

# Universities without walls: evolving paradigms in medical education

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**Medical education is entering a phase of renewed change driven by developments in information availability and technology. Over the past half century medical education has remained largely isolated from the changes that have swept through most other businesses: enterprise-wide computerisation, client centred thinking, and a service philosophy.**

## Summary points

A wealth of information about biomedicine and health care is available in electronic formats, and this can be synthesised into courseware for medical education and distributed electronically

For many, the study of small or larger parts of medicine could be a recreational pursuit; for others, it might be a vital venture in self understanding in order for them to manage health risks and play a greater part in decision making about their health

For much of the time, course developers, tutors, and students can readily be separated in time and space and effectively linked by electronic communications: there is no need for co-location of all resources at a single site

The need for large investments in plant and facilities is reduced: students can work flexibly when and where they choose, often from home or another country

The new paradigm promises to address many of the requirements of the future practice of medicine, especially the integration and application of basic and clinical disciplines, and the development of appropriate cultural perspective and attitudes to the practice of medicine as a caring profession

The clients of the medical education process, who, worldwide, generally pay for themselves (though in some countries they are state funded) are guaranteed little for their money, often not even a modern, efficient, or entirely relevant educational programme. Many leave medical school financially poorer and often little enriched cognitively: they are generally weighed down under a vast burden of obsolescent information, the important elements of which could be found by an intelligent member of the lay public faster and in an updated form directly from the world wide web. They are also changed culturally, not necessarily for the better. Their time spent studying in the academic ivory towers, from which most graduate, separates them from their community roots and also reinforces the divide between primary and secondary care and does little to emphasise the essential humanity and caring intrinsic to this vocation.<sup>1</sup>

The time has come to adopt the computer, the world wide web, distance learning techniques, and effective educational strategies to create an entirely new educational experience.

## Key curriculum problems

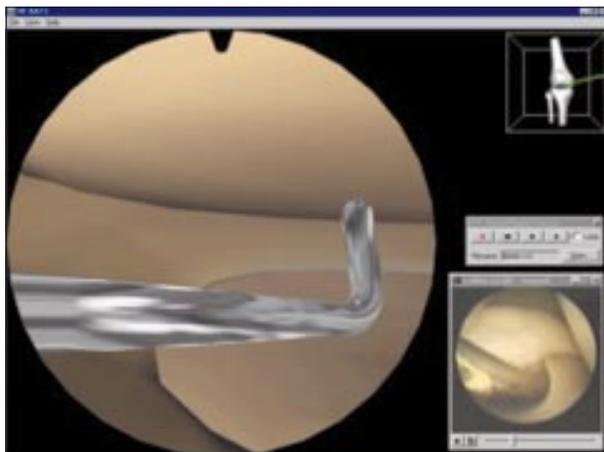
Medical schools are attempting to break away from the Flexnerian model of teaching, which suffers from various well documented problems.<sup>2</sup> Independent disciplinary courses present lectures and make assessments using instruments that stress memorisation of material by rote. The clinical years present a "reductionist" model of the body as a machine with organs that can be repaired by specialists in that organ system. The model largely rejects a role for patients in their own care and eschews health maintenance and healing methods from non-mainstream ("complementary") medical disciplines. Emphasis on acquisition of factual knowledge has displaced other, more relevant "soft" skills.

By contrast, the "post-Flexnerian" curriculum emphasises understanding mechanisms of disease as they relate to clinical problems, with teaching by problem based learning methods that promote lifelong, independent learning and integration across basic, social, population, and clinical sciences.<sup>3</sup> It aims to embrace health care in its wider perspective in a range of practice styles and modalities. Problem based learning is, by its very nature, patient centred and holistic, presenting the component sciences in the context of their practical application.<sup>4</sup> It can be used in independent study or as a basis for small group discussions, with or without a tutor.

## Educational content and process

So what is "education"—education for what? Traditionally, emphasis has been on mastery of a body of biomedical knowledge and skills deemed essential for competent practice. Today, however, practitioners must continuously access and apply up to date information and diagnostic and therapeutic protocols to their practice. The paradigm has shifted.

Interactions with patients are also changing. The biomedical literature is readily accessible to patients, and doctors will frequently find themselves working through information from websites alongside their patient and other members of the therapeutic team, acting more as analyst, synthesist, guide, and the voice of experience rather than as the source of knowledge.



Simulated arthroscopic view of a knee used for training

Other than specialised hands-on skills such as manipulation or surgery, the unique contributions of the doctor are reasoning, knowledge of the “system,” and forming effective relationships and therapeutic partnerships with patients and other members of the healthcare team.

The goal of medical education must therefore be redefined broadly along the lines of Ludvigsson<sup>5</sup>:

- Understanding biomedical concepts related to disease mechanisms
- Developing interpersonal and hands-on skills, including forming productive partnerships with patients and healthcare team members and demonstrating appropriate professional values
- Applying a logical reasoning process to solving individual or community problems and to critical review of new information
- Accessing information resources appropriately to support high quality practice

To these might be added a fifth point (partly covered by the second):

- Willingness to empathise with patients’ (or relatives’) predicaments and anxieties.

### Information technology revolutions

Dissemination of information has itself undergone a profound change. Information used to pass directly from master to apprentice: both were in the same place at the same time. Writing enabled durable records to be made, thereby eliminating the need for direct interpersonal contact, but the printing press was required for wider, cost effective dissemination of information. But the information remained “linear,” with order and context as prescribed by the author.

Computer technology has created a dynamic environment breaching traditional boundaries. Large repositories of information have been established: multiple resources worldwide can be searched for specific occurrences of words, concepts, and associations. Links, networks, and dynamic associations can be established between material (text, sound, and images) not necessarily stored in the same physical place, allowing students to follow the pathway of their choice through the maze and reach their own personal understanding of the domain. But the wealth of accessible material must be organised into effective learning experiences, or students risk becoming overloaded. At the same time, it is recognised that lack of factual knowledge is not generally a prime factor in therapeutic error, which more often results from problems of attitudes and skills.<sup>6</sup>

There is no longer an absolute requirement for many of the restrictive aspects of curricula—such as fixed timings of courses and progression rates, synchronous physical attendance in a classroom, and sequential access to specific books or journal articles. A world of up to date information is available on line to anyone, including patients, with a personal computer, web browser, modem, and telephone line.

### Curriculum management and delivery

Curriculum delivery systems involve students, instructors, courses, and classes. Courses consist of teaching or learning modules and tests. Flexible courses can be assembled from a centralised curriculum archive of pages, static images, videos, sounds, etc, for computerised delivery by hybrid document and database management systems,<sup>7</sup> with contents being indexed by appropriate thesauri or nomenclatures.

Existing methods for traditional or lecture based learning methods assemble lecturer and students in a single place. By contrast, new technologies allow students to proceed at their own pace and create flexible learning environments. Advanced web technology allows programmed access to learning modules and tests. “Virtual” tutorials are conducted by threaded discussion groups. These methods hold great promise for allowing life-long learning through accessing up to date electronic knowledge resources on the web and CD Roms.

Additionally, during their clinical years, students can use web based technologies for keeping a learning log<sup>8</sup> to record their studies and to accumulate a personal log of cases or problems seen, procedures watched or undertaken, and skills acquired for certification purposes—a system often described as portfolio based learning.<sup>9</sup>

### The new paradigm

Finally, one can begin to see a future for education that offers students a high quality service within which they develop relevant knowledge, understanding, and skills at a competitive price and with effective and efficient educational strategies. The educational vehicle must be convenient for students, promoting flexibility and enabling the students to study anywhere convenient, in their own time, with non-threatening self assessment.

The educational framework will challenge students with problems that are prototypical examples of the range of pathophysiological processes while at the same time emphasising those conditions that are common in the regional community. Problems will reference a wide range of textual and audiovisual materials, all fully indexed for multiaxial searching and accessible on line. Students will browse and search these resources to locate interesting information, exploring virtual anatomical, histological, medical, surgical, and pathological specimens, images, and procedures on their PC in colour and with three dimensional appearance.

Investment in buildings and classrooms for study will be reduced, as will the need to remove students for long periods from their community to centres of academia. The need for physical access to materials such as cadavers, specimens, and journal articles will be largely eliminated. Interactive, low cost web sessions will link experts with students in different locations. Software will “serve” the successive components of a course directly to the students when and where they may require it.

Overall, the potential exists to greatly reduce costs while offering students a “service” that is flexible, convenient, and efficient and can be tailored to meet exactly their personal needs and circumstances. In broad terms the same principles should apply to study after graduation.

Preparation of students for encounters with patients may involve interactive simulations, models, and computer based simulators. The acquisition of some skills will still require apprenticeship—such as learning to interact with and examine patients and to perform physical procedures and developing humanistic and caring attitudes. These skills can be acquired wherever there are competent care providers able and willing to impart them. Indeed, at present students are dispatched to various locations of primary and secondary care on attachments, rotations, and electives to develop these skills in the same way. In our experience some of these skills, and particularly the



Model of a knee with simulated display used for training

attitudes, may be better transferred by role models away from the centres of academe.

The crucial issue is to ensure that students have developed appropriately, which must be done through assessments of fitness to practise in relatively conventional ways and under controlled and supervised conditions.

### Implications

Obviously, this new paradigm must affect teachers and students, with implications for all stakeholders.

### Students

The new paradigm will improve equity of access to the best educational experiences for all students and will appeal particularly to certain types of student. They will no longer need to be independently wealthy to study medicine, and could pay their way by continuing to work as they study flexibly. Students from rural and remote community backgrounds will be able to study within the social and clinical context of their community, so increasing the probability that they may remain there to practise.

For some, medical study modules will become a recreational pursuit; for others, it may be a vital venture in self understanding in order to manage health risks and play a greater role in decision making about their health.

### Medical schools

The reduced cost, increased flexibility, and lower dependency on physical facilities of the new paradigm will hopefully make it possible to expand available places quickly and easily and to admit more students from a wider range of backgrounds—ethnic, social, and academic—as well as to accept students who otherwise might not qualify. The easy accessibility of course materials will open them to productive critical review by faculties and students, which must be beneficial.

### Teachers

These new teaching programmes will require a small core of curricular planners and learning resource managers in dedicated education centres under the direct control of the head of the educational programme. Other staff will mostly work part time and be remote from students and campus. Experts on the content of courses will interact with students using web enabled technologies based not on their physical location but on their primary language and the students' stage of development. Students will be apprenticed to clinical tutors within their district charged with developing skills and attitudes.

### Government

Escalating costs of medical education (and education generally) are leading to its progressive privatisation: North America

is already privatised, and rising “co-payments” are a feature of higher education in many other countries, such as Britain and Australia. This trend threatens to return medicine to a preserve of the wealthy even though the need to attract a more representative cross section of the population, especially ethnic and cultural minorities, into medicine is widely accepted. Reducing the cost will benefit all, but especially the less well off. Such encouragement for an increased production of a medical workforce will ameliorate shortages where they exist and promote development of a supply and demand marketplace in healthcare services.

Emphasis will shift from institutional self accreditation of courses towards accreditation of graduates through external examinations, with increasing internationalisation. The issue is whether students have the requisite knowledge and skills, regardless of where or how they acquired them.

### Community

Communities will welcome graduates who are community oriented and appropriately skilled in up to date, evidence based information. The patient centred, problem based focus of their study programmes and the person based approach of their apprenticeship will give graduates an appropriate background for assisting patients to manage their own health risks and to assume responsibility for and control over their own health care.

### Conclusions

Medical education is poised to undergo another step in its evolution. Basic biomedical knowledge is developing rapidly, adding to the information overload already evident in traditional curricula. Humans can neither carry the entire knowledge that comprises medicine in their head, nor can they readily keep it up to date. Education is a combination of

- Acquiring knowledge and understanding of structures and processes involved in illness
- Mastering carefully identified hands-on skills
- Using a logical, problem solving and reasoning process
- Developing the ability to interact productively with up to date electronic information.

The new paradigm envisages the separation of course developers, tutors, and students in time and space and the use of learning resources that are accessible electronically. Developments in information management, internet and web technology, educational strategies, and computerised courseware have opened the door to the creation of flexible, problem based, distance learning.

This style of programme has many advantages, not least the modest cost required to establish and operate this system and the opportunities to make it widely available and convenient for students. Students can complete much of their study in their home or office, studying as and when they can find the time without leaving their home community. Similarly, staff can discharge their educational responsibilities largely at times and places of their own choosing. A wealth of up to date material is available in electronic form on the web and on CD Roms for use as resource material to support such a programme.

Competing interests: None declared.

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