EDUCATION AND TRAINING

CURRENT TRENDS IN UNDERGRADUATE MEDICAL EDUCATION: TEACHING, LEARNING AND ASSESSMENT

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This is the second article for the Samoa Medicine Journal on undergraduate medical education. The first considered program and curriculum design and this article focuses on teaching, learning and assessment methods.

Introduction

This article considers some of the contemporary trends in medical education relating to teaching, learning and assessment. In the last two decades, medical education has drawn from a range of disciplines to introduce new teaching and assessment methods and approaches to educational intervention. The article takes an international perspective (looking primarily at Australasia, the UK, the USA and Canada) in considering some of the current trends in undergraduate medical education in teaching, learning and assessment methods.

TEACHING AND LEARNING

Methods

Teaching and learning methods in medical education have much in common with those in other health and social care professions. Although, traditionally, there was much mystique about learning the ‘art’ of medicine as well as the ‘science’ (situated firmly within a biomedical and positivist model) there is increasing awareness and recognition that ideas and methods from other disciplines can and should be used in medical education. The introduction of benchmarking and the need to ensure programs meet quality assurance requirements from higher (tertiary) education funding bodies, as well as professional and statutory bodies (PSBs), also stimulated medical schools to pay greater attention to teaching and learning and, in particular, to ensuring that teachers and curriculum developers had appropriate educational skills and knowledge. Many schools have established medical education units specifically to support curriculum development, develop materials (including online resources) to train academic and clinical teachers and to carry out medical education research.

The changing role of the doctor

Teaching and learning approaches are designed to ensure that students acquire the appropriate scientific and clinical knowledge; that they acquire the practical, procedural and communication skills or competencies needed to practice medicine, and that they develop professional attitudes and demonstrate behaviors appropriate to the practice of medicine (Australian Medical Council [AMC]). The CanMEDS framework (see Figure 1 below) has been highly influential internationally on medical school curricula in identifying the wide ranging roles of a doctor.

Other bodies responsible for regulating medical school curricula have also begun to delineate and define the different roles of the doctor as a basis for curriculum design and selection of teaching, learning and assessment methods. For example, the recent UK General Medical Council (GMC) recommendations ‘Tomorrow’s Doctors’ structures learning outcomes around three domains: the doctor as scholar and scientist, doctor as practitioner and doctor as professional. This heralds the direction in which medical education is currently moving, with increasing emphasis at an early stage on becoming a professional, whilst paying attention to underpinning scientific knowledge and practical skills and competencies.
**Curriculum structure and course content**

The medical curriculum is primarily delivered in two separate contexts: the university based ‘classroom’ or ‘laboratory’ context and the ‘clinical’ context (which includes hospital and community based settings). In the first article in this series, we discussed examples of ‘symbiotic curricula’ (e.g. in Australia) which tend to take a much more integrated, ‘immersion’ approach where students learn primarily in a clinical context. The changing face of ‘basic’ sciences, in particular deepening understanding of molecular biology, genetics and physics, has led to a restructuring of the basic science components of medical courses.

In some countries, such as India or the former Soviet Union, the curriculum is still divided into pre-clinical and clinical phases, each delivered in separate contexts by biomedical scientists and clinicians respectively. In the USA, although curriculum integration occurs, the timing and nature of assessments determines curriculum design. Curriculum design predetermines assessment timing, content and method in many curricula. In the USA for example, the first stage of the national licensing examination (USMLE) takes place within the undergraduate course after the pre-clinical program. In most other countries, although debate is occurring around whether and how students may be registered by professional bodies, assessment within the medical program is managed by the medical schools which have devolved responsibility from the professional bodies for ensuring that graduates are fit to practice. Licensing and registration (and associated assessment) occurs after completion of basic medical training and is the responsibility of professional or statutory bodies.

In other countries (such as the UK, Canada, Australasia) curricula have become more integrated and are typically ‘systems based’. This has led to a changing relationship between science departments and teachers and clinicians. Traditional teaching would have been led in the early years by basic scientists (physiologists, histopathologists, anatomists, biochemists etc), then as students moved into clinical practice, they would learn from clinicians. Most schools now have much more integrated teaching and curriculum design so that scientists and clinicians work together to teach students throughout the course. This is more marked in the early years, where we have seen much more involvement of clinicians in ‘classroom based’ teaching, e.g. in clinical skills teaching, as well as in lectures, tutorials and small group teaching, including Problem Based Learning (PBL, see below). In integrated courses, students also undertake early clinical experience, often in general practice or with nurses or other health professionals, where they see patients and observe clinicians. The movement towards more integrated curricula was in part a response to the realization that learning happens best when it is relevant, ‘situated’ and contextualized within the development of professional practice.

**Outcomes based education**

In the late 1990’s, there was a shift towards outcomes based education so that the learning outcomes of graduates were more clearly defined and the overall curriculum and separate teaching sessions were developed so that the outcomes can be achieved. Although outcomes based education can be critiqued if it restricts learning, clearly specifying the outcomes that students should be able to achieve as a result of any educational intervention helps the teacher to define the teaching and learning methods as well as helping to guide assessment.

For example, if learning outcomes are about knowledge (e.g. as a result of this session, students should be able to list the cranial nerves), then the learning and teaching methods must be relevant (this might be a lecture, or self directed reading) and assessment must require students to list the nerves (e.g. by an MCQ or plotting these on a diagram).

If learning outcomes relate to a skill (e.g. as a result of this session, students should be able to accurately take a blood pressure) then it would be inappropriate to teach students this skill just by a lecture or through reading, as opportunity must be made for deliberate practice of the skill and feedback. Assessment must test that the student can take a blood pressure (use equipment appropriately, communicate with the patient etc) and that the reading they get is accurate.

**The learning process and problem based learning**

The move towards outcomes based education was paralleled with an increasing awareness in medical education that the ‘process’ of learning was as equally important as the outcome. ‘Medical curricula can be delivered in many ways. The overall approach developed by individual medical schools depends on the philosophy of each curriculum. It is recognized that different learning systems suit different students so such diversity is supported. However, irrespective of the approach a significant amount of learning should be active. There must be sufficient time for self-directed learning and reflection to encourage students to develop the habits of lifelong learning. Educational shifts towards more active, reflective, student-led learning led to a reduction in lectures and an increase in small group teaching/learning methods, particularly for topics such as
There are many examples of shared or open cadaver or dissection work in the curriculum. That many medical schools no longer include prospected and preserved and the decreasing need for teachers, the capability of specimens to be multi now increasing acceptance an anatomy demonstrators) for up to a year. There is under supervision (often by surgery trainees or were allocated a cadaver which they dissected Traditionally a small group of medical students education has been around anatomy teaching. Another long-standing debate in medical education has been around anatomy teaching. Traditionally a small group of medical students were allocated a cadaver which they dissected under supervision (often by surgery trainees or anatomy demonstrators) for up to a year. There is now increasing acceptance that the range of multi-media resources available to students and teachers, the capability of specimens to be prospected and preserved and the decreasing need for students to learn dissection as a skill means that many medical schools no longer include cadaver or dissection work in the curriculum. There are many examples of shared or open communication skills, medical ethics and case discussions. One of the major introductions was problem based learning (PBL), first used in engineering education and introduced into medical education at McMaster University, Canada in the 1960s. PBL is similar to the ‘enquiry based learning’ (often used in nurse education) or the ‘case based learning’ used in management education. PBL however, as used in medical education, has specific purpose, features and outcomes and was used as a driving force to generate curriculum reform through concentration on a single curriculum element.

‘PBL represents an approach to learning where students discuss specially prepared cases constructed from problems or presenting conditions. Students work in small groups to generate hypotheses, derive learning goals and research and report back on the derived goals. The group process is important. Tutors are trained as facilitators and guardians of group process rather than content experts. Content expertise is provided through case writing and delivery of supporting lectures and practicals. PBL has been grounded in the literature of cognitive psychology particularly through its emphasis on learning in context, activation of prior learning and elaboration of learning (Schmidt) (Prideaux, p295).

Some schools (eg McMaster, Harvard (USA), Maastricht (Netherlands), Glasgow, Liverpool (UK) and Oceania University of Medicine, Samoa) take a ‘whole curriculum’ approach to PBL whereas many others consider PBL not to be the dominant model of learning, but to be just one of many teaching and learning modes. Research into whether a ‘PBL curriculum’ is more effective than a ‘traditional curriculum’ demonstrated some advantages, although it was difficult to ascribe these simply to PBL as a methodology, but may have largely reflected the shift from large scale lectures to a more intense facilitated small group teaching.

Learning technologies

Another long-standing debate in medical education has been around anatomy teaching. Traditionally a small group of medical students were allocated a cadaver which they dissected under supervision (often by surgery trainees or anatomy demonstrators) for up to a year. There is now increasing acceptance that the range of multi-media resources available to students and teachers, the capability of specimens to be prospected and preserved and the decreasing need for students to learn dissection as a skill means that many medical schools no longer include cadaver or dissection work in the curriculum. There are many examples of shared or open resources available to support anatomy and physiology teaching (as well as other topics) such as those from MedEdPORTAL, supported by the Association of American Medical Colleges or the Harvard-MIT open courseware initiative. The widespread availability of resources and the capacity of technology to support learning has led to e-learning and simulation being widely used in medical education, particularly around the integration of basic science and clinical medicine and in health informatics. Students must be educated and provided with opportunities to use technology and communication tools as they are used in practice and be flexible enough to incorporate changing technology. The use of technology needs to be well planned and introduced to support learning, not simply because the technology is available.

Simulation includes not just models and manikins for learning clinical skills and procedures, but also simulated patients (often actors) who are used for assessments and learning communication skills and team working, and large scale simulated environments such as theaters and anesthetic rooms. Acknowledging that finding real patients with real clinical signs at the appropriate time in the curriculum can be problematic has also led to the introduction of expert patients, peer learning and paid volunteers.

Clinical teaching

Clinical teaching traditionally involves patients as the cornerstone of all learning and teaching events whether this is at the bedside, in the clinic or in the operating theater. Care needs to be taken to ensure that patients (and their carers / relatives) are fully informed and involved in educational activities.

Clinical teachers have a range of teaching and learning methods currently available to them. It is no longer appropriate to teach students by ‘humiliation’ or by teaching through an entourage of junior doctors, students and other health professionals on grand rounds. Instead, clinical teachers need to plan educational activities carefully for learners so that optimum learning can take place with minimum disruption to patient care. Learning outcomes need to be identified, clearly linked to learning needs, and structured learning events need to be set in place for students and trainees. There are many examples and suggestions in the medical education literature for clinical teachers to seek opportunities for teaching ‘on the run’ and through corridor conversations and we will look in more detail at clinical teaching techniques in a future SMJ article.
ASSESSMENT

The purpose of assessment

A definition of assessment in the QAA subject benchmark statement summarizes the approach to assessment in medical education:

‘Assessment strategies and methods must ensure that the knowledge, understanding, skills and attitudes set out previously are sufficiently covered. Methods must be both valid and reliable. Appropriate procedures for standard setting should be employed. Clinical competence must be rigorously assessed so as to identify those who are not yet fit for practice. Methods of achieving these aims may vary but should always include frequent direct observations of students interviewing and examining patients. Assessment of some qualities will require extended observations to be made. While professional attitudes, for example, may be difficult to assess directly, the consequences of attitudes on behavior must be assessed - usually by observation of that behavior over a period of time. Assessment needs to be thorough but should not be so onerous or so frequent as to interfere with the learning process’.6

The AMC medical school accreditation standards require assessments ‘to be integrated across the curriculum to encourage students to develop an integrated approach to learning … and a programmatic approach where multiple measures of student’s knowledge, skills and abilities over time are aggregated to inform judgments about progress’1,p19.

Assessment programs should be blueprinted (matched to learning outcomes) and developed for their ‘educational impact’. Standard setting is important and there are a range of different techniques used in medical education to determine standards and pass marks and enable decisions to be made about borderline performance. Common standard setting methods include the Angoff procedure13 and the Hofstee method14.

The AMC suggest selecting highly reliable methods such as multiple choice questions (MCQs) and objective structured clinical examinations (OSCEs) for high stakes examinations alongside instruments which ‘measure domains such as independent learning, communication with patients, working as part of a health care team, development of professional qualities and problem solving skills where reliability is less well established’1. Some of the most commonly used assessment methods are described below.

Written, knowledge based assessments

Written assessments include common assessment methods such as essays, but (largely to accommodate large numbers of students in each cohort) a range of written assessments are used that can be marked quickly and easily, often using optical mark readers. Written assessment methods15 are usually about testing knowledge and understanding and include:

1. ‘True or false’ questions, concise and can be answered quickly but hard to construct and may encourage guessing.

2. Multiple Choice Questions (MCQs), these include ‘single, best option’ MCQs and ‘multiple true or false’ questions. These are some of the most commonly used ‘knowledge based’ assessments for factual knowledge at all levels of medical education.

3. ‘Short answer’ open ended questions (SAQs), also called ‘modified essay questions’ (MEQs). These are also commonly used and are most helpful for assessing aspects of competence that cannot be tested in other ways.

4. ‘Key feature’ questions where a description of a realistic case is followed by a small number of questions that require only essential decisions (questions may be MCQs or open ended questions). They are useful for measuring problem solving ability and application of knowledge.

5. ‘Extended matching questions’ (EMQs) which include a list of options, a lead in question and some case descriptions or vignettes. They are also useful for testing problem solving ability and application of knowledge.

Many medical schools have developed large question banks for knowledge based assessment questions that can be randomly collated into question papers by computer. There are also examples of shared question banks which many schools have collaborated on developing e.g. the UK-based Universities Medical Assessment Partnership – UMAP. UMAP ‘is a collaborative project focusing on the generation, quality assurance, use and analysis of core, applied knowledge assessment items for undergraduate medicine. We produce and quality assure two question formats for the UMAP bank; applied, one-best-answer, scenario based, multiple choice questions (MCQs), and applied, one-best-answer, scenario based, extended matching questions (EMQs)’. All UK medical schools are eligible to join UMAP and international medical schools can also join the associate member scheme.
Assessment of clinical competence

‘The AMC considers it important that clinical examinations, whether on real or simulated patients, form a significant component of the overall process of assessment of the clinical disciplines. They provide an incentive to students to learn relevant knowledge and skills. Clinical examinations should also include an assessment of student ability to recognize abnormal clinical findings (and their distinction from normal) and the ability to provide an appropriate interpretation of these findings. The AMC also encourages medical schools to utilize the direct observation of student performance in in-training or other forms of clinical assessment’ 1,2,19. Clinical competence includes communication skills as well as competence in history taking, examination skills or carrying out practical procedures.

Workplace-based assessment is usually competency-based. Despite criticisms of competency-based education, concerns have usually been expressed where competencies are viewed as narrow, reductionist and overly simplistic. Competencies used for the purpose of designing workplace-based assessments are best written as holistic statements which are framed as ‘a complex structuring of attributes needed for intelligent performance in specific situations’ 16,17.

Skill based or practical assessments

Traditionally, assessment of clinical competence was assessed through ‘long case’ assessments and the viva voce (oral) examination. The long case assessment is patient based, but the examiner does not usually see the candidate with the patient, instead the candidate summarizes the patient problem followed by the examiners’ posing a series of questions to the candidate about their findings, diagnosis and management. The oral examination is traditionally an unstructured face-to-face session with examiners in which the candidates’ understanding of various topics relevant to clinical practice is explored.

These assessments have been critiqued for their lack of reliability and validity and for their case specificity. Over the last thirty years, a more structured approach to assessment of clinical competence has led to the development and widespread implementation of assessments that sample performance widely over a range of patient problems. This is deemed to be particularly important for high stakes examinations, and these assessments are used at all levels of medical education. Such assessments include the OSCE, and other forms of structured clinical examinations such as the OSLER (objective structured long case) and the PACES (practical assessment of clinical examination skills) assessments.

The ‘short case’ involves one or two examiners directing a candidate through a series of five or six observed encounters with real patients, after which they are questioned and a judgment is made based on the responses and observations across all the encounters. A structured long case will included defined guidelines for examiners on the topics to be covered, so that all candidates have a standardized experience, some also specify the questions to be asked or have designed clinical scenarios18.

The OSCE is one of the most commonly used practical assessments in medical education. In an OSCE, learners travel through a series of stations (for example containing a simulated medical scenario, data sets for analysis or practical procedure) where they are asked to perform a specific task. At each station there is a task with instructions for the learner and material (e.g. a manikin, simulated or real patient, laboratory test result) and an examiner. The learner spends a fixed amount of time at each station (usually five or ten minutes) before moving onto the next station. A variation on an OSCE is a simulated surgery where the examined doctor stays in a consulting room and simulated patients attend at fixed intervals. This can test much more complex issues than the simple OSCE, but needs well trained usually professional actors. There has been a lot of work in the Netherlands (cited by Norcini19) on testing doctors with simulated patients turning up at their place of work. This allows a good test of actual performance as opposed to competency.

Workplace based assessment

Swanwick and Chana20 suggest that in line with the focus on situating learning more closely with clinical and professional activities, there has been an increasing trend (particularly in early postgraduate training) towards workplace based assessment: i.e. assessment of practice, in practice, by practitioners, peers and patients. This also reflects moves towards more direct engagement in formal assessments of doctors by peers, other health professionals and patients and a move towards encouraging, facilitating and formalizing ongoing reflection on practice.

Current methods used for providing feedback and gathering evidence from the workplace consider observations of clinical activities, discussion of clinical cases, analysis of performance data and multi-source feedback20.

Observations of clinical activities

The traditional method of assessing clinical skills was the long case presentation. The problem of
case specificity using this technique, limiting the potential to sample widely, has given rise to the mini-clinical evaluation exercise or mini-CEX. The mini-CEX assesses multiple clinical encounters observed by a clinical teacher or supervisor. It is widely used in a range of clinical contexts to assess the clinical skills that learners most often use when working with real patients. Assessments are recorded on standard forms which enable an evaluation of a learners' performance over time. Other assessments that focus on clinical assessors observing workplace based clinical activities include the Direct Observation of Procedural Skills (DOPS) and the Mini-Imaging Interpretation Exercise (Mini-IPX) of the UK Royal College of Radiologists.

Discussion of clinical cases

Structured case-based discussion assessments derived from oral assessments using chart-stimulated recall are used in the USA and Canada; they have also been used in the UK GMC’s performance procedures. Case-based discussion is one of the evidence gathering tools used in workplace-based assessment in the UK Foundation program as well as in specialty programs. The value of case based discussion is that it enables an in-depth reflective conversation to be held between assessor and learner, in which the assessor can probe into more depth in specific areas. These can also be videoed so that the learner can learn formatively from the discussion.

Analysis of performance data

Swanwick and Chana cite Norcini as describing the basis for making a judgment on clinical performance data as having three potential sources: outcomes, process and volume. Outcomes of care, while being the most desirable measure, are limited by problems of attribution (to the individual), complexity, case mix and numbers. This poses problems in assessing performance. The process of care is more directly attributable to the individual doctor but effective processes do not necessarily mirror the best patient outcomes. The use of volumes of activity is premised on the basis that the more of a given activity that a doctor performs, the better their quality of care is likely to be. This basis for judgment is typified by the log books of the craft specialties such as surgery.

Multi-source feedback

Multi-source feedback (MSF) is widely used in the workplace to assess an individual’s performance from a range of perspectives from peers, co-workers and patients who are asked to complete standardized surveys. Often the individual is also asked to complete a self-assessment at the same time (e.g. in the UK mini-PAT, mini peer-rating assessment tool). Other MSF tools include patient satisfaction questionnaires and 360° appraisals. Feedback from all the assessments is provided (usually aggregated) with an opportunity for comparing self-assessment data with those provided by other raters.

Portfolios

Wilkinson et al describe portfolios as comprising a dossier of evidence collected over time, which demonstrates a doctor’s education and practice achievements. Portfolio models include online (web based) portfolios or log book based versions and should chart the journey of a learner towards the attainment of professional expertise. A portfolio: aims to serve as the reflective learning log of the learner, available to be shared with their educational supervisor demonstrates the learner’s progress towards covering the breadth and depth of the curriculum acts as a repository for assessments provides a framework for learning agreements between learners and teachers charts a learner’s progression and can help in making career choices and decisions.

Conclusions

Teaching, learning and assessment methods used in undergraduate medical education are continually changing in response to educational understanding, developing learning technologies and external healthcare agendas. As students become more dispersed and mobile and medical schools increasingly need to ensure they produce doctors who are safe, competent practitioners who can practice professionally in a range of contexts, teaching, learning and assessment methods need to adapt to reflect the demands of patients and healthcare systems. Effective teachers therefore need to stay up to date, not only with their subject discipline knowledge but also with appropriate, contemporary educational theory, methods and techniques. Providing a variety of appropriate learning activities and assessments will help students and trainees get the most from their medical education.

References


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