# BEME Guide No. 3: Systematic searching for evidence in medical education—Part 2: Constructing searches*

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SUMMARY *Searching for evidence to inform best practice in medical education is a complex undertaking. With very few information sources dedicated to medical education itself, one is forced to consult a wide range of often enormous sources—and these are dedicated to either medicine or education, making a medical education search all the more challenging. This guide provides a comprehensive overview of relevant information sources and methods (including bibliographic databases, grey literature, hand searching and the Internet) and describes when they should be consulted. The process of constructing a search is explained: identifying and combining core concepts, using Boolean algebra and search syntax, limiting results sets, and making best use of databases' controlled vocabularies. This process is illustrated with images from search screens and is followed by numerous examples designed to reinforce skills and concepts covered. The guide has been developed from the ongoing experience gained from the systematic searches conducted for the Best Evidence Medical Education Collaboration, and concludes by looking ahead to initiatives that will shape future searching for medical education evidence.*

## Constructing searches

*There is a process of structuring a search query that you should follow before sitting down to search a database. The process can be broken down into three steps, and should ensure that the time you spend searching is more focused and that the results are more relevant:*

*Define and write the issue down in the form of a question or hypothesis.*
*Identify and expand the essential concepts.*
*Set out the scope of the search query (e.g. inclusion and exclusion criteria).*

*The process is usually iterative, as you may wish to adjust or refine your search query after you have some database results (Figure 1).*

### Defining the search query

> Before beginning a Hunt, it is wise to ask someone what you are looking for before you begin looking for it. (*Pooh's Little Instruction Book*, inspired by A.A. Milne)

Defining the search query is the first critical stage of literature search. A well-designed question goes a long way to ensuring that the query is answered in a way that is objective, explicit and independently reproducible. All consequent stages will develop from the question's parameters, so attention must

be given to breaking the query down into its component parts. Most search queries result in a single question, though multiple or composite questions do arise.

Search queries must be precisely defined. In medicine, evidence-based queries are broken down into the following components: *population, intervention, comparison, outcome* and *study design*. A rough parallel exists in medical education, where it is advantageous to think of the query in terms of the following components: *participants, educational aspects* and *outcomes*.

The medical education query, ''Can an OSCE effectively assess communication skills in undergraduate medical students?'', might seek to define its components by asking the types of questions in Figure 2.

### Identifying and expanding the essential subjects

Look at your search query carefully and identify the words or phrases that make up the essential subject components of the issue you are addressing.

Examine each essential subject and make a list of any synonyms, alternative spellings, and related terms that you would like included in your results. To do this, it helps to
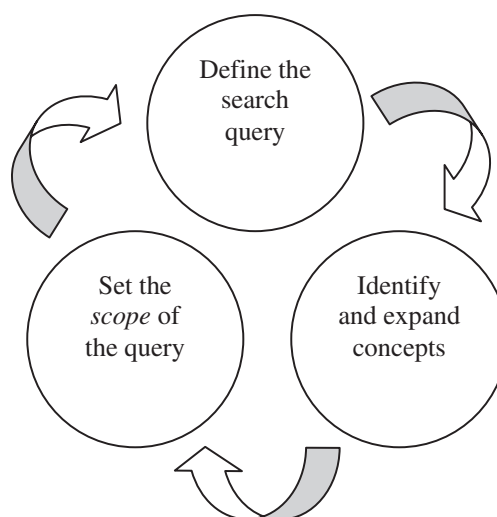


**Figure 1.** Structuring a search query.

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*Part 1: Sources of information, was published in the July 2003 issue (vol. 25, no. 4).

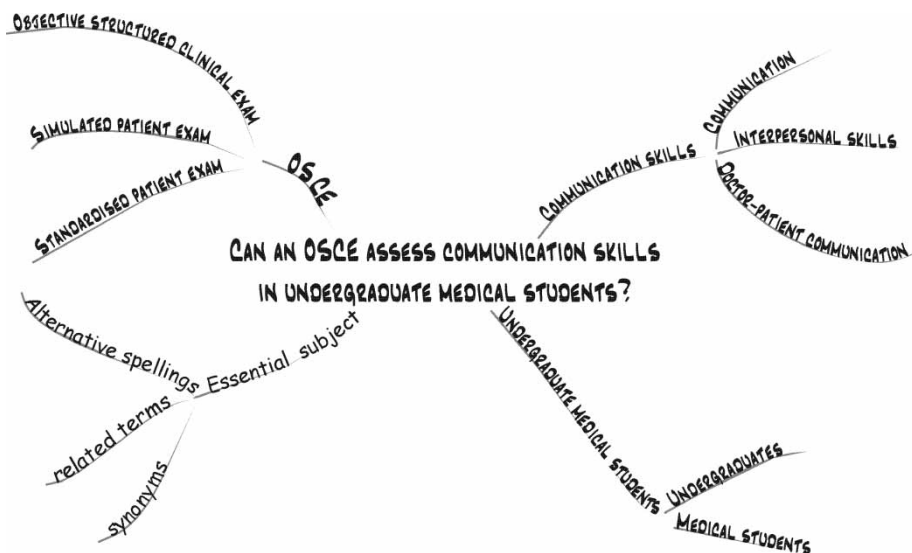| Question components | Topic: feedback in assessment |
|---|---|
| Participants | Who are they? Undergraduates, medical students etc.? |
| Educational aspects | Is an OSCE appropriate for measuring communication skills? |
| Outcomes | Are the exam results an accurate reflection of competence? |

**Figure 2.** Setting the scope of the query.



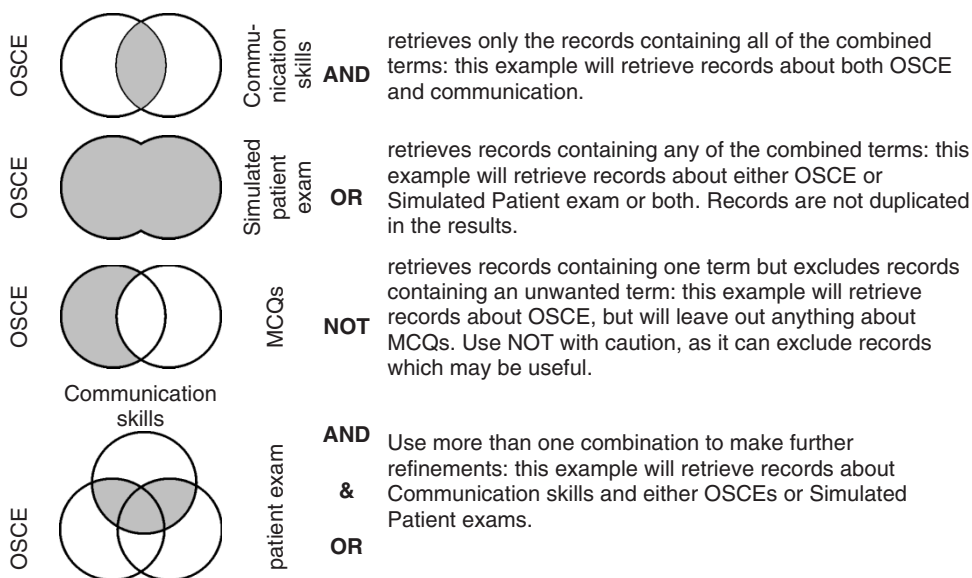**Figure 3.** Organisation of essential subjects and associated terms.



**Figure 4.** How to combine essential subjects and associated terms in searching databases.

think of formal terms (like myocardial infarction) as well as less formal terms (like heart attack). Be as specific as possible, and where you are interested in a largish area (like heart disease) list *all* the more specific topics (like types of heart disease) that you want to cover. (See Figure 3 for a diagram showing how you might organize your essential subjects and their associated terms.)

At this point you should also think about how your essential subjects and associated terms relate to one another in the context of your search query, and therefore how you will be combining them when you search the *database*s (Figure 4).

These combining commands are based on *Boolean algebra*, created by the English mathematician George Boole (1815–64). Boole established 'symbolic logic', which is the basis for the design of the digital logic of today's computers. Symbolic logic is a simulated language that removes the logical flaws and the lexical ambiguities of natural language and allows procedures to be processed. Fortunately for the *database* user,

only a very simplified form of *Boolean algebra* is required to combine *search concepts* to maximum effect.

### Setting out the scope *of your enquiry*

To make it so that you have fewer irrelevant results to look through, think about some parameters, or inclusion and exclusion criteria: Do you want to limit the search to a certain study design? Do you want to limit to age or type of learner? What about year of publication—do you need only the very latest, or do you want to cover 10, 15, 20 or more years into the past?

There are two points to bear in mind when setting out the *scope* of your search query:

- You are establishing an important part of your ''materials and methods'' at this stage, so if you plan to write a literature review you need to note down what inclusion and exclusion criteria you set and why.
- Some parameters, like language of publication, do not necessarily ensure that your search results are of greater relevance and of higher quality. Think about which limits really do refine your research question, and which are arbitrary ways of reducing the number of results you have to look through.

Search strategies often need to be refined, depending on the topic and how complete you think the results should be. Searches can be refined both at a conceptual level with the topic itself, and by using the three standard components (as discussed above), or by altering the search terms and language (as discussed below).

You should now have a very clear definition of what you are looking for in the *database*. This will save you a lot of time in the long run.

### A sample Medline search

This sample search of Medline will take you through the basic steps in performing a subject search. The goal of this search is to find information to help answer the question ''*Can an OSCE effectively assess communication skills in undergraduate medical students?*'' The sample search is intended as an illustration of various techniques and ways of addressing problems associated with literature searching.

> *To reinforce the techniques described in this example, we recommend that you follow the steps with a live Medline search of your own.*

This sample search is illustrated with screen-shots of the Ovid (http://gateway.ovid.com) *search interface* with the kind permission of Ovid Technologies, but the authors do not endorse Ovid, nor recommend it above other database providers. The techniques illustrated are not unique to this interface, and can also be performed with other interfaces to the Medline database.

When you log on, you will be presented with a list of databases to choose from. Medline itself is divided up for convenience into various groups of years, and each group is also called a ''*database*''.

### Subject searching

On the main search page (Figure 5) you can see a reminder of which *database* has been selected at the top, and if you change your mind about year selection, use the icon:



By default, the Main Search page is set for a *Subject heading* search. Unless you deselect *Map Term to Subject heading*, your search terms will be mapped (or matched) with the index terms, or *Subject heading*s, used by the National Library of Medicine to describe the content of articles. This mapping facility ensures that the records retrieved in your search are more likely to be relevant.

For this search, we've typed 'communication skills' into the input line provided and can click on *Perform Search*.

### The mapping display

Next, the Mapping Display shows a list of the Subject headings that best match ''communication skills'' (Figure 6).

'Communication skills' is not a Subject heading, so a list of alternative or closely related Subject headings is displayed. *Communication* is the closest synonym. To select the Subject heading(s) you want from this list, click in the adjacent box(es). Alternatively, you could choose the last item in the list, Search as Keyword. This runs a *free-text* search for the phrase 'communication skills' in the title, abstract or Subject headings of each article record.

### The difference between *Subject heading* and Keyword (*free-text*) searches

Medicine *Subject heading*s (**MeSH**) are 'tagged' by professional indexers to articles to describe the content, and should allow you to retrieve articles on your subject no matter what spelling or synonym the author has used in the article. Also, when an author doesn't put important words into the article title or abstract, the Subject headings should make up for the omission. Only with standardized and defined concepts (i.e. a *controlled thesaurus*) can the creators and the users of *database*s consistently employ terminology to maximum effect.

The Keyword search looks for your term regardless of its contextual meaning. The Keyword search in Ovid is a **free-text** search, literally looking for precisely the term or phrase in the title, abstract and other available or specified record *field*s. So, for example, if you searched for the word 'stress' as a Keyword, you would retrieve articles about stress fractures, dental stress, psychological stress, and more. Problems can also arise from simple errors in keying records. Medline currently has 11 records that mention ''prostrate cancer'' (*sic*) and 112 for ''myocardial infraction'' (*sic*)—these errors obviously slip by computerized spell-checkers.

### Why use *Subject headings?*

A Subject heading search will usually bring up a higher proportion of relevant records, provided you have used the most appropriate *Subject heading*. The problem of **polysemy**

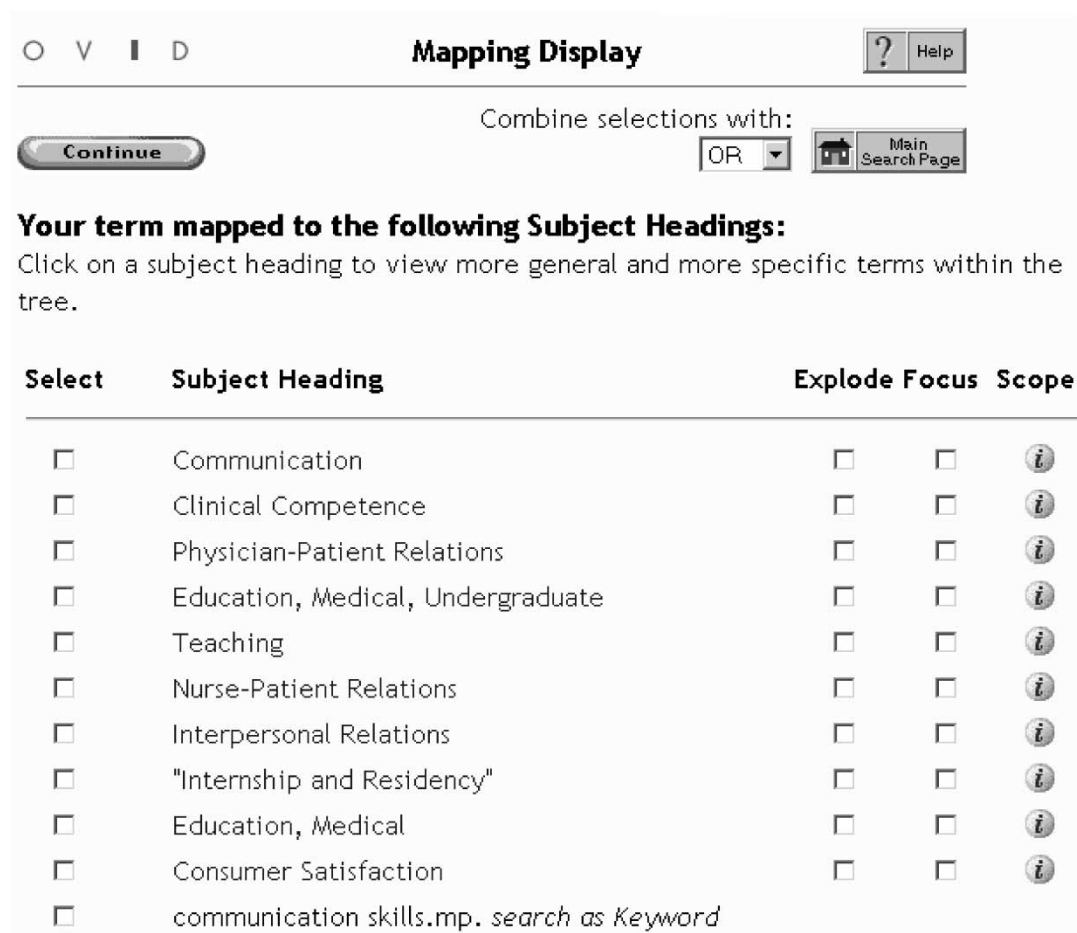**Figure 5.** The main search page.



**Figure 6.** Subject heading mapping display.

illustrated above with 'stress' should be largely removed. *Indexing* endeavours to establish a balance between ***selectivity*** (choosing the concepts of greatest utility to the users) and ***exhaustivity*** (ensuring that all prospective concepts are represented), and effective *indexing* dramatically improves both search *sensitivity* and *specificity*.

*Subject heading*s reduce the problem of ***granularity*** of terms, *granularity* being defined as the relative size, scale or depth of penetration of a term. Authors of papers, the people who write abstracts and the various different users of *database*s can all have different ideas as to what is the scope (*granularity*) of a term. For example, problem-based learning citations may not mention 'problem based learning' anywhere in the record but instead refer to 'active learning', 'experiential learning', 'problem based curriculum', or 'PBL'. An indexer would recognize the citation was about problem-based learning, assign the Subject heading 'problem-based learning', and any user searching with the *controlled vocabulary* would find all the possible context-specific documents. *Sensitivity* is improved, as relevant documents not containing the literal term 'problem based learning' would still be retrieved, while *specificity* would improve, as the false *hit*s associated with *free-text* words would be drastically reduced.

As a rule of thumb, you should begin your searches by finding the most appropriate *Subject heading*s.

### When to use a Keyword (*free-text*) search

If there is no appropriate Subject heading—and this can happen if you are searching for something new or rare—then it is best to use a *free-text* search. Free-text searching is also the best way to find the full bibliographic details when you have been given an incomplete reference—you can search with the pieces of information you do have: author name, page numbers, journal title words, etc.

Sometimes, despite there being a matching Subject heading, it still seems there should be more records on the topic. If this seems the case, you can select both the matching Subject heading and the Search as Keyword option and combine them using OR. In addition, for higher *sensitivity*, you could search using a series of free-text searches to cover the various synonyms or spellings that may be used by authors. Special techniques for free-text searching

(***truncation*** and **proximity commands**) are illustrated in subsequent steps of this sample search.

### The Tree Display

Returning to our sample search—to find out more about a Subject heading, such as its coverage, related Subject headings and definition, click on it—in this example (Figure 6), we follow the link from the phrase *Communication*.

By clicking on a Subject heading, you are taken to the Tree Display (Figure 7a).

The Tree Display has several important features.

#### *Subject heading hierarchy*

You can see the organizational hierarchy of *Subject heading*s, and by clicking on other *Subject heading*s you can explore the hierarchy to find the most appropriate headings. This allows you to adjust the route of your search at this point if you prefer to take a ***broader*** or ***narrower*** approach. You'll have to scroll down the page to see *Communication* (see Figure 7b).

You can see how the *Subject heading*s are organized in a hierarchy with *broader* (left) and *narrower* (right) Subject headings. *Communication* is subordinate to the *broader* heading, *Behavior* (not shown in Figure 7b), and has its various aspects identified by *narrower*, or more specific Subject headings. As a rule, indexers only apply the most specific possible Subject heading—for example, an article given the heading *Interdisciplinary Communication* would not normally also be given the *broader* heading, *Communication*.

There are some options available from the Tree Display (see Figure 7a for the headings to the columns to the right of the Subject headings):

#### *Explode*

When you want to search for a Subject heading and include all the *narrower* Subject headings that branch off from it, select the *Explode* option. Here, we have clicked in the boxes for *Communication* and its adjacent *Explode*, so our *search set* will include *Communication* as well as *Communication Barriers* and *Disclosure* etc., as well as any even *narrower Subject heading*s which branch off from the headings subordinate to *Communication*.
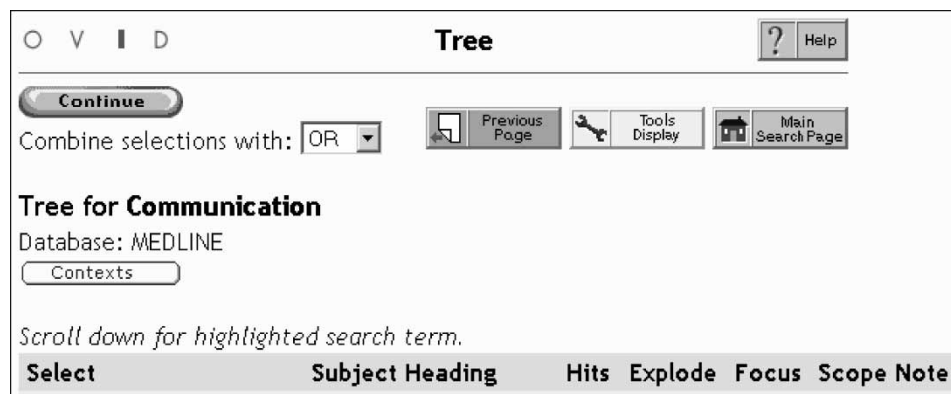


**Figure 7a.** Tree Display – top.

**Figure 7b.** Tree Display – bottom.

*Focus*

This option will bring up only records of articles in which the *Subject heading* is a primary topic. This reduces the number of articles retrieved. For sensitive searches, the *Focus* option is not recommended.

*Scope Note*

The main reason to use this is that it usually gives you a glossary definition of the *Subject heading* as well as an indication of what other terms are covered (see *Used For* at bottom of Figure 8). This is important because the creators of the *database* might attach a slightly different meaning to a term than you would, and you should make sure you are matching the definitions used in the *database*. For detailed searches, it is worth looking for a *Year of Entry* so you know how long the Subject heading has been in use, and what to use if you need to search in prior years.

We have selected *Communication* and the adjacent *Explode* (see Figure 7b)—we are ready to continue (you would click on the green lozenge-shaped button at this point).

*Subheading* Display

Most Subject headings have a number of *subheading*s to which you may limit your search (Figure 9). This can be a useful shortcut to a few articles on a particular facet of a

Subject heading. Many of these subheadings will not be useful in a medical education search and as a general rule one should always begin a search broadly and apply limits later. Also, for sensitive searches, you should be cautious about using subheadings because they are not consistently applied.

For this search, we shall not limit to any particular *subheading*s.

However, *subheading*s should not be ignored for two main reasons. First, they can significantly qualify educational content; the Methods, Organisation and Administration, Standards, and Trends subheadings all can be of considerable benefit.

The other key utility of *subheading*s is realized by searching them on their own. 'Education' itself is a subheading for some *database*s, notably Medline; because Medline's *focus* is medicine and not education, the 'education' subheading can be used to extract citations not found by either *controlled vocabulary* searching. Many citations with the education subheading applied to one of the *MeSH* are only educational in a peripheral sense, yet many others are primary education studies. There are 111,110 Medline citations with the 'education' subheading and 327,494 are indexed with or beneath the *explode*d controlled vocabulary term 'education'. Significantly, over 30,000 citations have only the education subheading. In the nursing database CINAHL there are over 8000 citations in a similar situation. Few medical education searches capitalize on this way of improving the both the
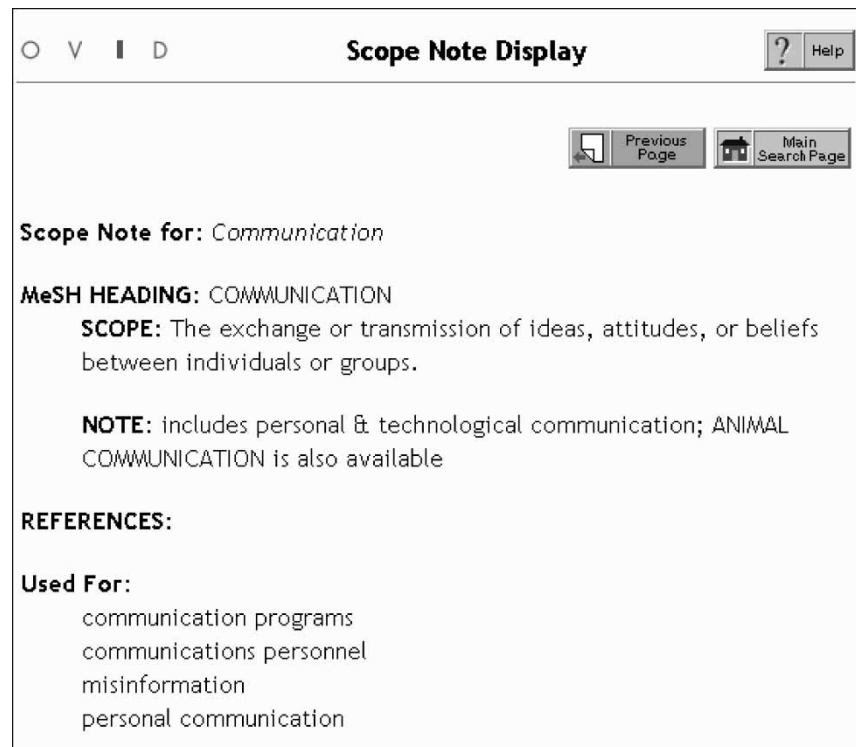
468

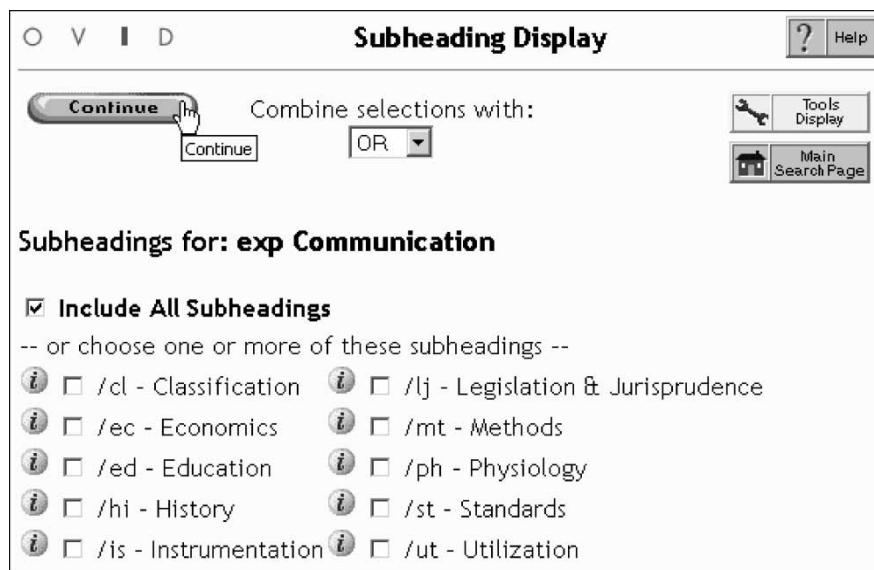**Figure 8.** Scope note display.



**Figure 9.** Subheading display.

*sensitivity* and *specificity* of their results. (See below, Search Examples 9 and 10.)

*Building the search history,* free-text *searching and proximity commands*

We have returned now to the Main Search page (Figure 10), and the first *search set* is listed in the Search History. Any subsequent search sets will be added to the Search History. We could look through the results now, but we would waste too much time sifting through records of irrelevant articles.

The next step illustrated is a search for communication skills as a *free-text* search. Note that we have de-selected the *Map Term to Subject heading* option for this step.

We could search for the phrase 'communication skills' but the concept is likely to be expressed in many ways other than in that exact phrase. The command **adj***x* is Ovid's proximity command—where ***x*** is the number of words that are allowed to be between the terms specified. The search 'communication adj3 skills' finds any occurrence of communication within three words of skills (in any order). Proximity commands allow a sort of compromise between phrase

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**Figure 10.** Free-text searching with the proximity command.
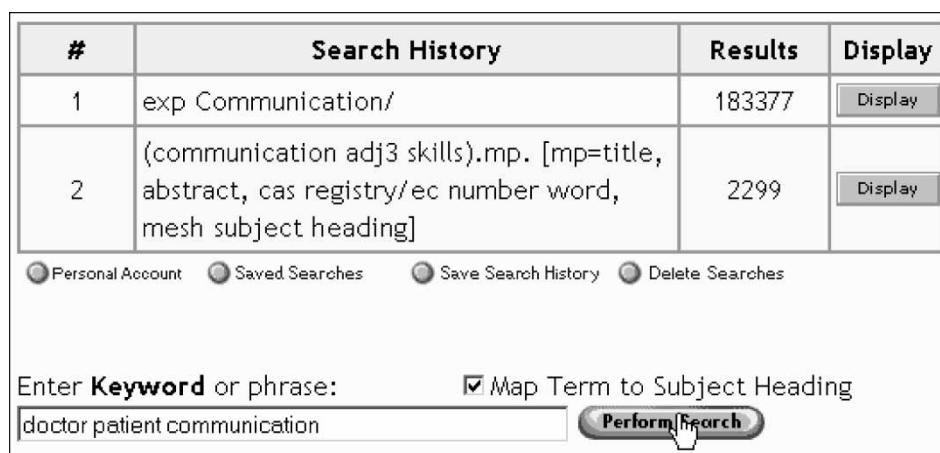


**Figure 11.** Building the search history with another related phrase.

searching and the Boolean AND: the exact phrase is too restrictive, and a search for 'communication AND skills' would return many results that have those two words somewhere in the searched *field*s but not necessarily linked together conceptually. As a general rule, the closer together two words are, the more likely it is they will be conceptually linked. Bear in mind that proximity commands nearly always ignore stop words such as 'the', 'and' or 'that'.

We are now ready to move to another of the related phrases from the list we created at the start. Remember that the *search set*s are not related at all to one another until we combine them using Boolean Commands at a later stage.

We have selected *Map Term to Subject heading* again before executing this new search to take advantage of any suitable *Subject heading*s that may be presented.

Again, 'doctor patient communication' is not a *Subject heading* (Figure 12), but *Physician–Patient Relations* looks promising, and it was not a heading that we saw under *Communication*. To see its context in the organization of *MeSH*, we will click on *Physician–Patient Relations* and go to the Tree Display.

In the *MeSH* hierarchy, Physician–Patient Relations is placed under *Professional–Patient Relations*, which in turn is under *Interpersonal Relations* (Figure 13).

In the *Scope* Notes, *Physician–Patient Relations* is defined as 'The interactions between physician and patient'; *Interpersonal*

*Relations* is defined as 'The reciprocal interaction of two or more persons'. *Interpersonal Relations* seems a bit vague, but because of its similarity the commonly used phrase 'interpersonal skills' it is probably worth selecting.

It is arguable whether or not at this point we should simply select and *explode Interpersonal Relations* in the same way we did for *Communication*. For this example, we want to illustrate the selection of multiple *Subject heading*s from the Tree Display so we have selected *Interpersonal Relations* and *Physician–Patient Relations* and will continue with those two, which are by default combined with OR (see Figure 8a).

*Combining synonymous* search sets

In the previous steps we have tried to illustrate the process of building up a sensitive search history by submitting standard phrases used in discussing communication skills, matching them to *Subject heading*s, and augmenting those with *free-text* searches. Figure 14 shows the search a few steps forward from our selection of the Subject headings *Interpersonal Relations* and *Physician–Patient Relations*. Set 4 shows a free-text phrase search for 'doctor patient communication'—note that some *search interface*s require phrases to be surrounded by quotation marks, but this is not required here. Set 5 shows a free-text search for interpersonal and skills within three words of one another, just as we did for communication skills

**Figure 12.** Mapping Display for doctor patient communication.



**Figure 13.** Tree Display for Physician-Patient Relations.

in set 2. The sets in the history are still not associated with one another.

The next step is to combine the sets (this could also wait until the very end). We want articles within any of the sets, so we want to combine using the Boolean command **OR**. We have typed '1 or 2 or 3 or 4 or 5' in the input line—or we could have clicked on the Combine tool at the top of the Main Search page:



If we had wanted to use another Boolean command, we could have typed '1 and 2, etc.' or '1 not 2' depending on what is appropriate. Clicking on Perform Search will execute the combination. See set 6 in Figure 15 for the results of this combination.

As shown in Figure 15, we have begun to search for terms related to the idea of objective structured clinical examinations. Set 7 in Figure 15 shows a *free-text* search for the acronym, OSCE. We found that there is no *Subject heading* specific to the idea of OSCEs, so we are relying on *free-text* searches. If a term has a commonly used acronym or

**Figure 14.** Combining a cluster of synonymous search sets with OR.



**Figure 15.** Using the truncation symbol.

abbreviation, it is important to include a search for it as well as for the complete phrase.

### Truncation—right-hand and internal

*Free-text* searching is more effective if you allow for variations of words by truncating the ending. In Figure 16 we have entered 'objective structured clinical exam$' to allow for the fact that examination could appear as exam, exams, examination or examinations. When you truncate a word, be sure not to make the root too small (so that you get irrelevant words) or too big (which will restrict the number of relevant variations). The right-hand *truncation* symbol here is $, but it varies from one *search interface* to another (* is a common *truncation* symbol).

Internal *truncation* can be used within a word to allow for variations in spelling. Figure 16 shows 'standardi#ed

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| # | Search History | Results | Display |
|---|---|---|---|
| 1 | exp Communication/ | 183377 | Display |
| 2 | (communication adj3 skills).mp. | 2299 | Display |
| 3 | interpersonal relations/ or physician-patient relations/ | 66593 | Display |
| 4 | doctor patient communication.mp. | 295 | Display |
| 5 | (interpersonal adj3 skills).mp. | 852 | Display |
| 6 | 1 or 2 or 3 or 4 or 5 | 238145 | Display |
| 7 | OSCE.mp. | 308 | Display |
| 8 | objective structured clinical exam$.mp. | 329 | Display |
| 9 | patient simulation/ | 591 | Display |
| 10 | simulated patient$.mp. | 467 | Display |

○ Personal Account  ○ Saved Searches  ○ Save Search History  ○ Delete Searches

Enter **Keyword** or phrase:   □ Map Term to Subject Heading
standardi#ed patient$   ( Perform Search )

**Figure 16.**  Internal truncation.

Enter **Keyword** or phrase:   □ Map Term to Subject Heading
test$ or exam$ or assess$   ( Perform Search )

**Figure 17.**  Entering multiple free-text words.

patient$' in the input line—this search statement will retrieve 'standardised' and 'standardized'.

Set 9 in Figure 16 shows a *Subject heading* search for patient simulation—this Subject heading was presented in the Mapping Display when we searched for 'simulated patients' and is defined in its *Scope* Note as 'The use of persons coached to feign symptoms or conditions of real diseases in a life-like manner in order to teach or evaluate medical personnel'. It seems appropriate to our enquiry, so we included it, as well as a *free-text* search for the phrase 'simulated patient$' in set 10. As you will have anticipated, 'patient$' will retrieve the singular and plural forms of that word.

We need to refine our searches for 'patient simulation/', 'simulated patient$' and 'standardized patient$' so that they are somehow related to the idea of examination. Figure 17 shows how multiple words can be entered all at once. This is pretty successful for *free-text* searches when all of the terms are to be combined with the same Boolean command. This is not usually good practice, though, as it does not allow you to see what *Subject heading*s would be presented by the *search interface*, nor does it let you see how successful the individual terms are by letting you see the number of results each separate word generated. It does save time, though!

Figure 18 shows further development of the search history with the addition of set 13, which shows how to combine sets using more than one Boolean command at once. Just like algebra, the *database* software knows to combine the sets in parentheses first. Set 13 will retrieve records about patient simulation or standardized patients (sets 9 to 11) and also about tests or exams or assessment (from set 12).

It is possible to make more complex combinations by nesting parentheses—for example, '7 or 8 or ((9 or 10 or 11) and 12)' would give us the same results as the combination '7 or 8 or 13'.

**Combining the groups of synonyms**

The last area to search on for our query is to do with the idea of 'undergraduate medical students'. Two relevant *Subject heading*s are returned when we search for that phrase: *Education, Medical, Undergraduate* and *Students, Medical*. These *Subject heading*s can be augmented by *free-text* searches for 'undergraduate$' and 'medical student$' (see Figure 19).

Set 19 in figure 19 sums up the synonyms for undergraduate medical students.

Now we are ready to combine our three subject areas—this is shown in set 20 (Figure 19), where the numbers 6, 14

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| # | Search History | Results | Display |
|---|---|---|---|
| 1 | exp Communication/ | 183377 | Display |
| 2 | (communication adj3 skills).mp. | 2299 | Display |
| 3 | interpersonal relations/ or physician-patient relations/ | 66593 | Display |
| 4 | doctor patient communication.mp. | 295 | Display |
| 5 | (interpersonal adj3 skills).mp. | 852 | Display |
| 6 | 1 or 2 or 3 or 4 or 5 | 238145 | Display |
| 7 | OSCE.mp. | 308 | Display |
| 8 | objective structured clinical exam$.mp. | 329 | Display |
| 9 | patient simulation/ | 591 | Display |
| 10 | simulated patient$.mp. | 467 | Display |
| 11 | standardi#ed patient$.mp. | 629 | Display |
| 12 | (test$ or exam$ or assess$).mp. | 2292852 | Display |
| 13 | (9 or 10 or 11) and 12 | 918 | Display |

○ Personal Account  ○ Saved Searches  ○ Save Search History  ○ Delete Searches

Enter **Keyword** or phrase:        ☐ Map Term to Subject Heading

`7 or 8 or 13`        Perform Search

**Figure 18.**  Using more than one Boolean command at once.

| # | Search History | Results | Display |
|---|---|---|---|
| 1 | exp Communication/ | 183377 | Display |
| 2 | (communication adj3 skills).mp. | 2299 | Display |
| 3 | interpersonal relations/ or physician-patient relations/ | 66593 | Display |
| 4 | doctor patient communication.mp. | 295 | Display |
| 5 | (interpersonal adj3 skills).mp. | 852 | Display |
| 6 | 1 or 2 or 3 or 4 or 5 | 238145 | Display |
| 7 | OSCE.mp. | 308 | Display |
| 8 | objective structured clinical exam$.mp. | 329 | Display |
| 9 | patient simulation/ | 591 | Display |
| 10 | simulated patient$.mp. | 467 | Display |
| 11 | standardi#ed patient$.mp. | 629 | Display |
| 12 | (test$ or exam$ or assess$).mp. | 2292852 | Display |
| 13 | (9 or 10 or 11) and 12 | 918 | Display |
| 14 | 7 or 8 or 13 | 1215 | Display |
| 15 | Education, Medical, Undergraduate/ | 10040 | Display |
| 16 | Students, Medical/ | 10180 | Display |
| 17 | undergraduate$.mp. | 8307 | Display |
| 18 | medical student$.mp. | 10464 | Display |
| 19 | 15 or 16 or 17 or 18 | 28220 | Display |
| 20 | 6 and 14 and 19 | 138 | Display |

**Figure 19.**  The finished search history.

and 19 represent the synonym clusters for communication skills, OSCEs and undergraduate medical students.

A total of 138 results is not very many to look through—in fact, it is rather a small number of results for a search that intends to be sensitive. We will look a bit later at how we could limit the results by setting some other parameters, but first we will look at some of the results to see how relevant they are.

**Search results and how to use them to refine your search**

It is always worth looking at search results at intermediate stages of *database* searching to see if they are the sort of results you were looking for, and how you might refine your search to make it more specific or more sensitive, or both. We have not looked at results yet in this sample search in the interests of space, but the following points would be useful for looking at results at any stage.

Figure 20 shows the first handful of results from the search—they look promising, and most even have 'communication skills' in the title. The *Complete Reference* is a valuable source of additional information about the article—we will look at the complete reference for the first article (complete reference does not mean the full text of the article).

The Complete Reference gives full bibliographic details about the article, but many records also have an abstract and other useful *metadata*, or descriptive information.

The Complete Record lists the *Subject heading*s that have been assigned to that article by the indexer, and if you find an



**Figure 20.** Search results in Title Display.

article that is useful for your search query, then having a look at the *Subject heading*s in its *database* record could give you some additional search terms to find more articles on the same subjects. The record in Figure 21 has the potentially useful *Subject heading*s *Clinical Competence* and *Educational Measurement* listed—terms that might give good results when combined with the idea of communication skills. The Subject headings that have asterisks next to them are '*Focus*' ones (see Figures 7a and 7b).

The abstract is another potential source of search terms: this one mentions an exam specific to communication skills that would be worth following up. Note also that the phrase 'role players' is used as a synonym for standardized patients.

You may also be able to identify why irrelevant records have appeared—for example, are any of the search terms consistently retrieving records wide of the mark, making it so

that you want to remove the terms from your search? *Free-text* searches are particularly guilty of this. Alternatively, you might be able to pinpoint irrelevant topics that you could exclude from your results by using NOT to combine them with your useful search terms (remember to use NOT with caution).

**Refining tools: Limits and *search filters***

*Limits*

There are various parameters or limits you might consider when designing a query—*search interface*s have various easily applied limits. Date limits are routinely available, but can be marginally more complicated to use if the database differentiates between the date when the citation was published and the date when it appeared in the database (the former



**Figure 21.** The Complete Record.

usually being of most utility). Geographic limits can be used to isolate population groups or areas of publication but limiting a search by geographic area is usually only possible by the combination of *Subject heading*s and *free-text* searches described earlier.

Figure 22 shows Ovid limits available for Medline, and just to illustrate what happens, we have selected various *Review* publication types.

The search results are now reduced to seven—really too few for a search aiming to be sensitive but, for a quick search intended to retrieve a sample of what is available, limiting like this is a useful tool.

*Search filters*

A *search filter* is a series of search commands designed to retrieve a particular type of result. Filters might be created to

locate a particular type of study (e.g. controlled trials) or query specific (participants, educational aspects, outcomes) studies (e.g. undergraduate students, OSCEs, or competences). Many filters exist on the web, though these are primarily of use to pure medical searches. Once you have created your own successful strategies, you might want to save them and rerun them when you need to filter future searches.

**Search Examples**

Though these examples are based on Medline searches done via Ovid, the exact syntax displayed has often been simplified. Each example shows:

- the search query;
- the search strategy;
- a text description of each line of the strategy.



**Figure 22.** Limits.

| 19 | 15 or 16 or 17 or 18 | 28220 | Display |
|---|---|---|---|
| 20 | 6 and 14 and 19 | 138 | Display |
| 21 | limit 20 to (review or review, academic or review, multicase or review, tutorial or review literature) | 7 | Display |

**Figure 23.** Limit results.

*The examples have been constructed to illustrate aspects discussed in the guide—refinements and alternative approaches are obviously possible.*

**Search Example 1:** Find citations about the OSCE.

1  osce [*free-text*]
2  objective structured clinical exam$ [*free-text*]
3  1 or 2

(1)  OSCE is not a *MESH*. When it fails to map to Medline's *subject heading*s, a *free-text* search must be conducted.
(2)  When searching an acronym, the full term should also be searched. A search for one or the other alone will almost certainly miss citations. The term examination is truncated to exam$ to find all possible alternative suffixes (exam, exams, examination, examinations, etc.)
(3)  The Boolean **OR** combines the sets, and retrieves any results found in both.

• Note: Ovid assumes a *free-text* search is a phrase search. Use Boolean logic if it is not.

**Search Example 2:** Locate records that *focus* on teaching hospitals that were written between 2001 and 2002.

1  *Hospitals, Teaching/
2  limit 1 to yr = 2001–2002

(1)  There is a *MeSH* for teaching hospitals. Because an emphasis on the term is desired (rather than any mention of teaching hospitals) the *focus* (*) is used. The *Focus* box should be ticked when the *subject heading* is selected.
(2)  Time limits can be easily specified.

• Note: *Focus* is up to the discretion of the individual *indexing* each record—which unfortunately means it is not always objective or consistent:

  –Use *Focus* to reduce large sets to smaller, more specific ones.
  –Do not use *Focus* when you need every possible record.

• Note: Some *database*s allow two types of time limit: date of publication (as above) and date of entry (i.e. the year the citation was indexed in the *database*).

**Search Example 3:** Find citations that have been indexed as being about both medical education and role play.

1  exp education, medical/
2  Role Playing/
3  1 and 2

(1)  This is the *MeSH* for medical education. It is *exploded* (exp) as there are many relevant subordinate terms that should be included.
(2)  There is a *MeSH* for role play; *exploding* is not required as there are no subordinate *MeSH*.
(3)  The Boolean **and** combines the two sets.

• Note: An added *free-text* search for role play will potentially yield more results, but will almost certainly include more irrelevant results.

**Search Example 4:** Find citations regarding curriculum and palliative care. The results should have an emphasis on curriculum while discussing any aspect of palliative care.

1  *curriculum/
2  Palliative Care/
3  1 and 2

(1)  Curriculum is a *MeSH*. Because an emphasis on curriculum is required the term is *focused* (*). It is also *exploded* (exp) to broaden the possible number of results. An examination of the *explode*d terms subordinate to curriculum shows they are relevant.
(2)  Palliative care is also *MeSH*. There are no subordinate terms to palliative care, so *exploding* is not necessary. Because any article that mentions palliative care is wanted it is not necessary to *focus*.
(3)  The Boolean **and** combines the two sets.

**Search Example 5:** What citations exist on the use of the *Internet* and distance education?

1  Education, Distance/
2  distance adj2 (learn$ or teach$ or educat$) [*free-text*]
3  1 or 2
4  *Internet*/
5  3 and 4

(1)  Distance education is a *MeSH*, but as the term has no subordinates no exploding is unnecessary.

  –This *free-text* search finds results that *indexing* has missed.
  –It will frequently become apparent that the *controlled vocabulary* is missing terms (low search *sensitivity*). If you suspect this, add a *free-text* search.
  –The parentheses (nesting) around the three *truncated* terms ensure that these are found first (i.e. any possible ending of the words *learn*, *teach* or *educate*) and the Boolean **or** ensures that any record that contains any one of them is included.

(2) The nested search results are then found anywhere within two (adj2) words of distance.
(3) It is also possible to have searched the truncated/nested terms separately before combining.
(4) The Boolean **OR** combines the first *search set*s.
(5) *Internet* also is a *MeSH* without subordinate terms.
(6) Both concepts are combined.

- Note: A simple exclusion strategy can be used to determine whether a *free-text* search is needed to supplement a *controlled vocabulary* search. In the example above, searching 2 not 1 would create a set that contains everything that the *free-text* search retrieves that the *MeSH* search does not. By looking at the results one can gauge whether to include (or refine) the *free-text*.

**Search Example 6:** Locate citations that discuss trends in telemedicine.

1  exp *TELEMEDICINE/td [Trends]
2  exp *TELEMEDICINE/
3  exp Forecasting/
4  2 and 3
5  future.ti.
6  2 and 5
7  1 or 4 or 5

(1) Telemedicine is a *MeSH*.
(2) Exploding the term broadens the search to reach subordinate terms, while it should be *focus*ed to ensure that telemedicine is discussed in enough detail to be relevant.
(3) While most *subheading*s in Medline are not relevant to medical education, in this instance the *subheading* '*trends*' is relevant.
(4) However, if the search is to be more comprehensive alternative steps should be taken:
(5) The telemedicine *MeSH* without the *subheading*.
(6) *Trends* is not a *MeSH*, but the *MeSH Forecasting* is a good synonym.
(7) The Boolean AND combines 2 and 3.
(8) Another option is to look for the word 'future' in the title *field*.
(9) The title search is combined with the *explode*d and *focus*ed telemedicine search.
(10) All three strings are combined with OR.

- Note: Exclusion strategies (e.g. 4 not 1, 7 not 1, 4 not 7, etc.) would reveal that there are relevant citations to the topic in each

**Search Example 7:** Any citations in Medline that mention the GPAS (General Practice Assessment Survey).

1  General Practice Assessment Survey [*free-text*]
2  gpas
3  grade point average$
4  gastroprotective agent$
5  genetically prone to audiogenic seizure$
6  3 or 4 or 5
7  6, 7, 8
5  1 or 7

(1) *Free-text* search for the full wording. There is no *MeSH*.
(2) Because the subject is frequently referred to by its acronym, this must be searched as well.
(3) Unlike the OSCE search (above) the GPAS acronym search retrieves many false *hit*s. By scanning the results of this line other uses of the GPAS acronym can be found. Grade point average(s) is one.
(4) Gastroprotective agent(s) is another.
(5) All three (lines 3–5) require *truncation* ($) to pick up possible plural forms.
(6) The false *hit*s are combined with the Boolean OR.
(7) The false *hit*s are eliminated from the GPAS total.
(8) The improved results from the acronym search are combined with the *free-text* phrase search.

**Search Example 8:** A *free-text* search for multiple-choice questions within medical education.

1  (mcq or mcqs)
2  (multiple adj choice adj (test$ or question$ or exam$))
3  exp education, medical/
4  (1 or 2) and 3

(1) Finds the singular and plural for the acronym.
(2) A complex line:

 –The double parentheses are searched first; in this case the truncated version of question and its synonyms are searched
 –The software then searches left to right (multiple beside choice beside question/synonyms)
 –It uses the adjacency (adj) command to indicate the words must be beside one another (rather than adj3, which would allow them to be three words apart)

(3) Retrieves *explode*d medical education citations.
(4) (1 or 2) and 3.

**Search Example 9:** Create a broad strategy to locate any possibly relevant educational citations within Medline.

1  exp Education/
2  exp Learning/
3  ed.fs.
4  1 or 2 or 3

(1) It is critical to *explode* education because there are so many smaller terms beneath it and tens of thousands of citations would be missed without the explosion.
(2) Learning is not subordinate to Education and needs to be searched (and *explode*d) separately.
(3) There is also a floating *subheading* for education, and this command will find all citations that have been affixed with that *subheading*.
(4) The lines are combined. Many (tens or hundreds of thousands) educationally relevant citations have only one of these headings/*subheading*s. See how many yourself by running exclusion strategies, e.g. 2 not 1, 1 not (2 or 3).

- Note: This search could be considered a *search filter*. It could be run and then combined with a subject search.

**Search Example 10:** A comprehensive search for problem based learning within dental education.

1   Problem-Based Learning/
2   experiential
3   active
4   case based
5   problem based
6   pbl
7   exp EDUCATION/
8   exp LEARNING/
9   ed.fs.
10  6 or 7 or 8
11  10 and (2 or 3 or 4 or 5 or 6)
12  1 or 11
13  exp Dentists/
14  dentist$ or dental
15  13 or 14
16  12 and 15

(1)  Problem based learning is a *MeSH*, but does not need to be *explode*d (no subordinate terms) or *focus*ed (wanting anything on the concept).
(2)  *Indexing* for the *MeSH* is not comprehensive and *free-text* must supplement the first search command. Users can decide on their own synonyms and/or see the Used For terms from the *Scope* notes.
(3)  A second synonym.
(4)  A third.
(5)  Problem based learning does an automatic phrase search for the *free-text*.
(6)  Finally, pbl is a frequently used acronym that appears in citations that are exclusive of the options above. Unfortunately PBL can also mean 'peripheral blood lymphocytes', amongst other things, and this line needs to be qualified to ensure the context is educational.
(7)  Exp EDUCATION/ or education uses the *explode*d *MeSH*.
(8)  Learning or exp LEARNING/ uses the *explode*d *MeSH* and the *free-text* in addition.
(9)  Searching ed.fs. finds all citations with the floating education *subheading*.
(10) Combines all broad descriptors for education/learning.
(11) The education/learning descriptors are combined with the ambiguous pbl and the synonyms.
(12) Combining these lines identifies all relevant problem-based learning citations.
(13) The *explode*d *MeSH* for dentists (dental education is covered by the explosion in line 8).
(14) A *free-text* search for dental as well as dentist, dentistry, etc. in case no *subject heading* has been assigned.
(15) The dental components are combined with OR.
(16) The final two sets are combined with AND.

**Search Example 11:** Any use of portfolios for assessment in an educational environment.

1   portfolio$ [*free-text*]
2   exp education/
3   exp learning/
4   1 and (2 or 3)
5   exp Educational Measurement/
6   assess$ [*free-text*]
7   evaluat$ [*free-text*]
8   apprais$ [*free-text*]
9   5 or 6 or 7 or 8
10  4 and 9

(1)  Portfolio is not a *MeSH* and must be searched as *free-text*. The *truncation* identifies both singular and plural for the noun.
(2)  As any education environment is desired, the *MeSH education* should be *exploded*.
(3)  *Learning* is a *MeSH* that is not subordinate to *education* and is relevant to the search. (\*Note: Depending on the search query, learning should be considered as an addition to education *MeSH* as it can improve *sensitivity* significantly.)
(4)  The nesting ensures either of the *MeSH* is searched first; the results are then combined with the *free-text* search.
(5)  Searching for assessment in Medline is problematic. There is a *MeSH* that covers the concept (*Education Measurement*), but unless the user knows this already the term he/she enters is unlikely to map to the correct *MeSH*. Furthermore, *indexers do not always use Education Measurement* and in order to be comprehensive a *free-text* search must complement the *controlled vocabulary*.
(6)  Assess$ picks up all the variations of assessment e.g. assessor, assessed, assessing etc.
(7)  The various permutations of evaluation must also be searched. The definition of assessment can differ between authors, abstracters, indexers, and geographical areas and synonyms for assessment must be searched.
(8)  Appraisal and its derivatives should also be searched. Adding the *free-text* steps 6, 7 and 8 will decrease overall search *specificity*, but it is necessary to improve the inadequate search *sensitivity* from educational measurement.
(9)  The Boolean OR combines the *MeSH* with all *free-text*.
(10) The assessment concepts are added to the statements that identified portfolios within education or learning.

## Managing information

Bibliographic management software is a valuable tool for anyone regularly reviewing the literature or collecting references and information sources in specialist subject areas. Essentially, bibliographic management software is personal *database* software purpose built for organizing bibliographic references to information resources, whether the resources are journal articles, book chapters, websites, or in other formats.

These are personal *database*s that allow (with variation between products):

• easy searching, sorting and extracting of relevant references;
• importing of records from *database*s like Medline;
• removal of duplicate references (very useful for compiling search results from multiple *database*s, e.g. Medline and ERIC);

- insertion of references during writing, without re-keying or copying and pasting citations;
- automatic formatting of citations in styles required by publishers.

Some of the most well-known commercially available products are EndNote (http://www.endnote.com/), ProCite (http://www.procite.com/) and Reference Manager (http://www.refman.com/) (all of which are now owned by the Institute for Scientific Information). Shapland (1999) has produced a comparison of Papyrus (http://www.researchsoftwaredesign.com/) with these and other products, which is helpful in assisting prospective users to choose a suitable package.

Recent releases or add-ons of some bibliographic management products allow users to make their personal *database*s available to others via the web in a searchable format (the Association for Health Information and Libraries in Africa and WHO have used this facility to provide access to the African Index Medicus (http://whqwings.who.int/RIS/RISWEB.isa/).

Most bibliographic software is client based—that is, installed on a computer (or local network drive), but there is a trend toward remote server-based software that is accessible via the *World Wide Web*. This is of benefit to those who move regularly between computers and have reliable and inexpensive access to the *Internet*. Two products in this format are RefWorks (http://www.refworks.com/) and WriteNote (http://www.writenote.com/). Functionality of these server-based products is limited compared with client-based software, but this is an area worth watching.

## A BEME Approach to Searching

> The real voyage of discovery consists, not in seeking new landscapes, but in having new eyes. (Marcel Proust, 1871–1922)

Too many people search in the patterns and methods they are used to, consulting the same sources in the same way they have always done. For BEME a search needs to be flexible. BEME's *inclusive* approach to research and practice is also reflected in its evidence searching methods. Any systematic search requires a number of sources to be consulted, but this guide has illustrated how important it is for medical education to consult a wide variety of sources. These sources not only span education and medicine/health but also cross professional boundaries within education and health. Search strategies must be broad and *inclusive*, and potential evidence not dismissed either because of its source (be it peer-reviewed or *grey literature*) or the methods by which it was found (*database*, web search or word-of-mouth).

A notable difference between BEME's search methods and that of systematic medical searches is illustrated by the use of *search filter*s. These pre-constructed searches are frequently employed in medical searches to help answer clinical problems. Originally these filters were based on work done at McMaster University (Haynes, 1994), and they have been widely implemented and adapted. Depending on the type of clinical question (aetiology, diagnosis, prognosis and therapy) a filter is selected to retrieve the type of study design deemed to be most suitable for these clinical questions. With medicine's emphasis on methodologies, there are also filters to extract particular study designs.

However, from its onset, the BEME Collaboration has favoured an *inclusive* approach with regard to study design, and consequentially has not required searches to isolate particular methodologies. Not only is medical education research broadly dispersed across all types of study design, quantitative and qualitative, but the ongoing work by such groups as the BEME Collaboration indicates that *inclusive*ness may serve medical education better than exclusion. In fact, given that medical education research design is not as rigidly defined and implemented as in medicine, it might not even be presently possible to design comparable filters—even if it were desirable.

## A look ahead

A consistent theme throughout this guide has been the difficulties presented by lack of standardization—of information sources, publication formats and search methods.

Relief, however, may not be too far off in the future. International standards for *metadata* are currently being established by groups such as IMS (www.imsglobal.org/) and Dublin Core Metadata Initiative (http://www.dublincore.org/). As standards become available and are adopted, many of the current time-consuming and frustrating experiences faced will be alleviated whether searching *database*s or the *Internet*.

The technical *metadata* initiatives mentioned above would set the frameworks for interoperability, but medical education still requires interpretive (descriptive) metadata. These interpretive metadata would define the concepts and processes unique to medical education, as well as the concepts and processes shared with other professions. The Medical Education *Thesaurus* Research Organisation (METRO) (http://srv1.mvm.ed.ac.uk/metro/index.asp) has already set out to do this. Sponsored by LTSN-01 (www.ltsn-01.ac.uk/) and NHS Education for Scotland (www.nes.scot.nhs.uk), the group aims to have identified, created and/or mapped relational descriptors for medical education within Britain, with the ambition to then extend and apply the work through international collaboration.

While comprehensive searching for medical education presents difficulties that are tangible (though it is hoped that this guide prevents them from seeming insurmountable!), the progress towards standardization offers great promise. Standardization will not mean assimilation. Instead it will allow the exchange of the rich and diverse ideas and experiences between medical education's dispersed professionals and practitioners.

> Opinion is that exercise of the human will which helps us to make a decision without information. (John Erskine)

Yet retrieving the information is just one step in evidence-based practice; information retrieval is followed by appraisal and synthesis. At time of press, the first Topic Review Groups of the BEME Collaboration are completing their systematic reviews, which will begin to be published in the latter half of 2003. As their work is reviewed and shared, it is hoped one can look forward to future BEME guides that further enable medical educators to base their practice on best evidence.

## Notes on contributors

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## Glossary

| | |
|---|---|
| Ancestry searching | The process of searching the bibliographies of relevant papers to discover references missed by other methods. |
| Bibliographic database | A database containing bibliographic information about publications, such as title, author and so on, but not usually the full text of publications. |
| Blogs | 'Web logs'. Individuals' chronological personal writings and collected links. |
| Boolean algebra | AND, OR and NOT are combining commands that you can use to combine search terms and therefore refine your results. Boolean algebra is also known as 'Boolean logic' and the commands as 'logical operators'. |
| Broader | In the context of Subject headings, means a Subject heading that is more general in scope or at a higher level in the hierarchy of the Controlled thesaurus. |
| Concepts, search | The subject(s) of a search. Search concepts can be ideas, theories, outcomes, interventions or populations. |
| Controlled thesaurus [or index or vocabulary] | A controlled thesaurus is a list of standard subject terms from which indexers select subject headings to describe the content of articles or other publications in a consistent manner. |
| Database | A structured electronic information file, maintained to facilitate the retrieval of information. |

| | |
|---|---|
| Database fields | A logical defined unit of data, e.g. author, subject heading, year. |
| Exhaustivity | The level of subject detail to which publications are described by indexers—ideally, a Controlled thesaurus should be comprehensive. |
| Explode | Exploding a subject heading retrieves all its smaller subordinate terms. In general, it is always a good idea to Explode to ensure a search is comprehensive. |
| Focus | When you search a subject heading with Focus, that subject heading will be an essential concept to all results retrieved. This reduces the number of results and may result in missed items, but increases the relevance. |
| Free-text search | A search that will look for a term or phrase in all specified or available fields, regardless of contextual meaning. |
| Granularity | The degree of description or detail; related to the scope of terms, particularly with regard to the level of detail indicated by Subject headings, where high granularity is equivalent to a very narrow subject heading and low granularity is equivalent to a broad subject heading. |
| Grey literature | That which is produced on all levels of government, academics, business and industry in print and electronic formats, but which is not controlled by commercial publishers (4th International Conference on Grey literature, 1997). |
| Hand searching | Hand searching is literally the searching of print (or electronic) journals volume by volume, issue by issue, article by article. |
| Hit | A search result—referring to the records matching your search term. |
| Html | Hypertext mark-up language—most web pages are written with this. |
| Hyperlink | A link that takes your web browser to another location. |
| Inclusive | Encompassing all the concepts described. Synonymous with sensitive. |
| Indexing | The process of classifying an item (for example an article) with subject descriptors to make it easier to retrieve. |
| Internet | The worldwide network of computer networks. |
| MeSH | Medical Subject heading—the terms in the Controlled thesaurus created by the National Library of Medicine and used by indexers to describe the content of articles indexed in Index Medicus (and therefore PubMed and Medline). |
| Metadata | Descriptive information, such as bibliographic details, but also subject headings, publication type, language, etc. A bibliographic database like Medline is full of metadata, but not usually the full-text articles (that is, the actual data). |
| Methodology filter | A 'ready-made' search of terms that will retrieve specific types of reports, e.g. cohort studies, controlled trials, diagnostic use, etc. Filters are not usually subject specific—they are meant to be applicable to any subject search. |
| Narrower | In the context of Subject headings, means a Subject heading that is more specific in scope or at a subordinate level in the hierarchy of the Controlled thesaurus. |
| Polysemy | Polysemy occurs when a search term has multiple meanings, e.g. simulation, which could be about computer simulations, heuristics, the Markov Processes, role-playing, or patient simulators. Polysemy is one cause of irrelevant results from free-text searches. |
| Precision | In database searching, means the proportion of hits that are relevant. A search with high precision has few irrelevant results, and is also described as having high 'specificity'. A danger with highly precise search techniques is that some relevant information will be missed because it was not well described by the author or indexer. |
| Proximity operator | Proximity (or adjacency) operators are used when one wants to find two or more terms within a certain distance of one another and can usually only be employed in free-text searching. The operator varies between search interfaces, e.g. 'adjx' (Ovid), 'nearx' (Silverplatter), where 'x' refers to the number of words apart the search terms may appear; or 'same' (Web of Science), which requires the words to be in the same sentence. |
| Qualitative research | Research involving detailed verbal descriptions of characteristics, cases and settings. Qualitative research typically uses observation, interviewing and document review to collect data. |
| Quantitative research | Research that examines phenomena through the numerical representation of observations and statistical analysis. |
| Recall | In database searching, the proportion of relevant hits retrieved by in a search—a search with high recall is called 'sensitive'. |
| Scope | The extent or range of a subject. |
| Search engine | An enormous database of Internet sites, usually compiled by robots. |
| Search filter | A search filter is a series of search commands designed to retrieve a particular type of result. Filters might be created to locate a particular type of study (e.g. controlled trials) or query specific (participants, educational aspects, outcomes) studies (e.g. undergraduate students, OSCEs, or competences). |
| Search interface | The 'front end' to a database—what you see when you are searching. This phrase can also imply the tools and facilities presented by the programming behind the interface. |

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| Search set | A single search statement—for example, in a search history like the one built up in the sample Medline search in this guide, each line in the search history is a 'set'. Building up a history of search sets as in the sample is called 'set searching'. |
| Search strategy | Sometimes used interchangeably with 'search history' but can also refer to a larger systematic strategy for retrieving information that also includes handsearching journals and discovering unpublished research. |
| Selectivity | The choice of Subject headings made by the indexer to anticipate the concepts of greatest utility to the database user; also the degree to which a search is specified or narrowed. |
| Sensitivity | When referring to a literature search, means inclusive, so that you get more hits, and may get some irrelevant ones. Synonymous with high 'recall' in that a sensitive search aims to retrieve the highest proportion possible of relevant database records. |
| Specificity | When referring to a literature search, means exclusive, so that you get fewer hits to sift through, but may miss some relevant information. Synonymous with 'precision'. |
| Subheading | In the context of Subject headings, represents a popular facet of study related to a Subject heading |
| Subject heading | A term used to describe the content of a publication—usually derived from a Controlled thesaurus. |
| Synonymy | Where concepts can be named using different terms—this a problem with free-text searching, which requires you to think of as many terms as possible to capture the various words or phrases that authors could use in writing-about the same concept. In theory, Subject headings should mitigate this issue. |
| Thesaurus | See Controlled thesaurus. |
| Truncation | Truncation (or wildcard searching) is the substitution of a character to retrieve variations in spelling and word ending. It cannot be used with the set terms of a controlled vocabulary, but is a powerful aid in improving the sensitivity of free-text searches. The truncation symbol varies from one search interface to another (see help or search tips to find out). Ovid uses the $: <br><br>portfolio$—finds the singular and plural (portfolio or portfolios) <br><br>evaluat$—finds multiple variations, evaluate, evaluation, evaluations, evaluative, evaluator, etc. <br><br>Internal truncation is also possible. With Ovid, the # can be used to find spelling variations between versions of English: an#esthesia or 'standardi#ed patient$'. |
| URL | Uniform Resource Locator—a website's address: www.bmj.com. |
| Usenet | Archived electronic discussion lists on nearly any topic imaginable; first appeared on the Internet in 1981. |
| Web browser | A software application that lets you view web documents written in html—like Netscape or Internet Explorer. |
| World wide web | One part of the Internet—other parts include email and discussion groups. |