Medical Teacher, Vol. 27, No. 8, 2005, pp. 699–703

The elusive content of the medical-school curriculum: a method to the madness

MARCEL D'EON & ROBERT CRAWFORD
College of Medicine, University of Saskatchewan, Canada

SUMMARY *A major problem for curriculum and course planners is coping simultaneously with the expanding knowledge base and having less time to teach. A widely used solution is to include huge amounts of information in the curriculum. A better solution is to identify a manageable core of relevant knowledge. One way is to begin with program goals and systematically identify content with increasing specificity that would be needed to achieve those goals. Another is the empirical determination of content, which has not been widely attempted. These studies would include experiments and practice analyses. There is a need to mount greater and more rigorous efforts to help advance the scholarship and to provide useful information to curriculum planners. Large-scale, multi-site studies that compare the results from various methods and from different sources will be more useful to medical education generally. In these days of exploding information and technology and greater understanding of how people learn, more than ever, efforts need to be focused on finding the very specific content that will result in the best learning for our students.*

Introduction

Over the past few decades, as in so many other areas in science, there has been an explosion of knowledge in medicine. Accompanying this flood of new information has been a very difficult decision for those setting the curriculum for medical schools: what content must be added to the curriculum, and what must be taken out? The trend to schedule fewer hours of classroom instruction and more for independent and self-directed learning, not to mention new topics as in the medical humanities, has also squeezed out some of the time previously devoted to the presentation and mastery of medical content. A major problem with determining the content of programs therefore seems to be coping simultaneously with the expanding knowledge base and having less time to teach (Bandaranayake, 2000). Compounding this dilemma is the phenomenon that it is easier to add content to the curriculum than it is to remove it (Jamshidi & Cook, 2003). We wrote this paper to help educators manage content decisions and to suggest a research agenda in this area.

One widely used solution is to include huge amounts of information in the curriculum in order not to miss anything important (Jamshidi & Cook, 2003). Unfortunately this only seems to "tax the memory, not the intellect" (Flexner, 1910) and encourages students to cram for exams (Entwhistle, 1992). Cramming the material may allow for adequate performance on exams but also contributes to significant memory loss over the long term (Sissons *et al.*, 1992). We have found that there is considerable evidence to suggest that information overload is detrimental to learning (Russell *et al.*, 1984; Krebs *et al.*, 1994) and that only important and common core content should be considered for the curriculum (Harden & Davis, 1995; Jones *et al.*, 1997). A better solution is therefore to identify a manageable core of relevant knowledge and skills to be mastered in the available time (Bandaranayake, 1985).

However the broad goals and objectives of medical education are determined and there is strong and relentless pressure especially from experts and specialists who over-estimate both the importance of some details and the ability of learners to master the content (Bransford *et al.*, 2000; Koens *et al.*, 2004).

Empirical studies are needed to help determine the necessary specifics and amount of detail for courses. These studies would act as a check on goals and objectives by asking about the real world of work into which our students are headed and the relevance of the content. An exploration of empirical methods for determining content is the focus of this paper.

Relevance

We believe that the first task to undertake when identifying relevant content, either theoretically or empirically, is to determine what 'relevant' means. There are several ways to view relevancy (Haylock & D'Eon, 1999) though the relative lack of publications on this topic might suggest that medical educators have assumed there is a commonly held understanding. The Funk and Wagnall's *Canadian College Dictionary* (1989) defines relevant as: "fitting or suiting given requirements; pertinent; applicable" and states the following about pertinent: "related to or properly bearing upon the matter at hand". Content is therefore relevant or pertinent to something and it is this something that is often assumed and misunderstood. Depending on what those requirements or matters at hand happen to be, we have different types of relevance. The same element of content could be relevant and irrelevant at the same time depending on the objects to which it is being related.

Some content might be considered relevant but the material is only closely related to a task and/or role for someone else, often the instructor. We call this 'vicarious relevance' and it is encountered frequently where the inclusion of skills or information is determined largely by the level of interest of the instructor (Sanson-Fisher & Rolfe,

Correspondence: Marcel D'Eon, MEd PhD, Associate Professor, Community Health and Epidemiology, College of Medicine, University of Saskatchewan, Room A204 Health Sciences Building, 107 Wiggins Road, Saskatoon, SK S7N 5E5, Canada. Tel: (306) 966-2756; fax: (306) 966-2601; email: marcel.deon@usask.ca

ISSN 0142–159X print/ISSN 1466–187X online/05/080699-5 © 2005 Taylor & Francis
DOI: 10.1080/01421590500237598

2000; Harden, 1986) rather than the needs of the learners or some other criteria. Certain knowledge and skills might possess 'exam relevance' because the material may appear in an exam. Exam relevance is a common reason given for students to learn the material. The warning, "It will be in the exam", is particularly convincing if the examination is from a licensing body such as the National Board of Medical Examiners in the United States or the Medical Council of Canada. If there is alignment between the examination and other goals then the content also possesses other types of relevance (Bloomfield *et al*., 2003).

Some content may have powerful 'personal relevance' where the material is pertinent to the personal circumstances and life experiences of the learner. For example, a lecture about angina and acute myocardial infarction (MI) may be particularly relevant to a student whose uncle or mother has been coping with these conditions. Or a dissection lab on the knee in the first term of first year might have personal relevance for a student who is determined to become an orthopedic surgeon. Content may be deemed to be relevant if it is related to future courses and academic tasks so the knowledge gained will help one learn and succeed in those courses. This 'academic relevance' is related to integration: the condition where one course leads to other(s) and helps with further learning.

Content may also possess 'future relevance' if it is linked to some far-off perhaps hypothetical future task or role. Future relevance is often reflected in the admonition or assumption that students may at some point in their medical career need to know a particular skill or piece of information however rare and esoteric. Often only a very small minority of the students ever enter a residency or practice where such knowledge is helpful (i.e. full anatomical knowledge of the knee through dissection). This type of relevance is to be distinguished from 'authentic relevance'.

Sometimes content is related to important and meaningful roles and tasks in the near future. We call this 'authentic relevance' and it is based on the immediate and real needs of learners to succeed either in the real world of work or in the next course (academic relevance). Houle (1961) discovered that this type of relevance motivates the goal-oriented learner. We see examples of authentic relevance when teaching and learning sessions are based specifically on what students need to know for either further training or imminent patient encounters or both. Chastonay *et al*. (1996) writes that medical curricula "ought to take into account the future professional role of the doctor to be" (p. 235). We therefore propose that for detailed content decisions curriculum planners and instructors aim for authentic relevance and academic relevance (hoping that the more advanced courses themselves possess authentic relevance).

Sources of data

Having decided that academic and authentic relevance are the most appropriate we can therefore determine content empirically by collecting data. We might consider designing experiments that evaluate which content gives better results at four different and successive levels: course satisfaction, learning, clinical performance and patient outcomes (Kirkpatrick, 1967). Sanson-Fisher & Rolfe (2000) have suggested that in this area rigorous experiments are impractical due to powerful confounding variables (such as the educational processes) and logistical and ethical issues. They recommend, perhaps reluctantly, that opinions from a variety of sources be sought to determine relevant content. Our review of the literature found only a handful of studies that could be considered experiments but none of them were randomized. We did find examples of direct and indirect practice analysis, methods we believe more powerful than the solicitation of (expert) opinions.

The practice analysis asks people in the field directly about their current medical practice to derive a picture of it. Then others (content and education specialists) reflect on those needs and make suggestions for content to be studied and practiced by medical students. The direct practice analysis tries to create a snapshot of current (and even future) medical practice to be used in determining the knowledge and skills needed by the clinicians in those settings and circumstances. Indirect practice analysis asks people to make a judgment about which skills and knowledge are relevant to their practice thus eliminating the middle step of having experts deliberate. Indirect practice analysis is to be distinguished from the solicitation of expert opinion where there is no clear or tight connection to particular practice settings. Expert opinion might be based on their own experience, their interests or other personal biases.

In this next section we comment on various sources of data derived from experiments, practice analyses and opinion. We have included students, residents, practitioners, the healthcare team and the general public.

Students

Who can reasonably contribute to the question of relevant content for medical education? All medical students have a substantial vested interest in this issue and they are a readily available source. They are the people who are paying tuition. They are also the ones who will have to learn material that may be of little practical value to them when they advance to the next year of study or when they are physicians. They are also the people who might miss out on some important skill or piece of knowledge integral to the management of a particular patient or patient group. Students, unfortunately, are not in a strong position to deliver a prospective opinion on whether or not the material presented to them is relevant authentically or academically (Sanson-Fisher & Rolfe, 2000).

Nevertheless, students can contribute to the data on relevance through practice analysis. Researchers can explore what beginning residents and clinical clerks do on the wards and outpatient clinics following their largely academic preparation. This practical clinical education can be analyzed to give direction for content decisions on basic and clinical courses (see Hunskaar & Seim, 1985; Bax & Godfrey, 1999) thus creating both authentic and academic relevance. Furthermore, higher level preclinical courses can be analyzed to help determine the content of lower level courses. For example, researchers could ask students taking a clinically oriented course on the pathophysiology of the respiratory system about what basic science knowledge in anatomy, physiology and biochemistry they needed to understand the concepts and principles presented and which knowledge was not helpful (either confusing or unnecessary). We did not find examples of practice analysis studies with students that involved preclinical courses. This type of practice analysis would offer data on the vertical integration of courses, and how earlier courses prepare or do not prepare students for later courses—an excellent way to build a rational curriculum (Bandaranayake, 2000).

We report here on two cohort experimental studies that measured knowledge loss in students over time. Blunt & Blizard (1975) asked students to recall anatomical knowledge 12 and 21 months after the end of the course as part of a planned study of the effectiveness of a new teaching and learning program in anatomy. There was, as expected, a deterioration of recall. Krebs *et al.* (1994) found that medical students only retained about 65% of simple basic science knowledge forgetting most of it only months after the course ended. The findings of these types of studies allow educators to consider the implications of reinforcement and use of clinically relevant content though conclusions are plagued by confounding variables (Sanson-Fisher & Rolfe, 2000).

Residents

Residents are also a readily available group with the advantage of being close to the students in experience and knowledge with enough grasp of medicine to be able to offer reasonable judgments about what should and should not be taught in undergraduate training. They may still remember the difficulty and frustration in learning material that has been of little use to them or in lacking adequate preparation. Richardson (1983) and Woodward & Ferrier (1983) asked former students to provide an opinion on how well they were prepared for the practice of medicine. These two studies provide only limited guidance to other institutions. Harris *et al.* (2003) conducted a clever study with first- and second-year family medicine residents. The residents wrote multiple-choice examinations from the preclinical undergraduate program and were asked to provide their opinion on each question in the exam with regard to its importance to the practice of medicine (an indirect practice analysis). To quantify clinical relevance of the content in the questions the grade per question that had been attained by the residents was divided by the grade per question of the undergraduates. If residents did better on a question than the undergraduates then the ratio would be over 1.0 and if they did worse than the undergraduates the ratio would be below 1.0. For some questions the ratio approached zero and suggested that these questions identified content of very low authentic relevance. Conversely, the questions with higher ratios suggested the areas with higher relevance. The results may be of use to other programs but the method of comparing resident and student scores is the most useful feature of this study, which could also be used with clinical faculty and practitioners.

Faculty

Clinical and basic science teachers also have opinions about content and they are the people who usually make the decisions on what is and what is not to be taught and tested. This group certainly has the expertise to assess sophisticated medical and scientific knowledge. The problem with faculty and experts in general, as has already been stated, is that they underestimate the difficulty of learning principles, concepts, and skills with which they are familiar (Bransford *et al.*, 2000) and they overestimate the importance of their own areas of expertise and what students should be able to learn (Koens *et al.*, forthcoming).

Sukkar (1984) conducted a type of direct practice analysis asking physiology teachers to create lists of clinical problems that would require knowledge of physiology. Clinicians then assessed the problems for their relevance. Dawson-Saunders *et al.* (1990) surveyed faculty across North America asking their opinion on the relevance of basic science and the clinical science topics. They identified nine broad topics and noted that those who taught in a given area tended to give it a higher importance rating than those who were not teaching in that area. Koens *et al.* (forthcoming) made a direct comparison between the opinions of basic science and clinical faculty on the relevance to undergraduate medical education of 80 example test items representing biomedical knowledge at four different levels: clinical, organic, cellular, and molecular. This study also confirms the finding of Dawson-Saunders *et al.* (1990) that teachers in an area rate the importance of that knowledge more highly than those who are not.

Practitioners

General practitioners could also be asked for their informed opinions about content suitable for medical student training. They would also make excellent subjects for a practice analysis. The scope of practice of these clinicians is the closest we have to the broad skill sets of the theoretical undifferentiated and multi-potential physician that we want our graduating doctors to be. They have the distinct advantage of being in a general practice and not tied to a particular specialty or field. They may, however, be subject (though to a lesser extent) to the same limitations as both faculty experts and lay people when giving an opinion: they may overestimate what students can learn in a period of time and they may not know the full compliment of medical knowledge available to the medical school faculty.

Morin *et al.* (2002) conducted a direct practice analysis in veterinary medicine. They asked over 2000 American veterinarians to indicate the frequency with which they performed each of 148 specific procedures. They also asked the practicing veterinarians to indicate the proficiency they would expect of graduates (an indirect practice analysis) as well as suitable topics for inclusion in the curriculum (expert opinion). This is the only example of a direct practice analysis that we found in the literature.

Two studies undertook indirect practice analyses by asking physicians to rate the relevance of content to practice. They did not directly ask what those practitioners did. Pabst & Rothkötter (1997) surveyed 109 German physicians who were on average seven years postgraduate. Burnstein *et al.* (1997) polled physicians on the relevance of the content of the fellowship examination for anesthetists in Britain. Please note that the topics evaluated in both of these studies were not specific details.

The healthcare team

Finally, the healthcare team can make some observations about the content knowledge that physicians and surgeons require. They work with them on a regular basis and have valuable professional knowledge in the healthcare field. They are, however, limited in their medical knowledge and are not involved in every aspect of the physician/surgeon role. We did not find any studies focusing on content determination for medical education that involved healthcare workers in any way. We only found a recommendation to include those who have a 'legitimate interest' in medical education (Bax & Godfrey, 1997, p. 351).

The general public

The general public also has a stake in the education of medical students. As consumers of medical practice they are interested in medical education to the extent that they want the students to be competent doctors. But patients can only stipulate with any authority what they want in healthcare and not the specifics of medical knowledge that their doctors need (Donovan *et al.*, 1989). Like students, they too must rely on others who know more about medicine and medical knowledge to decide what specific content can lead to competent practice. We found no evidence in the literature that the general public was consulted on the specific details of the content for undergraduate medical education.

Discussion

The issue of relevance and the amount of content in medical curricula and courses spans many decades from Flexner to the present. This paper has reviewed and classified some of the many ways in which the task has been approached and should provide other educators and researchers who are interested in this area with a variety of methods from which to choose. The first conclusion we wish to discuss is that the empirical determination of content has not been widely or systematically attempted. There are few studies reported in the literature and many of the possible methods have been entirely or largely ignored. For example, the members of the healthcare team and students are one good source of data and could be consulted more often where appropriate. Practice analyses, especially direct practice analyses, are under utilized and sporadically attempted. It would appear that there are advantages and disadvantages with the data from each group, whether an expert opinion about what medical students should learn or a practice analysis. It is our recommendation that a variety of sources be tapped for the purposes of comparative research. We have therefore constructed a table to reflect the various possible methods of accumulating data for content decisions: asking opinions of people with interest and expertise, the analysis of practice (both direct and indirect) and experiments. Some cells are marked 'Not Applicable' where involving these people would be inappropriate and ineffective. There is a need to gather more and different data from more sources to allow better decisions to be made (Table 1).

Our second conclusion is that it is not possible, unfortunately, to say whether one method of determining the detailed content is better than any other. It is not even possible to tell if any two or more of the different methods reported in this paper would identify the same relevant content when specifically applied to the same topic. Only three studies, Koens *et al.* (2004), Dawson-Saunders *et al.* (1990), and Sukkar (1984) used data from two sources and only Koens analyzed the comparison. Even then both sources were very similar—clinical and basic science faculty—considering the many different groups that might have been involved. If this field is to progress and if we are to find some answers to our practical and theoretical questions, then research must discover first to what extent different sources will generate different results and second which methods are 'better' (however, that is to be defined).

Large scale, multi-site studies that compare the results from various methods and from different sources would be more useful to medical education generally and to researchers working in this area. We may at least be able to determine which methods are simpler and less expensive while still yielding results that are similar to more elaborate studies. We may also get closer to answering the question of which set of content is actually better than another. In these

Table 1. A classification of methods for determining content for medical school curriculum.

Subjects	Opinion	Practice analysis	Experiments
Students	Not applicable	Hunskaar & Seim (1985) Bax & Godfrey (1997)*	Blunt & Blizard (1975) Krebs *et al.* (1994)
Residents	Richardson (1983) Woodward & Ferrier (1983) Harris *et al.* (2003)*	None found	Harris *et al.* (2003)*
General public	None found	Not applicable	Not Applicable
Faculty (Clinical or Basic Science)	Dawson-Saunders *et al.* (1990) Bax & Godfrey (1997)* Koens *et al.* (2004)	Sukkar (1984)	Not applicable
Physicians in practice	Pabst & Rothkotter (1997) Burnstein *et al.* (1997) Morin *et al.* (2002)*	Morin *et al.* (2002)*	Not applicable
Other members of the healthcare team	None found	Not applicable	Not applicable

*An asterisk indicates that this study has been classified under more than one heading.

days of exploding information and greater understanding of how people learn, efforts need to be focused on finding the very specific content that will help create the best curriculum and result in the best learning for our students.

References

Bandaranayake, R.C. (1985) How to plan a medical curriculum, *Medical Teacher*, 7, pp. 7–13.

Bandaranayake, R.C. (2000) The concept and practicability of a core curriculum in basic medical education, *Medical Teacher*, 22, pp. 560–563.

Bax, N.D.S. & Godfrey, J. (1997) Identifying core skills for the medical curriculum, *Medical Education*, 31, pp. 347–351.

Bloomfield, L., Harris, P. & Hughes, C. (2003) What do students want? The types of learning activities preferred by final year medical students, *Medical Education*, 37, pp. 110–118.

Blunt, M.J. & Blizard, P.J. (1975) Recall and retrieval of anatomical knowledge, *British Journal of Medical Education*, 9, pp. 255–263.

Bransford, J.D., Brown, A.L. & Cocking, R.R. (Eds) (2000) *How People Learn: Brain, Mind, Experience, and School* (Washington, DC, National Academy Press).

Burnstein, P., Jeevaratnan, R. & Jones, J. (1997) The need for basic sciences in the understanding and practice of anaesthesia, *Anaesthesia*, 52, pp. 935–944.

Chastonay, P., Brenner, E., Peel, S. & Guilbert, J.-J. (1996) The need for more efficacy and relevance in medical education, *Medical Education*, 30, pp. 25–238.

Dawson-Saunders, B., Feltovich, P.J., Coulson, R.L. & Steward, D.E. (1990) A survey of medical school teachers to identify basic biomedical concepts medical students should understand, *Academic Medicine*, 65, pp. 448–453.

Donovan, K., Sanson-fisher, R. & Redman, S. (1989) Measuring quality of life in cancer patients, *Journal of Clinical Oncology*, 7, pp. 959–968.

Entwhistle, N. (1992) Influences on the quality of student learning—implications for medical education, *South African Medical Journal*, 81, pp. 596–606.

Flexner, A. (1910) *Medical Education in the United States and Canada: A Report to the Carnegie Foundation for the Advancement of Teaching* (New York, Carnegie Foundation).

Funk & Wagnalls (1989) Canadian College Dictionary (Toronto, Fitzhenry and Whiteside).

Harden, R.M. (1986) Approaches to curriculum planning, *Medical Education*, 20, pp. 458–466.

Harden, R.M. & Davis, M.H. (1995) AMEE Medical Education Guide No. 5: the core curriculum with options or special study modules, *Medical Teacher*, 17, pp. 125–148.

Harris, J., Heneghan, H. & McKay, D. (2003) The rating of pre-clerkship examination questions by post-graduate medical students: an assessment of quality and relevancy to medical practice, *Medical Education*, 37, pp. 105–109.

Haylock, D. & D'Eon, M. (1999) Helping low achievers succeed at mathematics (Toronto, Trifolium Books, Inc.).

Houle, C.O. (1961) *The Inquiring Mind* (Madison, University of Wisconsin Press).

Hunskaar, S. & Seim, S. (1985) Medical students' experiences in medical emergency procedures upon qualification, *Medical Education*, 19, pp. 294–298.

Jamshidi, H.R. & Cook, D.A. (2003) Some thoughts on medical education in the twenty-first century, *Medical Teacher*, 25, pp. 229–238.

Kirkpatrick, D.L. (1967) Evaluation, *Training and Development Handbook* (New York, McGraw Hill).

Koens, F., Custers, J.F.M. & ten Cate, O.T.J. (2004) Clinical and basic science teachers' opinions about the required depth of biomedical knowledge for medical students, forthcoming.

Krebs, R., Hofer, R., Bloch, R. & Guibert, J.-J. (1994) Conversation et oubli des connaissances en biologie acquises pour le premier examen propédeutique de médecine, *MEDUCS Bulletin de l'Association Suisse d'Education Medicale*, 4, pp. 10–15.

Jones, E.D., Wilson, R. & Bhojwani, S. (1997) Mathematics instruction for secondary students with learning disabilities, *Journal of Learning Disabilities*, 30, pp. 151–163.

Morin, D.E., Constable, P.D., Troutt, H.F. & Johnson, A.L. (2002) Individual animal medicine and animal production skills expected of entry-level veterinarians in bovine practice, *Journal of the American Veterinary Medicine Association*, 221, pp. 959–968.

Pabst, R. & Rothkotter, H. (1997) Retrospective evaluation of undergraduate medical education by doctors at the end of their residency time in hospitals: consequences for the anatomical curriculum, *Anatomical Record*, 249, pp. 431–434.

Richardson, I. (1983) Consumer views on the medical curriculum: a retrospective study of Aberdeen graduates, *Medical Education*, 17, pp. 8–10.

Russell, I.J., Hendricson, W.D. & Herbert, R.J. (1984) Effects of lecturing information density on medical student achievement, *Journal of Medical Education*, 57, pp. 881–889.

Sanson-Fisher, R. & Rolfe, I. (2000) The content of undergraduate health professional courses: a topic largely ignored? *Medical Teacher*, 22, pp. 564–567.

Sissons, J.C., Swartz, F.M. & Wolf, M. (1992) Learning, retention and recall of clinical information, *Medical Education*, 26, pp. 454–461.

Sukkar, M. (1984) An approach to the question of relevance of medical physiology courses, *Medical Education*, 18, pp. 217–221.

Woodward, C. & Ferrier, B. (1983) The content of medical curriculum at McMaster University: graduates evaluation of their preparation for post-graduate training, *Medical Education*, 17, pp. 54–60.