

Rethinking Medical Education

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The notion that there is something wrong with medical education has existed almost as long as medicine itself⁽¹⁾. In 1863, the General Medical Council in the United Kingdom had already noted a tendency to an “overloading of the curriculum of education ... followed by results injurious to the student”⁽²⁾. The familiar complaints from patients who were the subject of bed-side teaching of medical students have had an equally long history. Martial (40 – 102AD), in one of his epigrams noted:

“I was falling sick; but you came at once to me
 O Symmachus, attended by your hundred pupils. A
 hundred hands frozen by the North Wind have
 pawed me,
 O Symmachus, I had no fever then, but now I
 have.”

In recent years, dramatic changes in the science and practice of medicine have catalysed a critical re-examination of the undergraduate medical programme in our Faculty. The same forces have sparked a fresh cycle of curricular reform in medical schools throughout the world. This paper discusses some of the major factors responsible for this and outlines the approach adopted by our Faculty of Medicine in its own curriculum review.

Medical education:- historical perspectives

Medical education in Britain, on which our medical undergraduate course is based, developed chiefly as an apprenticeship system. Initially, this mainly comprised the transmission, by precept and example, of the practical skills of the medical practitioner without involving a substantial understanding of the underlying theory. There was no real structured system of medical education or medical registration until the first half of the 19th century when a revolution in medical education led to a series of important reforms. During this period, the growth of knowledge in anatomy, physiology and pathology, and the increasing acceptance of the scientific method, resulted in the introduction of the medical sciences as an integral part of the teaching agenda of universities. Hospitals which had hitherto been places for caring for the poor, were transformed by the application of these new scientific approaches and knowledge to the management of disease. Hospitals themselves became increasingly active in the generation of new knowledge and bedside teaching in hospitals was incorporated as part of structured medical education programmes⁽¹⁾.

The product of these influences is the familiar British medical education structure with preclinical instruction in the basic medical sciences as a preliminary to clinical training based mainly in hospitals. Initially, newly qualified doctors were legally allowed to practice medicine without supervision or requirement for further training. However, arising from fears that the undergraduate medical course did not provide sufficient training for the independent practice of medicine, a pre-registration year was introduced in 1953 to provide for a period of service during which newly graduated doctors acquired general experience under supervision, prior to obtaining full registration to practice.

The “traditional” undergraduate course – impetus for change

The “traditional” medical undergraduate programme has proven itself to be robust and capable of producing well-trained doctors who have subsequently become proficient specialists or general practitioners. However, there is increasing concern that this form of curricular organisation has inherent deficiencies which may limit its capacity to meet the challenges which face the medical profession. The issues of particular concern include the following:

Factual overload and the “clinical-preclinical divide”:

In Goethe’s great book⁽³⁾, Faust laments:
 “Philosophy have I digested,
 The whole of Law and Medicine
 Theology, alas, thrown in.
 Poor fools, with all this sweated lore,
 I stand no wiser than I was before.”

Unlike Faust, most present-day medical undergraduates are confronted by curricula which are grossly overcrowded with information⁽⁴⁾. Much of this large body of factual knowledge is acquired largely through passive learning modes by students who may consequently have difficulty in differentiating critical from esoteric information.

Several factors are responsible for the tendency to curricular overcrowding. The spectacular and continuing explosion of knowledge in the biological sciences and its rapid accessibility through information technology, is a fundamental cause. The way in which teaching is organised in most medical schools, planned and based mainly at departmental

level, also creates the potential for unco-ordinated proliferation of factual content of different parts of the course and unnecessary duplication in coverage of topics⁽⁵⁾. A further factor is the trend to increasing specialisation as subspecialists often have a higher expectation of the knowledge base required of medical students in their area of expertise.

The organisation of the undergraduate programme into rigid preclinical and clinical phases has potentially undesirable consequences. In the preclinical years, students often do not appreciate the clinical relevance of their basic science instruction. This could carry over into the clinical phase of training, where students may develop a misperception that actual medical practice does not require much basic science knowledge.

The challenges created by advances in information technology

The increasing accessibility of medical information in the public domain, through information technology, is likely to transform the doctor-patient relationship. In the INTERNET era, the physician will have a diminished role as the main provider and interpreter of medical knowledge for his patients. To relate effectively to patients armed with abundant and up-to-date information on their medical problems, the clinician would need additional skills based largely on a deeper understanding of the underlying medical issues and contexts, and a greater ability to critically evaluate, interpret and synthesise data. Needless to say, the physician himself must be thoroughly familiar with obtaining relevant information through electronic means, as part of continuing medical education.

The increasing importance of effective communication skills

The trend for patients to have ever higher expectations of their doctors is likely to continue. Patients want to know much more about their medical problems and the outcomes and side-effects of treatment. Advances in medical technology, genetics and molecular biology will throw up increasingly complex treatment, moral and ethical issues which would need to be addressed at the level of individual patients. In meeting up to these challenges, it is essential that doctors are able to communicate effectively and sympathetically with patients and their relatives.

Dealing with constant and rapid change

Constant and rapid change is a hallmark of present-day society. In medicine, some of these changes are predictable and can be taken into account in medical curriculum planning. For example, changes in disease prevalence such as the impact of a rapidly ageing population and the rising prevalence of diabetes mellitus in Singapore, represent important trends that necessitate adjustments in curricular content and focus.

The much greater challenge, however, is the need to ensure that medical students are also equipped with the correct attitudes and skills to deal effectively with the unpredictable and dramatic changes in medical

practice which will occur in their professional lifetime. These include a solid basic science foundation, a zest for acquiring new knowledge and a habit for continual learning, inculcated through active modes of learning in medical school and early exposure to and continuing opportunities for research throughout their career.

Practical skills training for new doctors

The greater intensity of modern clinical medicine places great strains on new house-officers who suddenly find themselves entrusted with the heavy responsibility of managing a wide range of clinical situations and ward problems. Newly qualified doctors would be better able to cope with the rigors of housemanship if they were fully competent in the practical skills required of effective junior doctors. These skills range from knowledge of first aid and competence in the setting of intravenous lines to intubation and basic cardiac and advanced trauma life support. While many of these elements already exist in many undergraduate curricula, including our own, greater emphasis on training and testing for competence in these skills have become necessary.

Maintaining the ideal of the ethical and humane doctor

In his speech marking the opening of the Straits and Federated Malay States Government Medical School in Singapore in 1905, Sir John Anderson reminded the new medical students that they were gaining membership of "a profession of unselfish devotion and splendid achievement, a profession with lofty ideas and one which calls for all the best qualities, mental and moral, which a man can give." The Faculty of Medicine has a major responsibility for inculcating these values in our medical students, in the formative phase of their development as medical practitioners. Beyond instruction in ethics and professional conduct, there is the difficult, but important task of ensuring that students are exposed to a range of teachers who would serve as proper role models.

Changing the undergraduate medical curriculum

In our Faculty of Medicine, the objectives of undergraduate training were redefined (Table I) and the 5-year course re-organised in 1993, into 3 distinct blocks, comprising Human Biology in Year 1, Human Disease and Health and Disease in the Community in Year 2, followed by 3 years of clinical training featuring full-day clinical attachments. The ongoing curriculum review builds on this framework and is focused on the following principal areas:

1. Reduction of factual overload and integration of teaching

A central goal is the reduction of factual overload and the further integration of teaching in the "pre-clinical" and "paraclinical" subjects so that students would gain a more complete and integrated understanding of the science of medicine.

Three approaches are being taken to reduce curricular content overload:

- a. Teaching throughout the medical course will

Table I – Objectives of the Undergraduate Medical Course

The NUS Medical Undergraduate Course aims to produce doctors who will serve patients and the community with care and integrity. They will be equipped with both scientific and clinical knowledge to function effectively as houseofficers and have the potential to undergo further training leading to careers in primary health care, specialised health care and/or other biomedical disciplines. They should develop a healthy critical faculty, and possess the desire and skills to continue self-directed learning to keep up with future advances in medicine.

- be directed and co-ordinated at Faculty level rather than at departmental level hence lessening the tendency for rapid accumulation of factual content and duplication of teaching.
- b. Educational objectives and core curricula are being defined for individual components and modules throughout the course.
 - c. A Medical Education Section will be established in the Faculty of Medicine to monitor curriculum content and teaching.

Another key goal of the present curriculum review is to effect both “horizontal” as well as “vertical” integration of teaching. Teaching in the “preclinical” and “paraclinical” subjects will be organised around an organ-systems based approach, with greater emphasis on the clinical relevance of the basic science instruction and increased exposure to clinical teaching very early on in the medical course. Several subcommittees, each comprising staff from a range of clinical and preclinical departments, have been working to define the core-curriculum for each of the organ-system modules as well as for foundation modules for more general topics such as Molecular and cellular biology, General Microbiology, General Pharmacology, etc.

The Faculty-directed nature of the programme will also allow for vertical integration of teaching in curriculum themes which will span the length of the medical course. For example, horizontally integrated teaching in Oncogenesis in Year 2 will be reprised and extended during combined teaching sessions on Cancer in the clinical years, which will feature the active participation of clinicians and basic scientists. The greater involvement of staff from preclinical and paraclinical departments in teaching during the clinical phase will serve to underline the importance of the basic sciences in medical practice.

2. Promoting active learning

The need for students to understand, remember, recall and apply a fairly large core of knowledge is unavoidable since the proficient practice of medicine depends on this. However, it is clearly undesirable for students to acquire such knowledge through passive learning modes, characterised by “spoon-feeding” by teachers and rote-learning by the students. The inculcation of the habit for active learning will be a critical goal of the undergraduate course since it is this faculty which is central to the ability of students to keep up with the rapid and varied advances in medicine after they graduate from medical school.

Within our local context, we believe that active learning can best be inculcated through the following ways:

- a. Instruction organised around an integrated organ systems-based approach will be supplemented by strong problem-based learning components. In a typical problem-based learning session, a small group of students is given an instructive clinical case or pathophysiological condition. The students are expected to identify and critically discuss, amongst themselves, the primary problems or issues presented by the case. Following this, the students would independently research different facets of the case through reviewing the literature, before reconvening to consolidate their data and ideas. The tutor acts primarily as a facilitator who would guide the students during the course of their discussion. At the end of the whole session, the tutor would review the main learning points of the case and will point out important areas or issues which the students had overlooked and would need to look into.
The problem-based learning components can be weaved into the basic organ-systems based programme, with great effect and benefit. A problem-based learning session scheduled before an organ-systems module such as the cardiovascular system, can be used to stimulate students to think and read about aspects of physiology and/or anatomy which may relate to the illustrative clinical case. Similarly, a second problem-based learning session scheduled after the completion of the organ-systems module, will help students to consolidate and integrate their new knowledge.
- b. The Faculty plans to gradually increase the amount of project work in which students are expected to frame relevant questions and to independently plan and execute an approach which would address them.
- c. Students will be provided with greater exposure to and opportunities for research. A specific introductory module on research will be introduced which will present a broad overview of how new knowledge is generated, the scientific method and general basic research methodologies. As part of the University's Undergraduate Research Opportunities programme, the Faculty has made provisions for interested students to carry out a range of research projects under the mentorship of experienced investigators in the Faculty.

Concurrently with these efforts, greater emphasis will also be placed on equipping students with the tools necessary for effective self-directed learning. Students will receive specific instruction in medical informatics and the efficient use of information technology for retrieving data. Biostatistics and the critical evaluation of research papers are topics which

are already well covered in the current curriculum, but instruction in evidence based medicine will also be introduced.

3. Extending the effective use of Information Technology in medical education:

It is intended that Information Technology will be used extensively to reinforce the educational objectives of integrated teaching and to further encourage self-directed learning. For example, a well-designed multimedia programme on hyponatraemia can incorporate teaching elements in anatomy, physiology, biochemistry, chemical pathology and clinical Nephrology. An interested preclinical student can use the programme to learn about the clinical relevance of the basic science knowledge while a clinical student could use it to revise the scientific basis of clinical practice in regard to hyponatraemia. Most importantly, the student would be able to use the teaching programme to the degree and at the pace with which he is most comfortable.

4. Greater opportunities for elective study:

There have to be provisions in the curriculum for students to pursue in greater depth, areas in which they have special interest. In the current curriculum, a 6-week elective posting period already exists in the 4th year of the medical course during which time, students can choose from a wide variety of options ranging from clinical attachments to basic bench research. It is our intention that curriculum time freed up by the reduction of curriculum content in the first 2 years of the course, should provide additional opportunities for elective study. Ideally, there should be at least 1 elective period when students can opt for modules of study which are totally outside of medicine, since even this limited broadening of the undergraduates' education could help reduce the tendency for the students to be too narrowly focused on medicine.

5. Practical and communications skills training

Greater emphasis will be placed on ensuring that students achieve competence in the practical skills required of young doctors. The Faculty has set up a clinical skills laboratory which is equipped with mannequins for students to practise practical procedures such as venepuncture and catheterisation, teaching aides for instruction in basic clinical skills such as cardiac auscultation and per rectal examination, supported by plastinated anatomical specimens, relevant radiographic and other images and multimedia teaching programmes. Instruction will commence in the second year of the medical course, starting from April 1998, and will be reinforced in the third, fourth and final years. This will be complemented by training in Basic Cardiac Life Support and Advanced Trauma Life Support, which are already components of the current curriculum. Formal training in communications skills will be carried out concurrently with instruction in practical skills.

6. Winning the support of the teachers:

Successful implementation of changes in the curriculum requires the active support of all teachers. Discussion and debate on the intent and substance of curriculum reforms is an essential process which is often helpful in clarifying difficult issues. The active participation of teachers from the Faculty of Medicine, the National University Hospital, restructured hospitals and the private sector, will help engender a feeling of joint ownership of the revised undergraduate teaching programme which will be critical for its successful implementation. Many teachers would also require additional training, particularly in the conduct of problem-based learning activities, to ensure that educational objectives can be effectively met.

7. The inevitable review of examinations:

Since examinations have a profound influence on the way students study, a comprehensive review of our system of evaluation is currently being undertaken with a view to instituting changes which will reinforce the educational objectives of the new curriculum. For example, integrated, systems-based teaching in the preclinical subjects must be tested in integrated examinations evaluating students on the areas covered rather than in the separate Anatomy, Physiology and Biochemistry examinations. The traditional clinical examination is a key component of evaluation in our medical course and will remain to be so. However, there should be a greater emphasis on testing of knowledge and skills in acute medicine, and in practical and communications skills. The examination review committee has also been tasked to recommend the proper balance of tests which will help promote self-directed learning. These would include evaluation based on project work and open-book examinations.

CONCLUSION

Curriculum review is a complex and time-consuming activity. Instituting changes in the curriculum inevitably results in disruptions which will perturb both students and staff. However, the Faculty of Medicine is duty-bound to proceed for in the words of Thomas Huxley (1876), "the burden we place on the medical student is far too heavy and it takes some doing to keep from breaking his intellectual back". The exertions required by the current curriculum reform would be more than adequately rewarded if we are able to produce new doctors ready and equipped for the exciting challenges of the new century.

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