern the authenticity of tasks, variation between tasks, scaffolding of task support and guidance, sequencing of tasks and self-regulated learning (see Table 26.2). Concerning the authenticity of simulation-based learning environments, for example, a distinction can be made between psychological fidelity (the learning environment replicates the psychological factors experienced in the real environment), functional fidelity (the learning environment behaves in the same way as the real environment) and physical fidelity (the learning environment looks, sounds, feels and smells like the real environment).[25]

A second theme relates to variation between tasks. Each real-life task is unique: not one patient is identical to another patient, and not one intervention is identical to another intervention. To reach transfer, that is, the ability to perform an acquired complex skill in new, unfamiliar situations (e.g., in the workplace rather than in the training setting), it is thus critical that learning tasks enable variability of practice and differ from each other in all dimensions on which real-life tasks also differ from each other. For example, when practising nephrostomy, it is important that learning tasks use different patients or models (obese or not, septic or not, etc.), different renal problems (kidney stones, scoliosis, cystic kidneys, horseshoe kidneys, etc.), different complications and so forth.[26] Although variation is necessary for transfer to occur, it is still an open question how variation across tasks can best be designed to optimise learning and transfer, especially because some types of variation have negative effects on performance during learning but positive effects on transfer (i.e., the 'transfer paradox').[27]

Table 26.2 Research on learning tasks: five themes

Topic	Example research questions*
Authenticity of tasks	How similar should learning tasks be to real-life tasks? How to design learning tasks for interprofessional education?
Variation between tasks	How can variation across tasks be best designed to facilitate transfer?
Scaffolding of task support and guidance	How do different types of learning tasks differentially affect learning? Which types of scaffolding are most effective to support learning?
Sequencing of tasks	How can learning tasks be best sequenced to facilitate learning and transfer?
Self-regulated learning	How can we help learners make use of valid cues to evaluate their task performance and identify points of improvement? How can we help learners select tasks with an appropriate level of complexity and support?

* Note that according to the instructional design approach, the answers to these questions will typically be dependent on the characteristics of the target learners, the context and the tasks or subject matter taught.

A third research theme concerns *scaffolding*; that is, the provision of support and guidance to learners who are working on learning tasks – in combination with *fading* this support and guidance as learners acquire more expertise. Thus, the basic idea is that learners who are working on tasks at a particular level of complexity should first receive a sizeable amount of support and guidance but receive increasingly less support and guidance for later tasks at the same level of complexity. Only when they can perform the learning tasks at a particular level of complexity without any support or guidance, do they progress to learning tasks at a higher level of complexity. Research has identified many ways for scaffolding learners, such as using different types of learning tasks or providing tutor guidance.[28,29] Here, the main research question is under which conditions particular tasks and/or guidance approaches can be best used to provide learners with an optimal level of support.

A fourth research theme concerns the sequencing of learning tasks. In traditional educational programmes, learning tasks are organised in such a way that students first practise parts of the whole task and practise only the whole, real-life task at the end of the educational programme. There is, however, accumulating empirical support that this approach only works well when there is little coordination between the parts required; for tasks that require much coordination between parts, a whole-task sequencing approach is more effective[30] (as per our stoma example earlier). One may then sequence from simple to increasingly more complex versions of the whole task, an approach that is in line with the concept of the 'spiral curriculum'.[31] For example, when practising nephrostomy, one may work from relatively simple whole tasks (e.g., fixed kidney, small distance between skin and kidney, no scar tissue) to increasingly more complex versions of the whole task (e.g., mobile kidney, large distance between skin and kidney, scar tissue).

A fifth and final research theme concerns the fostering of self-regulation learning skills (see also chapter by Artino and colleagues in this book). In general, self-regulation can be conceptualised as a cycle of monitoring and control.[32] Monitoring includes the judgement of the level of performance and competence, revealing strengths and points of improvement. Control includes actions to find suitable learning activities to work on the points of improvement. Further research is needed to shed light on how we can teach learners to use valid cues to monitor their understanding and performance, and how we can support them in selecting appropriate learning activities. Research is needed to understand how we can simultaneously teach domain-specific complex skills and self-regulated learning skills.[28]

Supportive information

Supportive information helps students learn to perform non-recurrent aspects of learning tasks, which involve problem-solving, diagnostic reasoning or decision making. For our example, to successfully diagnose patients with diabetes, supportive information includes a systematic approach and rules-of-thumb for diagnosing patients with diabetes (i.e., a SAP, which may be based on the analysis of cognitive strategies as part of CTA; see Phase 2 in Table 26.1). It also includes information on different forms of diabetes (i.e., domain models, which may be based on the analysis of mental models as part of CTA; see again Phase 2 in Table 26.1), which may help learners to reason about alternative diagnoses and to make decisions. Supportive information is specified again for each higher level of task complexity because learners need to know *more* about diabetes and how to diagnose and treat it for performing tasks at a higher level of complexity. The supportive information thus provides a bridge between what learners already know about diabetes and what they need to know about it to work on the learning tasks. For the design of supportive information, relevant research themes concern presentation strategies (e.g., guided discovery, self-explanation, feedback approaches, debriefing and group discussion) that help learners connect new supportive information to what they already know. For programmes that rely strongly on self-regulated learning, relevant research themes are closely related to resource-based learning and information literacy, investigating how learners can be taught how to monitor their understanding of the supportive information and how to support them with independently finding and studying further relevant supportive information based on their monitoring.

Procedural information and part-task practice

Procedural information allows students to learn to perform recurrent aspects of learning tasks that are always performed in the same way. For our example, procedural information may include just-in-time information displays that specify how to use the Electronic Health Record (EHR) to propose an adjusted management plan for a patient with diabetes (see Phase 3 in Table 26.1). This can be done by online help, a quick reference guide or a job aid. But for learning tasks that are performed in the doctors' practice, procedural information may also be provided by a supervisor who is 'looking over the learner's shoulder' or by a mobile application. Procedural information is quickly faded as learners gain more expertise. Here, relevant research themes concern just-in-time presentation strategies that help learners construct cognitive rules. One example can be found in 'augmented reality', where augmented-reality glasses can be used to project how-to instructions in the learner's visual field precisely when he or she is looking at the scene in which the actions must be performed.

Finally, part-task practice pertains to the additional practice of recurrent aspects so that learners can develop routines with a very high level of automaticity for selected task aspects. One of the courses developed based on 4C/ID in general medicine is 'The child with fever'. In this course, part-task practice is used for 'spot diagnoses', where learners practice the quick diagnosis of childhood infectious diseases with prototypical cases. Furthermore, it is often used for constituent skills that play a role in many different whole tasks (e.g., cardiopulmonary resuscitation, auscultation, stitching, liver palpation, venipuncture) and for critical tasks in, for example, emergency medicine. Part-task practice typically provides huge amounts of repetition and only starts after the recurrent aspect has been introduced in the context of whole, meaningful learning tasks. For the design of part-task practice, relevant research concerns practice strategies (e.g., overlearning, distributed practice, time compression) aimed at full automation of the recurrent constituent skill.

For researchers interested in self-regulated learning, important research themes are closely related to the domain of deliberate practice and concern methods to help learners make correct judgements about the development of routine aspects of the whole task and methods to help learners independently find procedural information and opportunities for part-task practice.

Development: Instructional media

In the development phase of the ADDIE model, research typically concerns the use of particular media in relation to learning processes. Some media are better to support, enable or sustain particular learning processes than others. Learning tasks will usually be performed in a real or simulated task environment. Future research can focus on the development of virtual reality task environments, digital simulations (e.g., virtual patients) or serious games. For supportive information, future research can focus on the development of multimedia sources, such as online simulations, e-learning modules or the increasingly popular podcasts. For procedural information, future research can deal with augmented reality and smartphone applications that allow learners to consult how-to instructions precisely when they need them during task performance. Important research concerning part-task training revolves around the development of part-task trainers (e.g., box trainers with haptic feedback) or online applications for skills training. Educational programmes developed according to a whole-task approach such as 4C/ID will typically make use of a rich mix of different media.

Finally, all instructional materials need to be constructed using the selected media. It falls beyond the scope of this chapter to discuss 'instructional message design' and related research, but highly specific research is done to develop guidelines for the construction of instructional texts,[33] slides for lectures,[34] multi-media materials such as animations and dynamic representations,[35] e-learning applications,[36] simulations and serious games[37] and so forth.[38]

The implementation and evaluation phases

The eventual success of instruction depends on how well it is implemented in the educational organisation and whether evaluative data are used for continuous improvement or not. Implementing instruction based on whole-task models is far from easy.[39] Here, important research themes concern the question of how to evaluate the quality of courses and the curriculum and, above all, how to ensure that these evaluations result in continuous improvement.

Implementation: Preparing staff, students and the organisation

At the staff level, it is important to involve professionals working in the field and to train them on how to design a variety of learning tasks. Within whole-task curricula, teachers need to provide support and guidance to students and are often involved in small group teaching or coaching of students within a simulated learning environment or at the workplace. Teachers need to be prepared for these roles through a faculty development programme in order to increase their confidence and awareness of effective educational practices, but also to enhance positive changes in attitudes towards teaching, and stimulate more involvement in education.[40,41] Second, staff members must collaborate in multidisciplinary teams because whole learning tasks that are based on real-life tasks rarely make an appeal on only one discipline – almost by definition, these tasks are multidisciplinary.

At the student level, it should be made clear to students why they are confronted with a variety of whole tasks that are based on professional tasks, what their roles and responsibilities are and why they should apply what they have learned to a variety of tasks. Second, it is important to involve students in the design and evaluation of the curriculum. Students can make valuable contributions based on their experiences. They can give tips on how to improve learning tasks and whether these learning tasks build on learning tasks offered earlier in the curriculum. Finally, it is important to prepare the organisation. One of the biggest challenges is that schools are often characterised by a high level of autonomy of disciplines and that collaboration between disciplines is limited.[42] However, if collaboration between disciplines or professions is lacking, it will be very difficult, if not impossible, to implement an integrated whole-task curriculum, because whole tasks, by definition, are multidisciplinary. When implementing whole-task curricula, it is thus important to strengthen collaboration between teachers in multidisciplinary teams of teachers and for these teams to collaborate with faculty developers. A central management team oversees these multidisciplinary teams responsible for designing, implementing and evaluating the courses.[42]

An important research theme in the implementation phase concerns the composition and workflow of curriculum design teams in this process of participatory design.[43]

Evaluation

When evaluating courses and programmes, it is important to derive evaluation items from whole-task instructional design models rather than using those with no underlying theory about teaching and learning. For example, Frick *et al*.[44] developed an evaluation questionnaire that contains scales of items measuring the first principles of instruction by Merrill,[20] being authentic problems, activation, demonstration, application and integration. The information collected with such an evaluation instrument can help to improve courses within a whole-task curriculum. An important research theme concerns how the effectiveness of the instruction can be evaluated based on theories or models of current instructional design and empirical support for what makes effective instruction. While the effectiveness of an educational programme is essential, evaluations should also focus on the programme's efficiency (i.e., what does it cost in terms of different kinds of resources?) and attractiveness (i.e., how much do students and staff enjoy this curriculum?). When improving curricula, it is important to collect data from a variety of sources; for instance, from interviews or observations, and from a variety of stakeholders, including ones who may have different values and views on the effectiveness, efficiency and attractiveness of a programme.

BOX 26.1 Theoretical influences and the ADDIE model

In the ADDIE model, guidelines and models for the Analysis and Design phases are typically linked to particular research paradigms or perspectives on learning, such as behaviourism, cultural-historical theory, cognitive theory or social-constructivist theory (for an overview of perspectives, see[46]). For example, original taxonomies of learning for the specification of learning goals were based on behaviourist and information-processing approaches. Whole-task approaches – such as first principles of instruction,[20] cognitive apprenticeship learning[21] and 4C/ID[28] – are typically based on cognitive and/or social-constructivist perspectives. For example, 4C/ID links each of its four components to the construction and automation of cognitive schemas: the construction of cognitive schemas results from inductive learning while performing learning tasks and from the elaboration of new supportive information (i.e., linking it to prior knowledge); the automation of cognitive schemas results from the formation of cognitive rules from procedural information and their subsequent strengthening as a result of part-task practice. In addition, whole-task approaches with a focus on workplace learning often rely on cultural-historical perspectives; for example, activity theory[47] analyses learning as the result of three interacting entities – the individual, the objects and tools used and the community.

Conclusion

The primary goal of this chapter was to introduce research themes that are pertinent to the field of instructional design. We covered a number of key points and research suggestions explicitly linked to the main phases of instructional design, as per the ADDIE model (Box 26.1). We end by considering future research directions.

Future research on instructional design in the health professions will increasingly be aimed at the development of instructional design guidelines and models that allow learners to deal with the fast changes and the ever-increasing complexity of the healthcare professions (new technologies, more interprofessional work, increasing cultural diversity, etc.). Such competencies are often called twenty-first-century skills and include adaptive expertise and cognitive readiness.[45] Instructional design research aimed at their development should study how novelty in the form of unfamiliar learning tasks can be introduced after an initial level of proficiency in the domain has been achieved, and how learners should be stimulated to explore these tasks, solve them with limited scaffolding and reflect on errors. Good research on instructional design will help to sustain teachers' and designers' continuous improvements and innovations of education and will help to develop instructional design models that better prepare learners for their future tasks in a profession that will tomorrow be different from today.

Practice points

- CTA on real-life tasks provides a good basis for the design of whole-task curricula.
- Whole-task curricula can be designed from four interrelated components: (a) learning tasks, (b) supportive information, (c) procedural information and (d) part-task practice.
- Media will be different for each of the four components; thus, whole-task curricula will typically make use of a rich mix of media.
- Successful implementation of whole-task curricula requires careful preparation of teachers, staff, and organisation, and evaluations that lead to continuous improvement.
- Good research on instructional design might help to realise future innovations in health professions education and thus contribute to quality of care.

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27 Cognitive load theory: researching and planning teaching to maximise learning

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It is 05:00 in the morning and the resident on-call is awoken by a 'code blue' called overhead in the hospital. The resident arrives to the hospital room to find a pulseless patient and a nurse performing chest compressions. The resident is tasked with simultaneous patient assessment, team management and the recollection and application of the appropriate cardiac arrest algorithm to care for this patient.

Both performance and learning in this type of scenario require considerable mental effort from medical learners, and the risk of cognitive overload (and resultant poor performance and ineffective learning) is high.

Though necessary, training that focuses on only one specific aspect of the case at a time (e.g., learning a cardiac arrest algorithm), is insufficient to allow for the integration and coordination of the composite skills required to perform a complex task like cardiac arrest management.

To be effective, medical educators must be able to develop strategies to teach whole-tasks while considering their learners' cognitive architecture and adapt their teaching to manage excessive working memory load in a way that allows trainees to learn effectively, thereby optimising their clinical performance and improving the care delivered to their patients.

Introduction

Cognitive load theory was devised for conditions under which people must deal with large amounts of interrelated information, and hence it has implications for both training and practice. In the following, we discuss the cognitive architecture that underlies the theory and some of its consequent general design guidelines before applying it to medical education and practice. By the end of this chapter, you will have been introduced to cognitive load theory; with a focus on (a) cognitive architecture that incorporates those components of human cognition that are relevant to instructional issues and related areas; (b) types of cognitive load; (c) techniques for measuring cognitive load and (d) cognitive load effects based on empirical evidence.

Cognitive architecture

In recent years, cognitive load theory has placed an increasing emphasis on biological evolution when discussing human cognitive architecture.[1] Firstly, it has used Geary's evolutionary educational psychology to categorise classes of information.[2] Geary divides knowledge into two basic categories: biologically primary and biologically secondary. Primary knowledge is knowledge we have evolved to acquire. It tends to be very complex but very easily acquired without conscious effort. It is also modular with different types of knowledge probably acquired at different epochs. Examples are learning to recognise faces, acquire generic skills such as general problem-solving strategies, learning to comprehend and speak a native language. These skills are acquired automatically and unconsciously and so do not need to be taught. In contrast, biologically secondary knowledge is knowledge that we are able to acquire but that we have not specifically evolved to acquire, such as writing or algebra. These skills need to be explicitly taught. The vast majority of topics taught in a medical course are likely to consist of biologically secondary knowledge such as learning how to interpret a blood gas. In contrast, since general problem-solving strategies are biologically primary, attempting to teach them is likely to result in no discernible improvements.

There are particular structures and functions of biologically secondary knowledge that constitute those aspects of human cognitive architecture relevant to instructional design. They can be described by five principles that underlie human cognition. All of these principles for acquiring biologically secondary information are themselves biologically primary and so do not need to be taught.

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1 *The borrowing and re-organising principle*. The human information processing system obtains its vast store of information by borrowing it from others. Humans imitate other humans, listen to what others say and read what they write to achieve the same aim. Cognitive load theory was designed to assist in these processes. It might be noted that while our tendency to obtain information from others is biologically primary (we are one of the very few species of animals that has evolved to both provide and obtain information from others), what we obtain in an educational context is biologically secondary.

2 *The randomness as genesis principle*. While the human information processing system obtains most of its information by borrowing it from other stores, that information must be created in the first instance. Random generation followed by tests of effectiveness during problem-solving creates the initial source of human knowledge. Humans typically only will use this principle to gain knowledge when knowledge is unavailable using the borrowing and re-organising principle.[3] As an example, during a medical emergency, there may be insufficient information available to make a decision between alternative procedures. In that situation, randomly choosing between two or more actions may be all that is available. With sufficient practice, practitioners may gain sufficient knowledge to subsequently no longer need to guess the best course of action.

3 *The narrow limits of change principle*. Once acquired by either of the two previous principles, information must be processed in working memory that is limited in capacity and duration. This notion that working memory is limited in capacity and duration forms the core of cognitive load theory.[4] Working memory load (or cognitive load – the terms are interchangeable), is determined by the number of information elements that need to be processed simultaneously within a certain amount of time.[5] When dealing with novel information, the capacity and duration limits are very narrow. No more than two or three elements can be processed at any time where an element is an item of information that needs to be learned. Furthermore, novel information can be held in working memory for no more than about 20 seconds without rehearsal.[6,7] Working memory can determine which novel information affects the system and ensure that the amount of novel information permitted to be added to the information store (see next) is small. Change is incremental. It is of crucial importance that we take the limitations of working memory into account when designing instruction and strive for reducing unnecessary working memory load.

4 *The information store principle*. The human information processing system relies on a vast store of information in long-term memory. The aim of instruction is to organise biologically secondary information held in long-term memory (the memory where information elements can be stored for years or decades) in the form of knowledge.

5 *The environmental organising and linking principle*. This principle provides the ultimate justification for the human information processing system. Once information has been processed and stored according to the previous two principles, it can be transferred back to working memory to generate action appropriate to the environment. The capacity and duration limits of working memory are functionally eliminated when it brings in and deals with information that is already organised in long-term memory.[8]

On the basis of this architecture, cognitive load theory assumes that learning is the gradual development of knowledge stored in long-term memory. Knowledge influences what is considered an information element to be processed by working memory. Consider a common medical presentation that all medical students learn about – shock.

When learning about causes of shock, medical students may be asked to memorise a long list of possible causes including (but not limited to) the following: *tension pneumothorax, myocardial ischemia, intraperitoneal bleeding, third spacing, pulmonary embolus, traumatic pelvic vessel disruption, myocarditis, valvular dysfunction, gastrointestinal fluid losses, arrhythmias, high spinal cord injury, anaphylaxis, cardiac tamponade, ruptured ectopic pregnancy, sepsis*. On the basis of the narrow limits of change principle, trying to memorise this seemingly random list is challenging, because the capacity of working memory is quickly reached. Using the environmental organising and linking principle, however, this list can be presented based on categories of shock (each representing one element, or chunk, in working memory), in a format like the one shown in Table 27.1. This commonly taught conceptualisation for the causes of shock makes remembering it simpler by using appropriate information already stored in long-term memory.

Similarly, seeing an X-ray of someone's lungs for the first time, a novice student may perceive an almost unstructured myriad of elements to be processed deliberately. It will require time to process all these elements in an attempt to develop a preliminary schema and make sense of what is presented.

Table 27.1 Examples of shock organised by category

Shock Category	Examples
Cardiogenic	myocarditis, valvular dysfunction, arrhythmias, myocardial ischemia
Hypovolemic	traumatic pelvic vessel disruption, intraperitoneal bleeding, gastrointestinal fluid losses, third spacing, ruptured ectopic pregnancy
Obstructive	pulmonary embolus, tension pneumothorax, cardiac tamponade
Distributive	high spinal cord injury, anaphylaxis, sepsis

For a more experienced student, who has seen similar X-rays before and has developed a preliminary schema already, the same X-ray is expected to demand less working memory capacity, because the knowledge in long-term memory enables him/her to integrate knowledge of physiology, anatomy, lung disease theory and the projective geometry of an X-ray.[9] In short, compared to a novice, a more experienced student has more working memory resources available for deliberate processing of remaining unknown elements.

Cognitive load: the basics

The number of elements to be processed in complex material, such as an X-ray, depends not only on the number of elements present in it, but also on the extent to which there is interaction between these elements. If there is no interaction between the elements, all elements can be learned in isolation. For example, learning the names of anatomical structures can be a difficult task because of the large number of structures that must be learned. Nevertheless, since each name can be learnt independently of every other name, it is not interactions between elements that make the task difficult.

In contrast, some information is difficult to assimilate not because it has a very large number of elements, but rather because the (relatively small number of) elements interact and so need to be learned simultaneously. Processing a large number of elements simultaneously (e.g., physiology, anatomy, lung disease theory and the projective geometry of an X-ray) can place a heavy load on working memory. For example, the human body is a complex biological system in which organs interact in a variety of ways. It is therefore difficult to study the functioning of a particular organ in this system in isolation. Given that the hypothalamus links the nervous system to the endocrine system via the pituitary gland, it makes sense to strive for a combined study of the two systems as the neuroendocrine system. In a complex system such as this, element interactivity is typically high, and we should take this element interactivity into account when designing instruction and working environments. Cognitive load theory is primarily concerned with difficulty due to high element interactivity. High element interactivity imposes a heavy working memory load because interacting elements must be processed simultaneously in working memory. In contrast, difficulty due to a large number of isolated elements does not impose a heavy working memory load because each element can be processed individually without reference to the other elements, reducing the impact of cognitive load to some degree.

Cognitive load theory has evolved over the years. Currently, many experts distinguish between two main types of cognitive load: intrinsic cognitive load and extraneous cognitive load. Other experts also distinguish a third type of cognitive load, germane cognitive load.

1 *Intrinsic cognitive load*. Intrinsic cognitive load is a direct function of the number of interacting elements of information on the one hand, and the availability of a learner's prior knowledge (held in long-term memory), on the other hand.[10] Novice learners, who have little, if any, knowledge of the type of information presented, have to select, organise and integrate all interacting elements in order to learn or perform. As learning advances, however, information elements gradually become incorporated into knowledge networks (schemas) stored in long-term memory that can be handled as singular (but richer) elements in working memory via the environmental organising and linking principle (see earlier). Therefore, the intrinsic cognitive load that is imposed by particular information is much higher for novices than for more advanced learners.

2 *Extraneous cognitive load*. Extraneous cognitive load is due to suboptimal information presentation conditions. Extraneous cognitive load is related to the learner engaging in cognitive processes that are extraneous to the learning goals.[11,12] One example of such a process is having to mentally integrate spatially or temporally separated, but mutually related, information sources. (For example, critical information about a figure is presented in paragraph format on a separate page or slide from the figure itself.) This inefficiency in presentation imposes a very high cognitive load and hampers learning compared to the same information being presented in a spatially or temporally integrated form (within the figure itself). Another example of high extraneous cognitive load occurs when information that should be presented visually is presented verbally (e.g., the relationship of anatomical structures such as the vessels of the heart are orally explained in a lecture without presenting them visually using a diagram or model). This contributes to extraneous cognitive load as translating words into a mental diagram requires working memory resources on the part of the learner that consequently are not available for learning. This inefficiency of information presentation can have a negative effect on both learning and performance. This is especially true when working memory resources that are usurped by extraneous load are needed to deal with high intrinsic cognitive load. If extraneous cognitive load can be reduced and replaced by processes that impose a cognitive load that actually contributes to learning, learning should improve.

3 *Germane cognitive load*. Germane cognitive load is thought to represent the cognitive load that contributes to learning. Given that in cognitive load theory, learning is the gradual development of knowledge in long-term memory, this third type of cognitive load is the one that arises from relating relevant information from long-term memory or context to new information elements.[13] In other words, it pertains to the working memory resources allocated to dealing with intrinsic cognitive load via schema construction.[14] For example, variability in practice with diagnosing complex cases increases cognitive load, but this increase in cognitive load can aid learning. Requiring learners to compare and distinguish between cases rather than dealing with each case individually increases the intrinsic cognitive load of the task requiring more working memory resources (i.e., germane resources)[15] to deal with a new task.

In the traditional (i.e., late 1990s) version of the theory, intrinsic cognitive load, extraneous cognitive load and germane cognitive load were assumed to be three additive types of cognitive load. In the recent re-conceptualisation, however, only intrinsic cognitive load and extraneous cognitive load are thought to be additive: extraneous cognitive load should be minimised so that learners can allocate working memory resources (i.e., germane resources) to dealing with intrinsic cognitive load and engage in learning, and the sum of intrinsic and extraneous cognitive loads should be within the capacity of working memory (Figure 27.1a).

Recall that the amount of intrinsic cognitive load imposed depends on the number of elements and interactions between elements in the information, on the one hand, and the prior knowledge available in the learner's long-term memory, on the other hand. While intrinsic cognitive load depends on the intrinsic nature of the information the learner is confronted with, the amount of extraneous cognitive load experienced by the learner depends on the way the information is presented to the learner.

When a learner is confronted with information that has a low intrinsic cognitive load and the way this information is presented imposes a low extraneous cognitive load, an excess of working memory resources exists. A low intrinsic cognitive load can mean one of two things: either it is very easy information, or it is perceived as easy by the individual learner who already has well-developed knowledge for this type of information (but could be perceived as complex by a novice learner).

When information to be learned is presented in a suboptimal fashion, extraneous cognitive load is high. This could occur, for example, if a cube is described verbally by an instructor (instead of the instructor presenting a model of the cube visually). The cube itself is not a very complex shape and most people understand what a cube is and have mental representations of what a cube looks like. Providing a verbal (instead of visual) description of a cube, the learner may not realise that the description is about a cube, and therefore the cognitive processing required to translate the instructor's verbal description to a mental representation is extraneous.

Similarly, for a radiologist who is trained in interpreting X-rays of people's lungs, seeing yet another X-ray may impose a rather low intrinsic cognitive load (much lower than would be the case for a novice learner). When presenting that X-ray as it is usually presented (visually), the trained individual may notice an abnormality quite easily, while any verbal description of what could have been seen on the X-ray would contribute to extraneous cognitive load. However, for a less-advanced learner, verbal information presented along with the X-ray would likely be beneficial.

In cases where the sum of intrinsic and extraneous cognitive load overwhelm the capacity of an individual's working memory resources, a state of cognitive overload is likely to ensue, with deleterious effects on learning and performance (Figure 27.1b).

Cognitive load theory has led to many educational guidelines on minimising extraneous cognitive load and less commonly, optimising intrinsic cognitive load. As one example of minimising extraneous cognitive load that has implications for problem-based learning, providing learners with worked examples to study has been demonstrated in multiple studies

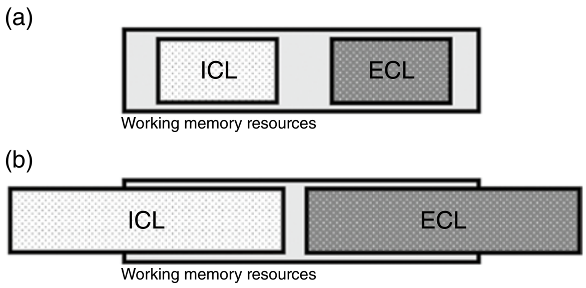

Figure 27.1 The relationship of cognitive load types and working memory resources. (a) The sum of intrinsic cognitive load and extraneous cognitive load should be kept within the capacity of working memory resources (the larger black rectangle). (b) A state of cognitive overload occurs when the sum of intrinsic cognitive load and extraneous cognitive load exceeds the capacity of working memory resources. Abbreviations: ICL, intrinsic cognitive load; ECL, extraneous cognitive load

as leading to superior learning than having them attempt to solve the equivalent problems. Details can be found in Van Merriënboer and Sweller[16] and in Van Merriënboer and Kirschner.[17]

Cognitive load: recent developments

Cognitive load theory has been recently expanded to include two new major concepts: working memory depletion[18,19] and environment-related factors (emotion, stress and uncertainty).[20,21]

Working memory had traditionally been thought to have a fixed capacity over time. Recently, Leahy and Sweller[19] showed that working memory resources can actually become depleted with cognitive activity and then later restored with periods of cognitive rest. In related work, Chen *et al*.[18] noted that learning episodes spaced by temporal gaps were superior to identical, massed learning with no gaps between learning episodes. In the latter group, participants were found to have lower working memory capacity, higher cognitive load and lower performance. This work suggests that the capacity of working memory becomes depleted over time. This has clear implications for the risk of cognitive overload and resultant impaired learning and performance outcomes when individuals are cognitively depleted.

The contribution of environment-related factors like emotion, stress and uncertainty on cognitive load have also gained recent attention within cognitive load theory.[20] In traditional educational settings, the assumption is that these factors compete with task-relevant cognitive processes, and thus represent extraneous cognitive load (and thus should be minimised in instructional design).[22] The situation is different in complex professional domains, like medicine, where emotion, stress and uncertainty are inherent to the work of being a physician.[23] It would be counterintuitive to shield learners from emotion, stress and uncertainty throughout their training; instead, instruction should be designed to foster the professional competencies necessary to deal with these affective factors effectively.[21] Medical simulation training is one instructional method that has been shown to engender some of these skills.[24]

Figure 27.2 shows a schematic representation of the concepts of working memory depletion and affective environment-related factors and their relationship with the components of cognitive load theory.

On the measurement of cognitive load

Given that the concept of working memory load lies at the very core of cognitive load theory, understanding working memory load is crucial to test specific hypotheses and provide concrete guidelines for further research and educational practice. In the first two decades of cognitive load theory, cognitive load measurement focused almost exclusively on this core construct of working memory load[4] (or mental effort[25] or cognitive load). These three terms have been used interchangeably for referring to cognitive capacity that is actually allocated to deal with the demands imposed by a task, and as such, reflects actual cognitive load.[26,27]

1 *Indirect measures of cognitive load*. In the first years of cognitive load theory, cognitive load was measured mainly indirectly. In the 1980s and early 1990s, it was found that learning strategies that require less problem-solving search (i.e., more directed instruction) tend to result in better learning outcomes and fewer errors during performance than learning strategies that require more problem-solving search.[28,29] Models of cognitive load supported this suggestion.[4] The additional demand on working memory resources due to the use of learning strategies that require more problem-solving search imposes both a higher

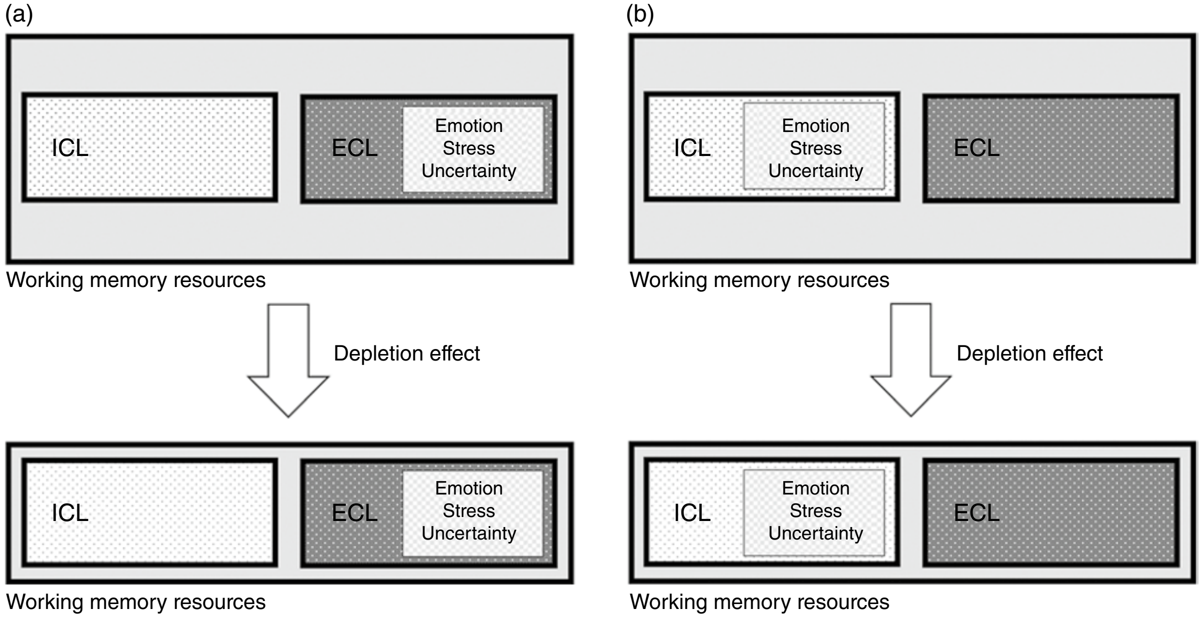

Figure 27.2 The working memory depletion effect and the contribution of affective factors to cognitive load in traditional educational settings (a) and in complex professional domains (b)

Note. With cognitive effort, working memory (the black rectangle) is thought to decrease in capacity through the depletion effect. Affective factors (e.g., emotion, stress, uncertainty) are thought to contribute to extraneous cognitive load in traditional educational settings (a) and to intrinsic cognitive load in complex professional domains (b) where these factors are inherent to professional tasks. Abbreviations: ICL, intrinsic cognitive load; ECL, extraneous cognitive load. Adapted from Szulewski, A., Howes, D., van Merriënboer, J. J., & Sweller, J. (2020) From theory to practice: the application of cognitive load theory to the practice of medicine. Academic Medicine, 96(1), 24–30.

cognitive load and may require more learning time. Despite this increased mental effort, it is not likely to result in better learning or performance. Two suggestions appear to follow from this finding. First, learning time could (at least on those tasks) provide an indirect measure of cognitive load.[30,31] Second, problem-solving search strategies do not change the intrinsic complexity of the information to be learned. As a result, the additional cognitive load resulting from more intensive problem-solving search does not contribute to learning or performance and can be expected to be extraneous cognitive load. However, a later study also demonstrated that an increase in intrinsic complexity of information (e.g., many variables in mathematical equations) can also increase error rates.[32] Therefore, it is evident that computational models (e.g., associated with changes in problem-solving search), learning time (or time-on-task) and error rates can serve as indirect measures of cognitive load, although the extent of validity of those measures as indicators of cognitive load are likely task dependent and may not be complete on their own.

2 *Subjective rating scales of cognitive load*. Subjective rating scales have been used intensively to estimate cognitive load experienced by learners, ever since the introduction of a now commonly used nine-point one-dimensional mental effort rating scale in the early 1990s.[25] Research suggests that the mental effort rating scale is best administered immediately after each task, rather than after a series of tasks.[33,34] In addition, though it is not entirely clear to what extent workload and cognitive load refer to the same concept across contexts, the multidimensional NASA task load index (TLX) is an example of another instrument that subjectively assesses experienced workload on five (i.e., mental demands, physical demands, temporal demands, own performance and effort and frustration) seven-point rating scales[35] that has been used in cognitive load research.[36]

3 *Efficiency measures*. Measuring overall experienced cognitive load by subjective or objective techniques can be very informative, especially in relation to measures of learning outcomes into the so-called efficiency measures.[37,38] Efficiency measures relate performance to the costs (in terms of overall cognitive load) needed to reach that performance. In other words, knowledge acquired per unit of learning effort expended. Higher efficiency is reached if higher performance

is achieved with the same costs or if the same performance is reached with lower costs. However, while extraneous cognitive load is clearly unhelpful, some intrinsic cognitive load is required for learning. It is not yet clear to what extent intrinsic cognitive load should be seen as a cost. For example, too little intrinsic cognitive load could make a task appear boring.[39] Overall cognitive load (which is thought to represent the sum of intrinsic and extraneous cognitive load) is often measured in studies.

4 *Measuring types of cognitive load*. If we succeed in optimising tools that measure intrinsic and extraneous cognitive load separately, we could test specific hypotheses with respect to cognitive load types. This would allow for a deeper understanding of the cost and efficiency of learning, by understanding the ratio of expended extraneous cognitive load to intrinsic cognitive load. The distinction between intrinsic and extraneous cognitive loads is important for education and education research. More cognitive load is not necessarily negative for learning. There is a common misunderstanding in the field that cognitive load theory argues that cognitive load needs to be as low as possible. Even though extraneous cognitive load needs to be minimised, cognitive load theory-based instruction argues for attempting to use all available working memory resources to deal with intrinsic cognitive load. Intrinsic cognitive load should therefore be optimised in instructional design by selecting materials that align with the learner's prior knowledge or expertise, while extraneous cognitive load should be minimised. In such a context, learners can be challenged to allocate available working memory resources for dealing with intrinsic cognitive load and actually engage in learning. In recent years, several studies have attempted to develop instruments for measuring one or more types of cognitive load.[40–44] A drawback of most of these studies is that one or more types of cognitive load are often represented by a single psychometric item. The use of multiple indicators of the separate types of cognitive load might yield a more precise measurement and might enable researchers to separate the types of cognitive load more clearly than the use of a single indicator for each scale. Further, when referring to one very specific instructional feature or cognitive process to measure extraneous or germane cognitive load, a conceptual problem may arise, because instructional features that are beneficial for less advanced learners may not be beneficial for more advanced learners (i.e., expertise reversal effects).[45,46] To help address this, a new psychometric instrument was developed that took an alternative approach to the formulation of questions for measuring different types of cognitive load in an effort to differentiate between intrinsic and extraneous cognitive loads, at least to some extent.[47] There is some support for the assumption that two factors capture intrinsic and extraneous cognitive loads, respectively.[48]

5 *Physiological measures of cognitive load*. Various researchers have suggested the use of physiological measures of cognitive load.[49] One study suggested that a nine-point mental effort rating scale was more sensitive to differences in task complexity than heart rate variability, in that the former could explain more of the variation in task complexity and performance.[50,51] Other studies have suggested using techniques such as functional magnetic resonance imaging (fMRI) and focus on, for instance, an increase in activity in the dorsolateral prefrontal cortex while the learner is processing information.[52,53] Yet others have suggested using electroencephalography (EEG).[54] Using EEG, a study of the use of the so-called hypertext leads (i.e., introductory text linking pieces together) found that the use of such leads resulted in better learning outcomes than using hypertext without leads, and alpha, beta and theta (EEG) measures were significantly lower in the hypertext lead group, suggesting that the use of hypertext leads resulted in a decrease in cognitive load.[55] Further, various researchers have suggested that particular eye-tracking variables could be related to cognitive load. For instance, increases in pupil diameter are positively correlated with increases in cognitive load, at least in a non-elderly population.[56–58] It has been suggested that saccade rate and amplitude correlate negatively with cognitive load.[59] Finally, average dwell time (i.e., time spent focusing in the same position or area in a visual stimulus) is also expected to reflect a higher cognitive load.[60] Again, for some of these variables, the relation with cognitive load is highly task dependent. Nevertheless, these and other relations between eye-tracking variables and (types of) cognitive load need and deserve further study.

6 *Secondary tasks*. An alternative way of measuring cognitive load may be through the study of performance on a secondary task.[58,61,62] A secondary task requires one to invest additional cognitive effort that is secondary to the primary task of learning or performance. One example of such a task is recognising a tone presented at random during the learning episode.[63] Another example is recalling or remembering letters.[64] The idea is that the fewer working memory resources the primary task of interest requires, the more working memory resources one has available to perform well on the secondary task.

7 *Combining two or more types of measures*. Secondary tasks have not been used as extensively as subjective measures because they may be more intrusive than other measures, require a more complex experimental design and, like physiological measures, more advanced equipment. Moreover, it is not yet clear how the use of secondary tasks or physiological measures can enable us to differentiate between intrinsic and extraneous cognitive loads. In contrast to secondary tasks, subjective measurement tools may help us to differentiate between intrinsic and extraneous cognitive load, but may be more difficult to use in particular contexts than a single-item mental effort rating scale.[47,48] For example, if individuals have to provide a mental effort rating after each of a series of tasks, it is easier to use a single-item mental effort scale at the end, rather than having individuals respond to the items after each task. However, it may be possible to use a single-item mental effort rating scale after each of the tasks and have individuals respond to the longer questionnaire either once at the end of the full procedure or, preferably, after each block of tasks. This procedure may provide researchers with insight into the extent of mental effort invested in separate tasks as well as in the experienced overall intrinsic and extraneous cognitive loads. Well-designed experiments that combine two or more of the types of measures discussed in this section – indirect measures, subjective response measures, biological measures and secondary task measures – may lead to new insights on convergence and divergence between these different types of measures. Further, the use of mixed methods that includes descriptive data obtained through cognitive task analysis (or other) qualitative methods may also help triangulate findings.

Cognitive load effects

Cognitive load effects are the empirical manifestation of cognitive load theory. Cognitive architecture, types of cognitive load and techniques for measuring cognitive load are all necessary to generate cognitive load effects. Each consists of a comparison of an instructional procedure generated by cognitive load theory with an alternative instructional procedure. These types of comparisons typically involve the use of randomised, controlled trials.[27,45,48]

A large number of cognitive load theory effects have been generated by the theory with each effect having the potential to change instructional procedures.[13] These effects are relevant to medical and healthcare professions education and practice.[15,16]

One of the most widely investigated effects is the worked example effect, which indicates that replacing practice problems (where no solutions are provided) with worked examples (in which solution-generation is shown either in writing or by an instructor), makes learning more effective as well as more efficient (i.e., less time or effort investment required) for students who have little or no prior knowledge of a task.[65,66] In medical education, example-based learning has proven beneficial with a variety of tasks, such as learning to diagnose certain diseases,[67,68] or acquiring bronchoscopy skills through simulation training.[69] Recently, it was also shown that the acquisition of diagnostic knowledge, which had been found to be enhanced by engaging in structured reflection on one's own initial diagnosis,[70,71] was made even more effective and efficient by providing students with worked examples of reflection.[72]

Medical decision making requires breadth and depth of knowledge, organisation of knowledge, communication skills and an ability to deal with emotions and stress. As students in the medical domain accumulate experience, their knowledge of diseases and related phenomena becomes more and more elaborate. This influences what is perceived as an element, or chunk, of information to be processed and may reduce the likelihood of cognitive overload on the part of a student when having to make a decision. This is especially true when emotion is involved. At first, one might expect that emotion can facilitate the recognition of relevant cues or patterns and as such supports learning or decision making in a particular context. However, if negative emotion (e.g., intense stress) or positive emotion stimulates bias, learning and decision making may be impaired.[73,74] Further, if negative emotion (e.g., due to learning about a previous misdiagnosis) or positive emotion leads us to think what caused that emotion, that very thought consumes working memory resources and may hamper learning and decision making.[75] For example, in one study, it was found that when teaching in a simulation context, cases in which the mannequin 'died' increased trainees' cognitive load and decreased learning compared to cases in which the mannequin 'survived'.[76]

Early in medical training, medical students largely rely on basic science or biomedical knowledge accumulated in various courses, including knowledge of anatomy.[46,77] As a case study, take, for instance, the anatomy of the human brain. The human brain is a large three-dimensional structure which is difficult to represent in two-dimensional pictures. Two-dimensional pictures of the brain (or of parts of the brain) already comprise many interacting elements, and having to mentally build a three-dimensional picture of the brain (or of a brain region) is something that results in additional cognitive load. To avoid excessive intrinsic cognitive load, it is important that students first study two-dimensional pictures of parts of the brain in detail, learn some core functions associated with those parts and learn important terminology. Verbal explanations of how to integrate two-dimensional pictures of parts of the brain to obtain a three-dimensional mental representation are unlikely to compensate for a lack of time spent on studying two-dimensional pictures of parts of the brain in sufficient detail. Verbal explanations are more likely to impose an extraneous cognitive load, because deriving a three-dimensional representation of the human brain from two-dimensional pictures is a visual and not a verbal process. As a result, medical students often go to an anatomy lab where they visually inspect cadaveric brains (or they study three-dimensional computer models) after having studied two-dimensional pictures in order to acquire this skill.

Training medical students to become experts in medicine is an important challenge. Different approaches to this challenge are encountered in the literature. In a traditional approach, students are expected to memorise large volumes of information and integrate them into structured knowledge. While memorising plays an important role in the medical curriculum, especially in early stages, there is no empirical support for the assumption that having students memorise with a minimum of instructional guidance results in optimal learning. Research in a variety of domains, including medicine, demonstrates that, especially in early stages of knowledge development, students learn much more from the study of well-designed worked examples than from autonomous problem-solving.[78] Autonomous problem-solving can result in very high intrinsic cognitive load due to a lack of prior knowledge and may impose a considerable extraneous cognitive load due to the need for problem-solving search. However, once students have developed sufficient knowledge of a particular phenomenon or situation through instructional guidance, autonomous problem-solving can be expected to yield superior results to the study of worked examples.[45] It is for that reason that problem-based learning (PBL)[79,80] could work 'as a supplementary approach with senior students to facilitate their exploration and self-study' (combined with worked examples in the form of clinical presentations) but cannot be expected to yield optimal learning outcomes when used as a single approach in the medical curriculum, especially for junior learners.[81]

A major strength of cognitive load theory is that the educational guidelines generated by this theory are based on well-designed randomised controlled experiments. These experiments have been replicated time and time again in the literature in various contexts, including extensively in medical education over the last decade.

Conclusion

In this chapter, we have provided an overview of cognitive load theory and its various key components, including how best to measure cognitive load and which research designs are favoured in this field of research. We believe the theory and its associated extensive body of data based on randomised controlled trials provide useful guidance in both teaching medical students and practising medicine.

Practice points

- Cognitive load theory has many implications for medical and health professions education research. A better understanding of cognitive load theory has the potential to improve education, which, in turn, should lead to better patient care. The following bullet points summarise the main messages:
  - The limitations of human working memory have clear implications for how much and what kind of information students and practitioners can process.
  - Unnecessary demands on working memory resources due to suboptimal information presentation may lead to cognitive overload and thereby hamper performance or learning in an already complex learning environment.
  - The combined use of different types of cognitive load measures could lead to new insights about types of cognitive load.
  - The development of cognitive load theory remains an iterative process as new research continues to refine the theory as well as its applicability across domains.

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28 Deliberate practice and mastery learning: origins of expert medical performance

William C. McGaghie and Theresa Kristopaitis

Physician Jerome Groopman affirms in his book, How Doctors Think,[1] that traditional apprenticeship clinical training in pediatric cardiology does not always work. Groopman describes a case where a four-year old girl with suspected cardiac tamponade was undergoing pericardiocentesis performed by a senior pediatric cardiologist. While observing the invasive procedure a junior trainee asked, 'Why do you stick the needle under the xiphoid?' The attending cardiologist replied, 'Because that was how my teachers taught me in my training.' 'And why do you think your teachers taught you the way they did?' 'Because that's how they were taught.' Clinical outcome: the procedure failed due to a misplaced needle stick by the attending cardiologist. The result was nearly fatal.

Years later, the former trainee [now an attending physician] recounted, 'She nearly died. The needle went right into her heart muscle. It was a catastrophe. She needed emergency surgery.' The attending physician remembered that as a trainee, 'He questioned everyone he could about why the procedure was done this way, and he received the same answer . . . it was handed down by mentors.'[1]

Elsewhere in his book Dr Groopman uses the familiar 'see one, do one, teach one' maxim to describe the teaching bedrock of clinical education. Groopman states that medical interns are 'lucky' if a senior resident is available for supervision on challenging cases. Groopman also writes interns are 'very lucky' if a senior resident takes time to explain clinical reasoning, medications and manoeuvres for the interns to imitate when treating their patients. The lesson is that chance encounters with clinic and ward patients who simply 'show up', and education ruled by trainee 'luck' at receiving useful supervision, govern apprenticeship clinical training. This is the enduring legacy of traditional medical education.

Dr Groopman's story is neither unique nor extraordinary. Similar clinical tales are told during coffee breaks, at morning report, amid 'curbside consultations' and on other occasions when physicians talk candidly about their education. The story describes an outcome from the apprenticeship model of medical education championed by Drs William Osler and William Halsted at the Johns Hopkins University Medical School in the 1890s.[2] The apprenticeship education model is grounded in bedside observation of patients by students followed by dispassionate discussion at the feet of a supervising physician. Ezekiel Emanuel, a prominent academic physician, endorses this medical education approach today, in 2022, under the guise of education re-imagining. Emanuel writes, 'The most pivotal aspect of teaching in these setting [sic] occurs in the apprenticeship model, in which an experienced physician and student share clinical situations and the imparting of knowledge and learning are inextricably woven into the actual caring for the patient.'[3] Apprenticeship education now thrives in medical circles despite a growing body of research evidence that documents its obsolescence.[2] In brief, medical education inertia sets conditions where twenty-first-century physicians are being educated using nineteenth-century thinking and technology, which has been handed down to successive medical generations.

The flaws and limits of traditional medical education are documented in many scholarly reports and in writings addressed to layperson audiences. Scholarly indictments of traditional medical education point out several consistent weaknesses: uneven coverage because the core curriculum is often based on random patient encounters rather than a systematic education plan; unreliable clinical performance ratings about learners; absence of feedback to students, residents and fellows; reliance on multiple-choice tests to make selection, advancement and certification decisions; use of norm-referenced achievement standards and many other problems that need improvement.[2] Public critics of traditional medical education include surgeon Atul Gawande writing in his popular books *Better*[4] and *The Checklist Manifesto*.[5] Gwande's writings not only criticise dated medical education practices but also

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healthcare delivery on grounds of inefficiency and obsolescence. Evidence-based scholarly argument and public discussion coalesce about the judgement that current approaches to educate doctors who aspire to become expert medical clinicians fall short. New strategies grounded in the science of expertise are needed to better educate expert physicians for the twenty-first century.

Expert medical performance originates from two complementary sources: (a) human capital, and (b) powerful education featuring deliberate practice and mastery learning.[6]

Human capital, the first source of medical expertise, is embodied in the medical students, residents and subspecialty fellows who undergo medical education. Rigorous selection procedures ensure that these persons come to medical training with the cognitive capacity, service ambition and upright character needed for education success. A talented, energetic and hardworking student body is an axiom in medical education. As a consequence, academic failure among medical students worldwide is a rare event.[6]

Powerful medical education is the second source of medical expertise. Powerful medical education grounded in the science of expertise features deliberate practice and mastery learning as key parts of a larger education bundle.[6–9] The powerful medical education bundle differs from the traditional model because it is planful and research based. Several features of powerful medical education include a graduated, systematic curriculum; reliable, realistic and valid assessments; feedback for improvement; high and uniform performance standards; and criterion-referenced decisions about education advancement and certification. Deliberate practice (DP) and mastery learning (ML) are two key components that reside at the core of powerful medical education. The old-fashioned apprenticeship model of medical education is gradually being replaced by education practices derived from the science of expertise to better develop and maintain expert medical performance.

This chapter starts by situating the principles of deliberate practice and mastery learning in today's powerful medical education context. We continue by updating and refining definitions of deliberate practice and mastery learning due to experience and recent research results. Next, four examples illustrate the use of these technologies for medical education and for education of patients and their caregivers. We conclude with a look to the road ahead about a deliberate practice and mastery learning research agenda and advice about programme implementation and maintenance.

Powerful medical education

We use the term *powerful medical education* (PME) to distinguish contemporary approaches to physician education grounded in the science of expertise from the obsolete nineteenth-century apprenticeship model and its lasting legacy.[6–10] The features, conditions and assumptions and context variables associated with PME are discussed in detail elsewhere.[7] Here we provide a brief summary of the PME model.

Table 28.1 lists twelve features of PME that have been derived from research on the science of expertise published by K. Anders Ericsson and his many collaborators[8,9] and from two decades of DP and ML medical education scholarship performed at the Northwestern University Feinberg School of Medicine, the Loyola University Chicago Stritch School of Medicine and other academic centres.[6,7,10–11] These 12 PME features, associated conditions and assumptions, and context variables in which they reside, provide a 30 000 foot 'big picture' view that captures contemporary research and thinking about the origins of expert medical performance due to PME.

There are at least seven *conditions and assumptions* that underlie and shape the expression of the 12 PME features.[7]

1. Screening and selection ensure that learners are ready and motivated to engage in medical education.
2. The features of PME are connected, they are not independent, there is much overlap in their form and function.
3. Assessment and instruction are inseparable.
4. The PME goal is acquisition of clinical expertise, defined in many ways, and its constant improvement throughout the professional lifespan.
5. Expertise is an attribute of medical individuals and teams.

Table 28.1 Twelve features of powerful medical education

1	Defined outcome and performance standard
2	Active engagement using multiple learning strategies
3	Customised learning – individuals and teams
4	Reliable assessment
5	Feedback
6	Valid decisions
7	Skill retention and refresher training
8	Mastery learning bundle
9	Controlled environment and administration
10	Technology utility and value
11	Healthcare team diversity
12	New faculty roles

Source: Adapted from McGaghie *et al*.[7]

6 PME aligns with external professional expectations such as certification requirements, Entrustable Professional Activities (EPAs) and milestones.
7 The faculty role is active and engaged: curriculum design; education management; assessment, feedback and coaching; outcome evaluation; quality control and others. The medical teaching faculty may include a variety of health professionals and technicians.

Four variables that shape the *medical education context* also affect PME operations.

1 There is an institution-wide incentive to train.
2 Multiprofessional training of all healthcare staff in their units requires taskwork and teamwork.
3 Individual and teamwork training must be integrated with clinical experience.
4 Education and training take place in a psychologically safe, mistake-forgiving learning environment.

The 12 PME elements and their associated conditions and assumptions and context variables together account for a near ideal medical education environment. We know, of course, that no medical education organisation can match or fulfil all of these expectations. The PME features and the surround we have pointed out are aspirational goals for medical educators. The twin themes of this chapter, DP and ML, should be seen as two necessary, but not sufficient, strategies to enact PME.

Deliberate practice and mastery learning

Deliberate practice and mastery learning are essential elements that lie at the heart of PME. A growing body of theory[12] and research shows that both of these constructs play a key role in the formation and maintenance of expert medical performance.

Deliberate practice

Deliberate practice (DP) is a term conceived and advanced by psychologist K. Anders Ericsson[8–9,13–15] and his colleagues. Ericsson sought to study and explain the acquisition of expertise in a variety of skill domains including sports, music, writing, science and the learned professions including medicine and surgery. The research goal was to isolate and explain the variables responsible for the acquisition and maintenance of superior reproducible (expert) performance. Ericsson and his colleagues found consistently that the origins of expert performance across skill domains do not reside in measured intelligence, scholastic aptitude or longitudinal experience. Instead, the acquisition of expertise stems from approximately 10 000 hours of DP in a focused skill domain.[16]

DP in medical education settings means that learners are engaged in difficult, goal-oriented work, supervised by teachers, who provide feedback and correction, under conditions of high achievement expectations and psychological safety, with revision and improvement. Maintenance of the clinical status quo is insufficient. To illustrate, the world-famous cardiac surgeon Denton A. Cooley writes in his memoir *100,000 Hearts*[17] about the countless hours of practice in animal and cadaver laboratories, biomedical engineering laboratories, carpentry shops and focused surgical practice with feedback from different sources he experienced to master and advance his craft. This far exceeds the 10 000 hour rule that Ericsson has set as a minimum requirement for the acquisition of expertise in a variety of domains. Another example from the sports world is the DP of Olympic gold medal gymnast Simone Biles. Despite physical gifts, fierce determination to succeed and great coaching Simone Biles describes her practice schedule where, 'I was . . . training more than thirty-five hours each week, with an intense focus on strength, conditioning, and connecting my skills to ensure that the whole routine looked effortless'[18] (p. 139). Denton Cooley and Simone Biles never stopped practising and always tried to improve.

A more practical, and granular, definition of DP is presented here for medical educators who intend to embed the approach in learner education experiences. This list of *10 essential features of DP* is a distillate drawn from several sources.[15,19,20]

Ten essential features of deliberate practice

1 Highly motivated learners with good concentration and active coaching;
2 engagement with a well-defined learning objective or task; at an
3 appropriate level of difficulty [emphasis on difficult aspects]; with
4 focused, repetitive practice [stop and start]; that leads to
5 rigorous, reliable education measurements; that yield
6 immediate, informative, actionable feedback from education sources (e.g., simulators and teachers) focused on areas of weakness; and where
7 trainees also monitor their learning experiences and current strategies, errors and levels of understanding; and

8 consistently engage in more DP with gradual refinements in performance; and continue with
9 evaluation to reach a mastery standard and then
10 advance to another task or unit.

The comparative effectiveness evidence about medical education grounded in DP versus traditional clinical education leaves no doubt that DP yields better results. A head-to-head meta-analytic investigation reported in *Academic Medicine* in 2011 compared outcomes derived from 14 studies of traditional clinical education versus simulation-based clinical education with DP.[21] The quantitative results are unequivocal and without exception. Traditional, Oslerian clinical education fell short in every individual comparison and across all 14 studies. The overall effect size (r = 0.71) translates to a Cohen's d coefficient = 2.00, which is very large.[22] These and other empirical data that demonstrate a dose–response relationship between DP and medical skill acquisition[23] strongly suggest that the traditional Oslerian approach to medical education featuring clinical experience alone is obsolete.

Medical educators are responsible for creating the conditions where learners can undergo the DP needed to acquire and maintain essential clinical skills, judgement and professionalism – core objectives of medical education. This is a behavioural engineering challenge. The question is, given learning objectives for individual medical learners or clinical care teams, 'How can education experiences be designed, implemented, and calibrated to help learners acquire the competencies?' The answer stems from thoughtful curriculum planning, DP management, reliable measurement, feedback, learner achievement to a mastery standard and advancement to succeeding objectives.

Mastery learning

Mastery learning (ML) in medical education is an especially stringent form of competency-based education.[24] ML requires 'excellence for all', knowledge and skill acquisition to high achievement standards without regard to learning time. As stated elsewhere,[25,26] the ML model has at least eight properties, which include DP, to promote high achievement among medical learners. These ML properties overlap with DP features which reinforces the connections among PME elements.

Eight properties of mastery learning:

1 Baseline, that is, diagnostic testing.
2 Clear learning objectives, expressed as units ordered by difficulty.
3 Education activities (e.g., deliberate skills practice) focused on the objectives.
4 Minimum passing *mastery* standard (MPS) for each unit.
5 Formative testing with feedback to assess progress towards the MPS for each unit.
6 Advancement if performance ≥ MPS; or
7 continued practice or study until the MPS is reached.
8 Learning time can vary among trainees, but outcomes are uniform.

The goal of ML is to certify that all medical learners achieve all education objectives with little or no variation in outcome. This is a practical, operational definition of acquiring expert medical performance from a curriculum. The amount of time needed to reach the MPS for a unit's education objectives varies among the learners.[10]

In medical education, ML has been used primarily for acquisition and maintenance of clinical procedural skills, such as advanced cardiac life support (ACLS),[27] paracentesis[28] and central venous catheter (CVC) insertion.[29] However, ML with DP has also been used to help learners acquire and refine cognitive and affective education outcomes. Research shows, for example, that competence to engage a patient in a difficult conversation about breaking bad news is a clinical skill that improves with DP with standardised patients to a mastery standard, just like performance of an invasive procedure.[30]

A study by Barsuk and colleagues illustrates the power of DP with ML to help Post-Graduate Year 1 (PGY-1) internal medicine (IM) residents acquire skills with a basic clinical procedure – lumbar puncture (LP).[31] The study also contrasts the IM residents' LP competence with the LP skills of PGY-2, -3 and -4 neurology residents who learnt the procedure using traditional clinical education. As expected, the IM residents expressed much variation at baseline pretesting using an LP simulator. However, after a minimum 3-hour education session featuring DP with feedback, all IM residents met or surpassed an LP mastery standard at post test. By contrast, only 2 of 36 (6%) traditionally trained PGY-2, -3 and -4 neurology residents met the passing standard, although they had much more LP clinical experience. The investigators also report that 42% of the traditionally trained neurology residents did not even specify routine laboratory tests for cerebrospinal fluid after the specimen was obtained. The article concludes, 'Few [traditionally trained] neurology residents were competent to perform a simulated LP despite clinical experience with the procedure.'[31]

An editorial titled, 'Does experience doing LPs result in expertise? A medical maxim bites the dust,' accompanied publication of the LP ML research report.[32] The editorial states, 'The Barsuk *et al*.[31] study is clearly a wake-up call for all of us who were trained in the era of 'see one, do one, teach one'—the so-called 'apprenticeship' model of clinical training. The old training methods are no longer enough to ensure the best education, and thus the best care for patients.'[32]

A growing body of research evidence now shows that medical education featuring ML with DP can lead to better health for individuals and populations.[33] This line of investigation casts medical education research as translational science because the outcomes of powerful education interventions are linked directly to better and safer patient care practices and patient outcomes.[34,35]

Medical education examples

A set of three medical education examples illustrate the application of PME principles, expressed as DP and ML, to a variety of learning contexts: procedure skill acquisition, readiness for clinical practice and complex clinical care and decision making. A fourth example shows how DP and ML are used for patient education about life sustaining self-care. These cases are a small cross-section of curriculum samples. The sum of a much larger and diverse sample of curriculum cases adds up to an operational definition of medical clinical competence.

Procedure skill acquisition

A curriculum evaluation study by Toal and colleagues focused on a common injury encountered in the emergency department – distal radius fracture.[36] Depending on the site and hospital protocols, emergency medicine physicians or orthopedic surgeons are the primary evaluators of the fracture and perform closed fracture reduction.

A simulation-based mastery learning (SBML) curriculum was developed for both first year emergency medicine and orthopedic surgery residents. Faculty developed a 41-item checklist, setting a MPS at 90%. Faculty consensus identified three critical items that resulted in an automatic re-set if missed. Instructional materials to prepare for the simulation were created for asynchronous delivery. Residents practised distal radius fracture reduction using a task trainer under supervision of a faculty coach who provided continuous feedback. Residents were allowed to spend as much time as needed for practice before a simulation-based assessment. During the skill assessment, if a passing score was not reached or if a critical action was omitted, residents reviewed the missed items and received feedback and more practice. They repeated the clinical process until the MPS was achieved.

The SBML distal radius fracture curriculum produced powerful, uniform results. All residents met or surpassed the MPS within three attempts. The simulation intervention improved fracture reduction skills from an average pre-test score of 40.2% to 94% on the post-test. Emergency medicine and orthopedic surgery residents demonstrated equal mastery skill performance. Pre- and post-training resident surveys showed increased procedure confidence due to the training. The study is also another demonstration that the traditional approach to clinical learning falls short in comparison to DP and ML. A sample of traditionally trained emergency medicine residents more advanced in their training (PGY-2, -3 and -4) were assessed simultaneously on fracture reduction skills; all scored below the checklist MPS (Figure 28.1).[36]

Readiness for clinical practice

Reed and colleagues developed a SBML curriculum within a fourth-year medical school emergency medicine clerkship for medical students to learn and retain clinical skills to prepare for residency.[37] The skills are embedded in the 2017 *Core Entrustable Professional Activities for Entering Residency*.[38] The clinical skills are ultrasound guided peripheral intravenous line placement, basic laceration repair, chest compressions during cardiopulmonary resuscitation, bag-valve-mask ventilation, defibrillator management and code leadership. Students were prepared for DP sessions by viewing introductory videos asynchronously. Fifteen paramedic instructors were trained to supervise students' skill training, assess checklist performance and provide one-on-one feedback. Each of the 135 student participants completed a final assessment for the six skills until the MPS was met. For retention assessment, a sample of 36% of students was retested, unannounced, 1 to 9 months later. Ninety percent of the students retested scored at or above the mastery performance level on first attempt with no significant decrease in mean score for any of the six skills. While five students did not reach the MPS on the first attempt for three skills, only 4 more minutes of DP and assessment were needed to reach the MPS on a second attempt.

Complex clinical care and decision making

Status epilepticus (SE) is a potentially life-threatening condition that neurology residents must learn to assess and manage. The education approach is usually via didactic instruction and clinical experience governed by chance.

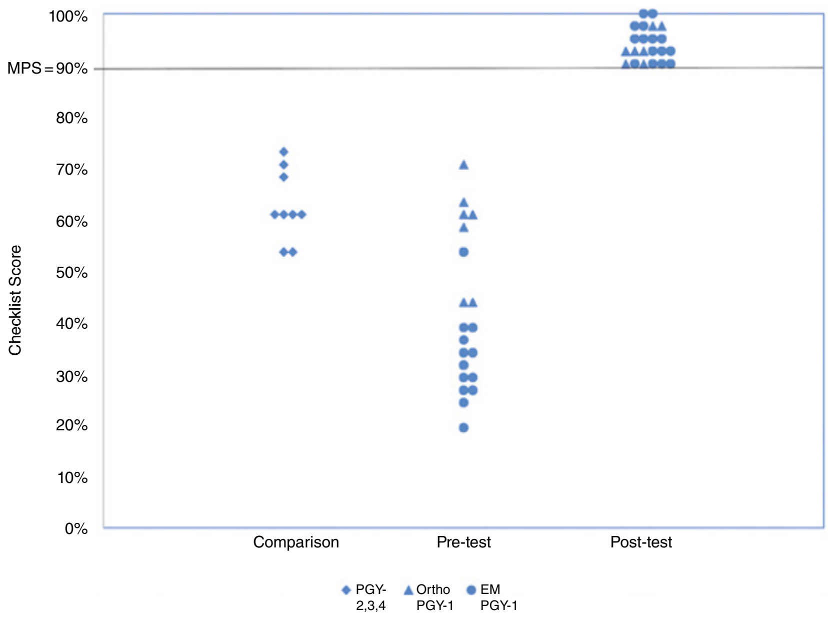

Figure 28.1 Improvement to mastery level on checklist completion percentage for both orthopedic and emergency medicine PGY-1 residents after the simulation-based mastery learning class. Increase in scores after mastery learning session is compared with a convenience sample of emergency medicine PGY-2 to -4 residents to emphasise the educational value of the simulation-based mastery learning session over standard training for this procedure. Toal GG et al. 2021[36]/Wolters Kluwer Health. https://www.simulationinhealthcare.com Reproduced with permission from Wolters Kluwer Health, Inc.

Mikhaeil-Demo and colleagues developed a SBML curriculum for second-year neurology residents on the evaluation, stabilisation, management and re-evaluation of patients with status epilepticus.[39] None of the 16 neurology residents who participated in the curriculum reached pre-test mastery using a pre-test checklist. All residents achieved post-test mastery after one (56%) or two (44%) sessions of DP. Specific 'critical steps' were managed correctly by only 3–5 residents on the pre-test with improvement to all residents managing these steps at post-test. The authors assessed retention and transfer of SE management skills 23 to 245 days after the initial achievement of mastery performance during an unannounced in situ simulation in an actual patient room in the hospital epilepsy monitoring unit. Of the 15 residents who participated in the retention assessment, 93% achieved mastery during the initial re-assessment, and the remaining resident reached mastery after one more DP session. There was no significant difference reported between the median post-test checklist score (94.23%) and the re-assessment score (92.31%).[39]

This is a clear demonstration that skills learned in a simulation lab transfer to a hospital setting and are retained over time. Resident surveys show increased confidence in their assessment and management of SE and agreement that the SBML curriculum is better than a traditional didactic curriculum. The authors also note that the most critical product of the curriculum would be its impact on patient outcomes. They intend to perform chart reviews to evaluate clinical outcomes from the simulation training.[39]

Patient education

Barsuk and nursing colleagues at Northwestern Memorial Hospital (NMH) conducted a groundbreaking study to evaluate the use of SBML for patient education. This research focused on patients with advanced heart failure who have an implanted ventricular assist device (VAD). After receiving a VAD, patients and their [usually family] caregivers must acquire skill and knowledge about VAD self-care quickly.[40] Effective patient self-care and caregiver education is essential for outpatient clinical success, including survival.[41]

The Barsuk research team identified three VAD self-care skills for the mastery learning intervention: VAD (a) controller, (b) power source and (c) dressing changes. Forty patients and their caregivers were randomised to SBML versus traditional self-care training. They completed a pre-test on the three VAD self-care skills, viewed videos created by the investigators and participated in DP with feedback on a simulator for a minimum of three repetitions per skill. At post-test, all patients and caregivers met or surpassed the MPS for each skill. Three participants (8%) did not reach the MPS for controller change at the first try; they needed < 1 hour of more DP to reach the MPS after one re-test session.

Traditional self-care training for VAD patients and their caregivers is neither standardised nor universal. The existing self-care training protocol for VAD patients and caregivers involves watching videos and skill demonstrations by nurses. A VAD nurse coordinator observes the patient and caregiver skills; training is complete when the patient and caregivers are confident they can perform the skills effectively. The VAD nurse coordinator must endorse the patient and caregiver self-confidence as the training outcome. There is no objective assessment of self-care skill acquisition.

At hospital discharge, both groups of patients and caregivers took a skills exam. Overall, the SBML group significantly outperformed the traditional training group in all three VAD self-care skills. A striking finding is that for dressing changes, 95% of caregivers trained using SBML met the MPS. No caregivers (0%) in the control group reached the mastery standard.

Given these results, NMH now has all VAD patients and their caregivers complete VAD SBML self-care training. The Barsuk team acknowledges that further research is needed to determine whether the curriculum improves downstream patient outcomes. In an accompanying editorial 'Educate, Engage, Empower', McIlvennan and colleagues point out that the key elements of the multi-faceted SBML curriculum are the use of technology for patient education; opportunities for DP, assessment and feedback; no increased costs or training time needed for SBML and improved self-care confidence among VAD patients and their caregivers.[42]

The road ahead

We see a two-lane road ahead for medical education research on DP and ML. The first lane addresses the research agenda, unfinished business that will increase our fund of knowledge and boost our skills as medical educators and scholars. The second lane is about programme implementation and maintenance, getting SBML 'up and running' and keeping the innovative curricula fresh and alive despite the weight of education inertia.

Research agenda

1. Development of measures that yield reliable data which permit decisions with validity evidence about the impact of PME interventions is a persistent problem. In particular, there is an acute need to create measures that capture expert performance involving complex clinical cases such as managing patients with Type 2 diabetes. Such cases are often ill-defined, have more than one 'right answer' and pose problems when clinicians disagree about the best approach to patient care. This underscores the Ericsson and Pool observation that a *highly developed field* like medicine must rely on objective ways to measure performance that permit use of training methods such as SBML to improve performance.[9] PME cannot work well without sound metrics that enhance objective performance assessment, actionable feedback and opportunities for improvement.
2. Research and measurement instrument development are needed especially in clinical specialties such as family medicine and psychiatry where practice patterns defy standardisation and frequently rely on a physician's adaptive capacities.[43,44] A prominent example is surgical intraoperative decision making where unexpected problems require fast reasoning and deft responses. Reliable measurement of quick thinking and clinical action under pressure is a knotty academic and technical challenge.
3. More studies are needed that use Ericsson's expert performance approach to identify and isolate features of reproducibly superior medical performance (expertise) in laboratory settings.[8,15] Results from these studies can be used to inform medical curriculum planning and to design DP experiences. We need to place greater reliance on evidence-based approaches to define expertise and shape its acquisition from PME interventions.
4. Healthcare is now a team-based enterprise rather than being delivered by solo practitioners. Thus there is a need for rigorous research to determine how the ML model works for team-based competencies.[45] We also need to learn more about the translational potential of team-based competencies in healthcare, although early research is promising.[46,47]
5. Research is needed to identify and measure the skill set and DP experiences that make simulation instructors effective. This is the expert performance approach focused on expertise among medical teachers versus medical experts in clinical practice. Evidence is needed to better understand the expertise of individual instructors – physicians, other health professionals, technicians – and education teams.
6. The use of artificial intelligence (AI) in many forms is growing rapidly in application and impact throughout medicine and healthcare.[48–50] Adoption of these technologies in medical education is inevitable. Research is needed to advance

the informed use of AI for medical learning, instruction and formative and summative personnel evaluation.

Program implementation and maintenance

Institutional research informed by implementation science principles[51] is needed to advance innovative PME programmes featuring DP and ML including their start-up, maintenance and evaluation.[52] Quantitative and qualitative research programmes are needed not only to evaluate short-run results from DP and ML studies but also to show how and why such immediate results are transferred, adapted and replicated in different settings.[53,54] Embracing and sustaining innovations like PME featuring DP and ML is a daunting challenge in healthcare that must be approached with thought and resolve.[54]

Conclusion

Twenty-first century medical education must move beyond its traditional reliance on the apprenticeship model by incorporating powerful medical education strategies grounded in the science of expertise. Deliberate practice and mastery learning are key science of expertise principles that shape the development of expert medical performance. Medical curricula that employ deliberate practice and mastery learning, similar to the examples presented in this chapter, produce robust short-run and translational education outcomes. Medical education research programmes that are thematic, sustained and cumulative will boost the skill and knowledge base needed for continued advancement.

Acknowledgement

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Practice points

- DP and ML can produce powerful and lasting results among medical learners in classrooms and medical simulation laboratories.
- Carefully designed and executed medical education and translational research programmes can produce downstream results measured as improved patient care practices, better patient outcomes and collateral effects. Such research programmes need to be thematic, sustained and cumulative.[35]
- PME research featuring DP and ML can be accomplished using modest resources. Careful research planning and nimble colleagues are more important for success than a big budget.
- The medical educator role is critical in PME environments that feature DP and ML. Setting goals, active coaching, measuring progress, giving feedback and acknowledging success by learners are all key education activities that must be fulfilled.
- The PME research agenda needed to fully address DP and ML in medical education is broad and deep with many opportunities for significant scholarship.

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29 Closing comments: building and sustaining capacity

David Taylor and Trevor Gibbs

Due to external pressures, the focus of your work is becoming more and more to do with education, and it is getting harder and harder to keep the momentum up in all of the strands of your busy work life. You need to drop some commitments and consider where to focus your time and enthusiasm. The things that have been interesting you most recently have been the conversations you have had with students, and you find yourself wondering where they have got their ideas from? You reflect on this for a few days and realise that the most obvious, and most interesting, path to develop further in your career portfolio is healthcare education research. You are not starting from scratch: you have already published a few articles in the medical education literature, presented at national conferences and have the beginnings of a network of research-interested colleagues. But how best to use your limited time effectively?

Research is stimulating, even fun, and most of us who get involved in it are highly motivated to understand more about the things that interest us and the things that matter. Our belief is that motivation and an enquiry-based approach to our everyday working lives is now the norm. However, it is all too easy to slip into being involved in a *'bit of research'*, often squeezed in and around clinical and/or teaching commitments, rather than working in ways which create long-term sustainable research programmes which will build knowledge and understanding of a topic. This habit can be further compounded by spending too much time and energy repeating studies that have already been carried out by other people with the misplaced view that repeating a study in another context will be publishable. This chapter sets out guidance to help readers consider how to move on from 'doing' a study as an individual to collaborating or leading a team-based, sustainable programme of educational research. In doing so, we draw together many of the messages in other chapters in this book.

The initial steps

An important starting point in getting going in health professions education research is to verbalise the issue, problem or gap. An example of this would be: '*My students never appear to read the material associated with my lectures in advance. Why is this?*' The research question could then focus on exploring student attitudes towards preparatory reading, or identifying barriers to preparation, or to considering if there are other, more effective, ways of teaching the topic in question. Distilling your research question is discussed in depth by Bezuidenhout and colleagues.

From here the process of research has already begun, but even at this early stage, challenges can arise. By looking through the literature for evidence on your topic or idea, you may discover that either your question has already been answered or there is a gap for further research. Even before you embark on your investigation(s), this step is influencing your work – your research is taking shape, you are asking questions, seeking and finding answers or even gaps in knowledge. Do the gaps in the literature fit with your research interests, knowledge and skills? Can you develop a research question and study that is within your academic capabilities and time constraints? Can you do it alone or will you need help? This personal period of constructive reflection is an essential first step in research and is covered in detail in the chapter by Frambach and colleagues.

If you find that your question or idea has not been addressed (and maybe you need to do a literature review to assess this, see chapter by Morris), and/or there are other questions of interest still to be asked – and you are still confident that this is what you wish to pursue – then it is time to start a process of refinement. This involves developing some

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structure around your aims – what you want to find out – and objectives – how you will find it out. At this stage you may also wish to discuss your research question with colleagues – several heads are typically better than one – to ask if they feel that your ideas are relevant, logical, appropriate and feasible. You may also wish to communicate with individuals or groups working elsewhere who already have a track record of research on the topic under consideration.

At this point, you should also reflect on your worldview (see McMillan's chapter) and your preferred ways of working in terms of philosophical approach and aligned methodologies and tools (see Cleland). It is crucial to consider both of these carefully and not, for example, launch down the pathway of using one particular data collection method merely because you have experience of using it before (rather than it being fit for purpose).[1]

This stage of research, identifying a problem and then a question, and thinking through the process of developing a research focus and question, is often a lengthy and creative process, but an important one. A logical approach at this early stage provides a strong basis for your research, as well as giving an indicator of how much work maybe involved to achieve your research aims and objectives.

Building a sustainable research programme

Moving from a single research question and study to building a research programme, there are five overlapping elements that underpin a successful and sustainable programmatic approach to research. These are topic focus, support from others, resources, education and training and strategic leadership.

Focus

One of the things that matters most in our current research environment is impact; the 'so-what' factor; a concept of transferability or translation to the real world (are others interested in the problem you want to address? see Lingard and Driessen chapter).

One way of ensuring impact or transferability is to be sure that there is a common theme underpinning your research programme(s). Embedding individualistic research questions under a common umbrella of research on a specific subject increases the chances of success in the area, increased publications, increased probability of research grants, hence, and increased long-term sustainability. This is often referred to as a 'track record', or an accumulative body of work in a particular area. Your track record will be scrutinised by funding bodies and other stakeholders who want to see if you/your team have the appropriate expertise and experience to conduct the research.[2]

Most institutions now concentrate their research on a small number of themes ('programmatic research'). In this way, the institution, not just the individual, develops the reputation of leading the way in a particular field. This protects against a research programme collapsing if any one individual leaves and may attract others who are interested in working on the same programme to the institution. There are numerous examples of programmatic research in medical education. Many of the authors in this book are known for their programmatic research on particular topics; for example, Jeroen van Merrienboer's programme of work on learning and instruction, Maastricht University, The Netherlands (see chapter by Frerejean, Dolmans and van Merrienboer); Jennifer Cleland's work on selection and assessment, University of Aberdeen, UK and now Nanyang Technological University, Singapore; Kevin Eva's work on mini-multiple interviews (MMIs), University of British Columbia, Canada, to name but a few.

Where the wider institution has a clear research mission, aligning one's own research focus with that mission is strategic. Doing so can enable access to (re)sources of internal funding, training and professional development opportunities, and other support from within the organisation (e.g., your Departmental Head re-assigning some of your tasks to free you to write a paper).

Support

The research environment itself is fundamental. The environment must encourage thinking and debate, and research activity. This is discussed in detail by Frambach and colleagues but, briefly, support mechanisms tend to fall into two categories: formal structures and personal support.

In terms of formal structures, in many institutions researchers are required to have discussed their projects with others before they apply for ethics review and grant funding. These systems of internal peer review can benefit both parties. The individual researcher is challenged to articulate clearly what they want to do and why. The end product of, for example, an application for external funding, is better articulated and more likely to be successful as a result.

Increasingly institutions also have formal mentorship programmes for junior faculty. There is strong evidence that mentoring is both important and effective,[3] provided that there is a good relationship between the mentor and the mentee and that they share similar outlooks.

It is also important to invest in people, and many institutions encourage those involved in education research to acquire the appropriate qualifications.[2] Although many of those working in medical and healthcare education research developed their skills and knowledge 'on-the-job', the current climate encourages formal learning and recognised qualifications. This is partly for the benefit of the individual, but also for the benefit of professionalising the community.[4]

Less formal support systems also exist. It can be very helpful to present ideas at research group meetings, journal clubs, at internal research days or at academic meetings and conferences. There is tremendous advantage in finding a critical friend,[5] who is someone with whom one can talk honestly and openly and share ideas. A third strategy is practice – get into the habit of regular writing.[6] It can be a painful business but, particularly if you are the one who has to be putting the grant proposals and the papers together for the team, it is a very useful habit. Embracing academic writing is also about creativity, one's ability to communicate ideas effectively (see Lingard and Driessen's chapter).

Resources

The biggest resource in research is human resource. Salaries are expensive! Applying for grants to fund staff time to work on projects can take up a lot of time. As discussed earlier, you also need a track record of attracting external funding (and delivering externally funded projects to time and budget) to be seriously considered for larger grants. It is therefore sensible to start small – as a collaborator rather than a lead applicant on a grant, then as a lead applicant on a small grant, then on a larger grant, then as a co-applicant on a large supranational research grant, and so on. Small grants may not look worth the effort but success in obtaining a small grant signifies to others that your work is of sufficient quality and importance to attract external interest and investment. Remember: everyone must start somewhere!

A critical mass of resources is important. Lone researchers are rarely successful. Collaboration is critical. This might be with colleagues from within health professions education, or more broadly: librarians, psychometricians, psychologists, sociologists or those who work in education research but are not immersed in the world of health professions education.

By working with people from other disciplines, you see things from other perspectives, creating a more innovative and stimulating learning environment and enforcing new ways of thinking and doing. This can help improve the quality of research in numerous ways, including in reaching the appropriate balance between what is theoretically important and what is pragmatically possible.[7,8] However, be warned that interdisciplinary working is often not easy as different disciplines have different worldviews (see MacMillan), views and attitudes. However, the gains are worth the challenge, both in terms of your individual development as a scholar and in terms of contributing to a more holistic, sustainable and socially robust learning in health professions education.

Other resources include IT systems; library and online access to journals and other sources of information; equipment; staff time; as well as an organisational ethos which encourages research (see earlier).

Training

Van der Vleuten[2] compared research training with communities of practice (CoP: see chapter by Torre and Durning) in that research can be nourished by a group activity that involves all levels of researchers, from undergraduates, faculty who have developed an interest in research, to those involved full time in research. This research CoP encompasses the values of inclusiveness, openness, supportiveness, nurture and mentorship and, by maintaining a close proximity to a themed research programme, extends corporate knowledge about a given area.

Education and training are important in capacity building. The best time to start learning about research is as an undergraduate.[9, 10] Vocational degree programmes such as medicine, which must fulfil demanding regulator standards and requirements, have long struggled with finding time for significant research training within formal curricula. However, it is important to create opportunities and expose students to research processes in stimulating ways.[11] One approach to doing so is that of 'student-selected components' or electives, used in various countries to give students the opportunity to explore research[12] and which may even lead to publications.[13] Our experience is that students are very motivated to engage in research to develop their research skills. Moreover, encouraging research activity early on can contribute to sustained activity and hence capacity building: 30% of Liverpool Medical School students, all of whom carry out a structured programme of research training, go on to complete Masters programmes within five years of graduation.

Training also implies formal educational programmes. In medical education, these range from programmes such as the series of Essential Skills in Medical Education courses that are run by the Association for Medical Education in Europe (AMEE), (http://www.amee.org/amee-initiatives#esme), through to Masters and Doctoral programmes of which there are a now a multitude.

There is also a place for running local training programmes. Such programmes can help to align practice with current research in the very specific local context.[9,14] They also help people over the threshold of the local research environment,[15] make it more likely that they will recognise and identify with the local landscape of practice[16] and maybe even choose to join it. The range of opportunities for using faculty development to build research capacity has recently been covered in some detail by Hodges.[17]

Finally, continual professional development is critical. Read, read and read more: keeping up to date with publications in the field helps in planning future studies. Attend conferences, meetings and research seminars. Moreover, there are also countless online resources, from TED Talks® to MedEdWorld (www.mededworld.org).

Strategic leadership

At some stage in its capacity-building a health professions educational research group must consider the proportion of its activity it devotes to research, development, innovation or simply training others. This remains a daily consideration for many of those charged with running such units.[18,19] The tension is clear and relates to the issue of whether the unit is working to produce things for people, or for the institution. Typically, markers of success for health professions research units are publications, invitations to speak and grant income. But there is real importance in helping one's colleagues understand how research can improve or develop educational practice in an institution, which is not (necessarily) measured in those terms. We (TG and DT) are fortunate to work in an institution where we are part of an academic health system (e.g., [20]) so supporting the development of education within the university and hospitals is seen as 'core business' for the university, which is, therefore, funded – and valued.

Conclusion

Most people who get involved in research are highly motivated to understand more about the things that interest them and the things that matter. For some, research is a process of steps used to collect and analyse information to increase our understanding of a topic or issue. For others, who wish to create change in healthcare or healthcare education, it can be to translate findings into practice and produce meaningful change in health or healthcare education outcomes. However, no matter how good the intentions, some research fails to achieve its outcomes, not because of its ideas or content but because of its failure to be planned in a way that ensures long-term effectiveness. Sustainability and long-term effectiveness can be achieved by moving research from an individual activity to a group process.

Practice points

- Early and in-depth shared discussion about research questions and projects are the start of ensuring the sustainability of a research programme.
- A team approach to research is usually more successful than an individual approach.
- An effective research team typically encapsulates diversity of expertise and experience.
- Formal and 'on-the-job' training is critical to ensure a sound knowledge base and continuing professional development for all researchers.
- Leaders must consider how best to position their health professions education unit, to meet the needs of key stakeholders.

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30 Conclusion

Jennifer Cleland and Steven J. Durning

The intent of this second edition of *Researching Medical Education* is the same as that of the first edition: to provide an authoritative guide to promote excellence in health professions education research, including medicine, nursing and dentistry, thereby progressing knowledge and understanding in these fields. This book sought to help provide a bridge between theory and practice, which ultimately could improve the care of patients.

We are delighted to have received feedback over the years about what learners and colleagues would like to see more of in the next edition. With this in mind, we worked hard to have a balance of established and new areas of research and ideas, increasingly popular theories and methodologies, and draw in more people who are active in the field of health professions education research in this second edition of *Researching Medical Education*. Our objectives were to introduce a breadth of conceptual frameworks, theories, research designs, methodologies and methods relevant to our field and to illustrate their application in health professions education settings. By explicitly linking these areas, we believe that the book you are reading fosters quality improvement, capacity building and knowledge generation.

Given our broad target audience, the book was divided into three sections. The first focusing on developing your practice as a researcher and covered the initial steps in the research process as well as thinking more broadly than just 'doing a study'. The second and third sections of *Researching Medical Education* focused on introducing a broad array of, respectively, methodologies and theories relevant to health professions education research. All chapters provided a sample vignette, multiple examples, practice points and key references. We cross-referenced chapters as appropriate to highlight to the reader common terms and understanding. We believe that this cross-referencing and merging between related fields is a key to advancing our understanding, and thus we highlight some key connections here. Firstly, several chapters emphasise the importance of aligning and considering the critical foundations of worldview or philosophy, ontology and epistemology, design and methods, no matter what the research topic is. Second, there is a commonality across the chapters in terms of the overarching frameworks, or the unifying 'grand' theories. Some chapters explicitly refer to social constructivism, whereas a post-positivist stance underpins the research reported in other chapters. Third, the importance of workplace teaching and learning in healthcare professions education practice is reflected by its centrality in numerous otherwise quite diverse chapters. Other chapters clearly illustrate the application of theories imported or borrowed from other discipline areas, such as mathematics, education, different branches of psychology and human communication. The introduction to such a wide range of topics in one volume helps the reader understand the key differences and similarities between the topics in terms of their use of theory – for example, what are the commonalities across those chapters focusing on the 'social' or those where the focus is on the 'individual', and how do these approaches differ in their assumptions about the meaning of knowledge and reality? Finally, many chapters bring not just a topic area but also different ways of studying that topic, thus illustrating that there is more than one way to build a programme of research.

We must stress here that no one volume can cover all the theories and approaches that are applicable to health professions education. For example, there is little about the philosophy of education in this book. Neither does the book explicitly examine how theory from organisational psychology and management science can be applied to health professions education.[1]

Many different data collection approaches are illustrated in this book, but again, these examples are not all encompassing. We urge the readers with an interest in qualitative approaches to also explore methods such as the guided walk[2] and creative methods, which employ art, drama, poetry and so on to engage participants in a more holistic way.[3] Those with a more quantitative worldview may have noticed that reliability and generalisability

Researching Medical Education, Second Edition. Edited by Jennifer Cleland and Steven J. Durning.

theories are not covered. Nor is there an example of a case-control study, although these are not uncommon in studies of health professions training.[4]

Although the book covers a range of topics – from selection to workplace-based learning, motivation to communication – as with theories and methods, we have not been able to include all the topics that are considered legitimate areas of study in healthcare professions research. For example, the (enormous) research topic of formal assessment would require a volume of its own.

In short, please do not think if a theory, methodology or a method is not mentioned in *Researching Medical Education*, then it is not potentially useful. Moreover, given that our field has always drawn from others and will continue to do so, it is important to be aware of theoretical and methodological developments in other disciplines. An approach that is considered relatively mainstream in, for example, sociology may be appropriate, novel and original in health professions education research.

This brings us to a last point. It is important to stress the need for interdisciplinary in addition to multidisciplinary research. Many of the problems and questions that need to be explored are not unique to any one area. Indeed, many are 'grand challenges' (such as widening participation and increasing the diversity of medical students) that require the bringing together of resources and knowledge from different fields and disciplines to understand and perhaps even solve complex, real-life problems.[5] In the latter, research problems are investigated from different disciplines, while in the former, theories, insights and methods from different disciplines are integrated to investigate a jointly defined problem. Interdisciplinary collaboration has the potential to forge new research fields.[6] Collaboration of this type is, however, not always easy – different disciplines have different assumptions, language, methods and viewpoints, as well as different journals, publication norms and standards.[7] Both of us have had the personal experience of working with colleagues from other fields where, after talking at apparent cross-purposes for some time, we often realise that we are actually saying the same thing, but using a very different language to do so. O'Sullivan *et al*.[8] provide a thoughtful overview of the gains and potential pitfalls of collaborative research in medical education. Finally, and on a practical note, funders often like – and look for – multidisciplinary collaborations. Indeed, the right team is a core feature of a successful grant application. Given that educational research in health professions education is inherently interdisciplinary – this book provides a number of examples of collaborative working across scientists, social scientists and clinicians from around the globe – the time is right to further diversify the perspectives brought to research questions in our field.

Finally, this book would not have been possible without the support and efforts of our authors. The book represents a truly global achievement, drawing on intellectual contributions from colleagues working across Africa, Asia, Australasia, Europe and North and South America. It is also timely here to extend our gratitude to the International Editorial Board members who helped guide us with formulating the first edition of *Researching Medical Education* and to those colleagues and students who provided thoughtful feedback and suggestions for this second edition.

We hope this new edition of *Researching Medical Education* stimulates fresh thinking and new ideas, stretching the reader's understanding and encouraging them to engage further with new theories, models, methodologies and analysis approaches introduced here for purposes of improving the work that we do.

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