New Approaches to Medical Education: An International Perspective

Ann Jervie Sefton

Faculties of Medicine and Dentistry, University of Sydney, Sydney, N.S.W., Australia

Key Words

Goal-setting · Curriculum alignment · Active learning ·
Assessment strategies · Evaluation for quality

Abstract

Internationally, medical education has increasingly been the subject of scrutiny and debate. This article represents a review of the burgeoning literature on medical education. The focus is on encouraging teachers to improve the quality of students' learning. The educational rationale for some of the major current developments is considered. Change imposes significant challenges for teachers and students, although there are helpful examples from the literature. The curriculum must be internally consistent, based on well-defined educational principles and effectively managed. Goals or outcomes – broadly defined – must be debated and determined so that they are clear to staff, students and the community. Several interrelated issues must be considered and resolved – student selection, specification of content, identification of core clinical skills and broader academic and professional behaviours. The most effective educational processes must be determined in order to support active learning. Problem-based learning is now well established and its underlying principles are discussed. Assessment of students must encourage learning and ensure that well-defined academic and professional skills are achieved. Programmes must be subject to evaluation so that the quality of the experiences of students, staff

and patients is progressively improved. In order to develop effective skills in teaching and in the management of programmes, teachers need to be supported by good staff development.

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Introduction

Over the last 30 years, medical, dental and health science education has been changing substantially, supported by well-founded educational research. Traditional teaching practices are increasingly being questioned, as the focus is now on encouraging students' learning. Good educational strategies are being developed and rigorously evaluated. Educational units have been widely established to assist staff. Modern curricula are grounded in valid and reliable educational research. Staff development is an essential requirement to enhance educational quality.

Old beliefs and dogmas are challenged, as evidence-based educational strategies are embraced. Some national medical accrediting authorities press for educational change, but elsewhere, staff struggle to change policies and practices derived from long-ago colonial times.

The relentless advance of knowledge challenges medical teachers. The sheer volume and complexity cannot be covered, let alone assimilated and recalled reliably by students. Defining an essential 'core' generates heated debates. Skills: critical thinking, problem-solving, communication, teamwork, integrating and applying knowledge

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Ann Jervie Sefton, Emeritus Professor
Faculties of Medicine and Dentistry, University of Sydney
Sydney, NSW 2006 (Australia)
Tel. +61 2 9958 4562, Fax +61 2 9405 5949
E-Mail anns@gmp.usyd.edu.au

and evidence-based practice are all becoming more important than memorising transient 'facts'. Staff must make difficult choices between competing priorities; curricular change is never easy.

New curricula are designed to achieve broad goals: communication, teamwork, reflection, self-appraisal, a commitment to lifelong learning, professionalism and evidence-based practice in addition to the traditional requirements for specific knowledge and high-quality patient care. Early clinical contact and effective skill training are now widespread. In addition, future practitioners must be skilled and critical users of information technology. Interprofessional education is developing.

New assessments match the new emphases, to certify that standards have been reached, but also to encourage reflection, ethical and professional behaviours and self-assessment. Curricula are stringently evaluated, to establish that goals are met and to effect ongoing improvement.

The Case for Educational Change in Medical Schools

Medical schools are charged with a complex task: they must produce effective general and specialist practitioners for the community, managers of health resources and medical researchers. For some time, the need for national change in medical education has been articulated in the USA [1], UK [2, 3] and Australia [4, 5]. Some of the criticisms of previous (and existing) curricula have included: an emphasis on 'facts' that change in the light of research; didactic teaching and assessment strategies that encourage the recall of isolated, poorly understood elements rather than a thorough understanding and the capacity to solve new problems; little emphasis on communication skills, teamwork or reflective self-evaluation; a delayed introduction to clinical work; teaching within isolated disciplines rather than integrating knowledge. There is now an emphasis on professionalism, ethical practice and lifelong learning, and the value of role models (both inside and outside the profession) has been pointed out [6, 7].

A body of research supports newer approaches to learning. Students will generally learn strategically: when confronted with large volumes of information, by adopting 'surface' strategies that do not lead to understanding, problem-solving and long-term retention of knowledge. The aim of good teachers is to ensure that their students know and understand, that is, engage in 'deep' learning [8]. Curricula are effective only if they lead to that thor-

ough understanding, so that core knowledge is retained and applied appropriately. Many traditional didactic curricula have also been recognised to be deficient in meeting the broader goals referred to above. Fortunately, teachers who respond to the need for change are now supported by a growing body of educational research. The Best Evidence in Medical Education movement [9–11] has been developed to mirror the strategies of evidence-based medicine [12]. The aim is to make good-quality, peer-reviewed evidence readily available to busy medical teachers.

Constructivist learning theories suggest that each student actively creates his or her own individual understanding. To achieve that end, a curriculum must be 'constructively aligned' [13]. That is, students learn optimally if the curriculum is consistent in its design and delivery. All the elements are interrelated to develop systematically and consistently: goals, content, educational processes, assessment and evaluation must be aligned. The different elements support each other so that learning is progressive, building deeper understanding and skills. Most importantly, students are not confused by 'mixed messages' from differing expectations and practices.

One consequence of accepting the need for both alignment and consistency is that the curriculum must be centrally designed and managed to be effective. Good design and management are more readily achieved in an integrated, rather than a discipline-based environment. These issues will be developed further below.

Curriculum Change: Issues and Challenges

Developing or changing a curriculum is never easy, even if a compelling case has been made [14]. The process inevitably challenges long-held beliefs and values as well as imposing new patterns of work. Adding curriculum development to existing teaching commitments obviously also increases overall workloads. The period of transition is philosophically and practically difficult as staff juggle teaching the old curriculum with planning and implementing the new.

With change, the balance of long-established teaching activities shifts. Teachers are often uncomfortable with, or sceptical about novel concepts and practices, particularly as they balance curriculum reform with ongoing teaching, clinical work and research. Subject experts not unreasonably protect their disciplines for emotional or financial reasons. Some, immersed in a particular subject or subdiscipline, find it difficult to see the 'bigger picture' of a whole medical programme.

Nevertheless, new curricula based on well-defined principles have successfully been introduced in many countries [14–16]. Change has been effected in existing schools [17–19], usually by revolution although an evolutionary or incremental approach is possible [20]. Reform, however initiated, has not always been successful [21]. Some of the key characteristics of the new programmes involve collaboration and teamwork across the entire Faculty or School, integration of disciplines in a ‘whole of programme’ approach. A commitment to appropriate assessment, continuous monitoring and quality improvement are key characteristics. An earlier concern about the need for ‘adult learning’ techniques [22] has recently been questioned in the context of medical learning [23].

There is a significant literature on implementing new medical curricula [see for example ref. 5, 15, 24–33]. Summarising, the first steps include collecting data about medical need, distribution of workforce and community expectations. In any process of change or of developing a curriculum in a new school, all the stakeholders must be informed – staff in medical and related faculties including librarians, students, graduates, allied health professionals, patients, health system managers, community representatives and government. An analysis of health needs in the local community guides decisions on essential content and emphasis. Data need to be collected about graduates in practice who must be willing to update their knowledge and skills regularly, and to base decisions on evidence. Developers can analyse strengths and weaknesses of existing curricula by seeking evaluations by students, recent graduates, academic and clinical staff, the medical and related professions as well as the community.

Determining the content for inclusion is a challenge. There are obvious tensions between meeting specific local community health needs or reaching international standards of specialist practice or research. Some schools may have a single dominant mission – to produce community doctors or educate future leaders in research or specialist practice – but most aim to produce a plurality of graduates. The explosion of knowledge forces hard choices on teachers both in medical sciences and in clinical work. How is it possible to balance the needs for a basic understanding of anatomy, systems physiology and anatomical pathology with the modern demands of genomics, proteomics, cell signalling? Many teachers simply cram in additional content each year, creating an impossible task for the overloaded and bewildered students. Staff in traditional disciplines who have been the ‘gatekeepers’ of knowledge can strenuously resist any reduction in what they see as ‘core’ content to include newer relevant disciplines. The Internet

offers unprecedented access to information, but controlling the quality is a challenge. The early and effective engagement of librarians, as managers of information, is essential, both during design and delivery.

Change must be affordable and staff workloads kept reasonable. Thus, resources – staff, money, facilities, contact time – must be costed during transition and predicted for steady state [34]. Decisions can be made to maintain the highest quality educational experiences in the most cost-effective way. Strategies for planning, recording and mapping a developing curriculum are essential to avoid duplication of effort, gaps or unnecessary duplication and to keep all staff informed [35]. Local support is essential, and external validation is useful but unusual [36, 37].

Agreeing on Goals: An Essential Prerequisite for a Consistent Curriculum

Regardless of the different missions of medical schools, effective new programmes have a common starting point in the definition of locally relevant goals [13, 33, 36] or outcomes [9, 38, 39]. The process of ensuring wide agreement on the characteristics and competencies of the graduates is difficult and time-consuming. To be effective, statements of goals, values or outcomes must define agreed essential, fundamental knowledge, skills and characteristics of graduates, while allowing for diversity to match a range of career paths (community or specialist practice, public health, research, teaching, management). In the past, many such statements of goals were rightly criticised for their unrealistic scope and vagueness; they failed to provide a useful ‘blueprint’ for design. Now, there are good examples to follow.

Useful statements of achievable goals or outcomes that guide development are brief, specific, but not as narrowly detailed as learning objectives. They provide staff and students with clear expectations and provide a framework for assessment and later evaluation. Examples of issues that will vary between different medical schools include: the nature of the cohort – from high school, graduates from university or college; previous educational experiences; the likely scope and emphasis of future practice in local communities and hospitals, expectations for research or health service management; medical needs of the community to be served; specific competencies and knowledge considered essential at graduation; ethical practice; communication, clinical skills and a commitment to lifelong learning. Regardless of the mission of different schools, various basic characteristics are now em-

phasised, including communication, teamwork, problem-solving, ethical and professional behaviours, reflection, self-assessment [33].

A useful strategy for determining useful goals or outcomes is to develop collaboratively a concise draft statement and to seek wide comment from students, staff, the university, professional and community groups. The agreed characteristics can be clustered into broader headings or themes to provide a useful framework for a curriculum. Themes or outcomes guide the development of knowledge and skills progressively throughout the curriculum across discipline boundaries. Although uncommon, working collegially with other medical schools that are also undergoing change is particularly helpful [36, 37].

In order to meet agreed goals and outcomes, the educational experiences must be internally consistent, integrated and progressive. Good management is essential to ensure that the elements remain congruent and effective in order to achieve the goals or outcomes.

Student Selection

The design of a curriculum is interrelated with the characteristics of students who enter [16]. Medical schools aim to admit the 'best' students and selection is usually highly competitive. In some cultures 'best' means those academically most successful in previous studies. Others aim to select those whose personal characteristics best match the curriculum offered. Yet others admit those judged most likely to meet the medical needs of the local community, provided they meet basic educational standards.

In much of the world, particularly UK, Europe and former colonies, students are usually admitted straight from high school. In North America, selection is made from amongst college or university graduates. In Australia, about one third of the medical schools now admit only graduates, although for many years a few graduates have been admitted alongside school leavers. Those supporting graduate entry point to the maturity, secure motivation and greater self-knowledge of applicants. Selection from more mature applicants reduces pressures from schools and ambitious parents when entry to medicine is seen as a valued 'prize' [40].

Issues in selection have been well described [41]. Broadly, medical schools seek to admit academically capable, strongly motivated students. Personal characteristics that lead to success in the programme and later in the profession may be taken into account. Strategies vary.

In some countries, admission is based entirely on prior examination results, with or without specified subject prerequisites. Increasingly, national entry tests of understanding, reasoning and written expression are also used (e.g., the US Medical Colleges Admission Test [42] or the Graduate Australian Medical Schools Admission Test [43]). It has been strongly argued that personal qualities should also be assessed [44]. Interviews are common worldwide. Often they are idiosyncratic, not standardised, subject to bias. Interview questions for US medical schools, which may include inappropriate or even illegal questions, are now commonly posted on the Internet, so new strategies to obtain valid responses must be considered [45]. If interviews are well structured and objective, they are reliable and predictive of success in medical schools [46]. The Australian Universities Medical Admission Test, a written assessment of personal qualities, is used to contribute to selection of applicants from school [47]. Equity schemes may be in place to ensure that applicants from underrepresented minorities are not denied access [42, 48, 49]. Students appreciate studying with a culturally diverse cohort [50].

Effective communication skills are crucial for progress within a medical course and may be considered for selection. Students must be able to communicate in the community language(s) of their future patients. English, as the international language of science and medicine is, however, often the language of instruction. The understanding of spoken or written English can be assessed before or after admission when the local language is not English, but it may also be necessary in English-speaking countries with a high migrant intake [51]. Support to develop oral and written skills is then required [52].

Strategies to Encourage Learning: Some Issues in Medicine

A substantial body of literature is available for staff to encourage student learning at university generally [8, 53, 54]. Educational support for teachers, once concentrated narrowly on skills in presenting and transmitting information, has recently shifted its emphasis to the development and support of students' learning. Many universities have teaching development units to assist staff in gaining a sound understanding of modern educational theories and strategies; some now offer qualifications in teaching and learning.

Medical education is complex, as students must develop a variety of skills. These include: a good scientific

understanding of health and disease; skills to communicate effectively with patients and examine them competently; good reasoning and problem-solving; collaboration with various health professionals; a commitment to ongoing learning, and a capacity to appraise the burgeoning literature critically. Professionalism and issues of role modelling are now discussed, but there is no commonly agreed definition [6]. Several journals focus on medical education (see examples in the reference list below), some are available on line. Useful books offer practical advice specifically for medical teachers [55]. Some traditional methods including well-designed lectures are still valuable [56]. Nevertheless, an increasing body of evidence offers novel ideas for supporting students' learning both in academic and clinical settings. Good teachers keep abreast of educational developments in their disciplines along with scientific and clinical advances.

Strategies chosen to support learning must be aligned with the agreed goals or outcomes for the programme [13]. An inevitable tension exists between developing students' understanding or problem-solving and covering content. With the burgeoning of modern understanding in cellular and molecular biology, teachers must make choices about what is important for students to know. Ready access to large databases of information in computers (including hand-held devices) releases doctors from relying on memorisation and rote learning of isolated facts. Values and priorities are thus changing for basic medical education. Recalling immense lists of minute anatomical details or detailed steps in a myriad of biochemical cycles is giving way to understanding basic principles, developing skills in analysing complex issues, integrating and applying knowledge to solve clinical problems.

'Active learning' that engages the students in discussing, thinking, using and applying information has been a particular focus in the medical sciences [57, 58]. Case studies and working through problems are valuable. Clinical reasoning is essential for future health practitioners and there are strategies for assisting students to develop the necessary skills [59]. If the critical evaluation of evidence is to replace the uncritical memorisation of 'facts', the skills need to be introduced early, practised and progressively developed [12].

For many years it has been argued that communication skills should be introduced very early into curricula [60]. Effective communication both with patients and colleagues has become increasingly emphasised for practitioners [61]. The overall curriculum must change to ensure that communication is introduced systematically and assessed [62]. New teaching methods have been developed

[63], including the use of standardised patients [64]. Recently, an advanced model of communication has been developed [65]. More complex skills should be specifically taught later in programmes [66]. Although awareness of social and cultural difference would be expected to influence communication in practice, recent evidence suggests otherwise [67].

The use of various forms of information technology (IT) is increasing in medical practice [68]. It now pervades university education generally to: deliver information; offer access to interactive learning tools; provide simulations and case studies; support self-assessment and discussion groups; manage and supplement face-to-face teaching (through learning management systems such as WebCT and Blackboard) [69, 70]. Quality control is an issue. A more sophisticated use of IT sees a seamless integration into a new medical programme [71]. Despite earlier concerns, students will accept computer-aided learning regardless of learning preferences [72]. Journals include examples of effective approaches to computer-based learning. IT is obviously crucial for developing skills in evidence-based medicine [12]. Interactive learning resources on CD-ROM or from the Internet are burgeoning and a strong case has been argued for the sharing of databases of validated learning objects between schools [73]. The problems lie in adequate quality control and suitability for the particular audience; staff need to acquire skills of critical evaluation.

Problem-Based Learning

Probably the most dramatic change in medical curricula came 30 years ago with the development of problem-based learning (PBL) in medicine at McMaster University, Canada [74]. Since then, variations on the method have been adopted by medical schools worldwide, reflecting many diverse cultures [e.g. see ref. 15–19, 36, 75]. PBL is a much-used term that does not have a single, agreed meaning, so it is crucial to define the specifics of any system under discussion [76–81].

PBL is used widely within and outside medicine [82]. Key elements include: the initial presentation of a problem carefully designed to drive enquiry and active learning in a small group; students are inducted into the process; ideas are freely exchanged; learning issues are identified by the group to help resolve the complexities of the problem; a trained tutor is a facilitator, not a source of information. The problem may be presented orally by the tutor, on paper, video or computer [83]. The 'trigger' may

be brief and simple, stimulating broad thinking, or highly detailed, requiring analysis. A cognitive structure underpins the process of the tutorial and contributes to the students' developing skills in clinical problem-solving. The primary aim, however, is not to find a single 'right' answer but to explore ideas and identify issues for individual learning. Active participation of students is essential in two or three tutorials, as they discuss and rehearse ideas, only possible in a group of fewer than 10. Particularly in the 'hybrid' PBL programmes that include some structured teaching [84], time must be programmed and protected for self-directed learning [34]. Many PBL programmes include the basic characteristics listed above, although implementation varies considerably [85]. With ready access to computers, PBL can now incorporate evidence-based medicine into the discussion [71].

Supporters of PBL have demonstrated that it is an effective method of active learning. Critics, however, continue to express concerns that students will not gain 'enough' knowledge and may harbour misconceptions, although comparative data, available for 10 years from results of US Medical Licensing Examinations, show that students in traditional and PBL programmes perform similarly [79, 86–88]. Although it has recently been claimed that effects in other dimensions were not apparent [89], the differences are inherently small and difficult to measure [90] but the effectiveness of PBL has consistently been demonstrated [91]. Successful elements include the satisfaction of students (and staff), clinical reasoning and skills, retention of knowledge and perhaps teamwork. More recently it has been argued that PBL successfully contributes to clinical problem-solving [92].

The interactions inherent in PBL programmes enhance communication skills and encourage teamwork. Although less often discussed, one of the benefits of PBL lies in the integration of knowledge that comes from considering problems set in a rich context. In discipline-based programmes, with a separation between 'basic' and 'clinical' sciences, students find it difficult to recall and correlate knowledge acquired at different stages and settings. Another undoubted benefit is that students rapidly become fluent in using scientific and medical language. The tutor's role is crucial, and valuable support is offered in Schwartz et al. [93].

It is useful to maintain a distinction between traditional case-based and newer problem-based learning [76]. Clinical cases or examples have long been incorporated into basic medical and health science curricula, in large groups and in situations that lack the defining characteristics of PBL. Rather than the core of learning, a case-based

approach may represent no more than an occasional additional exercise in an overloaded didactic programme [85]. In such programmes, staff are usually untrained in developing well-structured, integrated problems and in managing the interactive tutorial process. Students are rarely prepared adequately and focus on finding 'the answer'. For clarity, particularly if positive or negative effects are claimed, the specific characteristics of particular programmes need to be explicit, including the time available for self-directed learning.

PBL has often been said to be more expensive [89], in part because of the time commitment of basic staff. Nevertheless, it need not place unreasonable demands on their time [94]. That issue can be taken into account when designing a PBL curriculum, by carefully costing staff time and resources [34].

Principles of Assessment for Learning in Medical Programmes

Assessment drives learning; I can only deal briefly with some general principles from an enormous literature. Assessment must match the goals or expectations of the programme, be fair and consistent with the teaching methods used [13, 95]. Many strategies are available for assessing medical students [96]. Expectations or outcomes include not only relevant knowledge, but also effective communication, physical examination, basic procedures, clinical problem-solving, critical appraisal and perhaps teamwork. Professionalism, now considered important for students, still lacks quality assessment tools [97]. Assessing practice more broadly is a substantial challenge [98].

Outcome-oriented curricula provide a guide to assessing the anticipated competencies [9, 39, 99]. It has also been argued that the explicit link between learning and assessment has implications for quality assurance in practice [100]. Particularly in problem-based curricula, it is a particular challenge to ensure that assessment is compatible with the style of learning [95, 101].

Reflective practice and realistic self-evaluation are important outcomes for medical graduates. One recent strategy – formative assessment (without penalty) – encourages effective, progressive learning and the skills of self-assessment [102, 103]. For knowledge-based areas of the curriculum, it is crucial to ensure that the questions are relevant, appropriate and of high quality. When formative questions are made freely available on line, students make extensive use of them [71]. In clinical settings, good

tutors have always supported and encouraged students to self-assess by reflecting and commenting on their own performance. In PBL programmes, tutors and students regularly self-assess their performance and progress; those skills remain fairly stable over time, thus laying the foundations for effective reflection in practice [104].

Regardless of the sort of curriculum, many issues must be resolved for summative assessments. These include: graded or based on standards? If graded, how to weight and aggregate different elements? What is the balance between: written and/clinical assessment, knowledge and practical skills, professionalism, ethical behaviours, formal knowledge?

While multiple-choice questions are widely used, unless carefully prepared and rigorously evaluated, they may be invalid or misleading. If not well-constructed, they may encourage superficial rote learning and memorisation rather than deeper understanding and problem-solving. Strategies for standardising the experience in clinical examinations have led to a range of different formats [96]. Although there are many ways of assessing clinical performance, including a range of so-called 'objective' tests, objectivity and reliability may still remain elusive [105]. Training is needed to ensure that different examiners understand, accept and apply common standards [106]. Quality in assessment – fairness, appropriately targeted to the goals or outcomes, reliability – remains a continuing challenge for all medical teachers.

Evaluation for Quality

'Evaluation' and 'assessment' are sometimes used interchangeably. It is useful to distinguish them by using 'assessment' to refer to the measurement of student achievement. Evaluation then relates to methods of reviewing a programme, unit of study, teaching experience, or teacher [107].

Evaluations of the experiences of students and staff provide essential data to enhance quality progressively [102]. A programme can also be evaluated against its own goals or outcomes, although long-term studies are difficult. Students' academic and clinical performances can be assessed throughout their learning in order to identify areas of strength or weakness. Examples of failure to meet agreed goals or standards can be addressed. Decisions on corrections or improvements must then be fed back into the curriculum. It is increasingly apparent that students' expectations and classroom (or clinical) experiences are related to the effectiveness of their learning [54]. Compar-

isons between institutions are seldom particularly useful because of disparities between overall goals and expectations, as well as staff, students and resources.

Data can be collected orally, e.g. in focus groups, or in pencil-and-paper questionnaires, but ready access to computers automates the collection of data [108]. The usefulness of any evaluation for curriculum improvement, however, will always depend on the quality and relevance of the questions posed. Well-designed questionnaires target specific issues that are amenable to improvement, or seek opinions on the extent to which goals have been achieved, rather than establishing whether students like or dislike particular aspects of their programmes.

There are, however, still sensitivities about aspects of students' evaluations of their teachers or of elements of the curriculum. Some teachers question the right of students to pass judgement on staff, others are defensive or anxious. It is worth encouraging students to report on the extent to which their own styles of learning and preferred study methods match the delivery of the curriculum, separating issues of the personalities or styles of particular staff from the educational processes. Finding out *what* makes a lecture, clinical experience, practical class or tutorial effective or ineffective is more useful than assigning blame. Staff are more comfortable with questionnaires that offer the opportunity to indicate positive suggestions for improvement rather than focussing on negative or destructive criticisms.

Staff Development: Supporting the Teachers

Whatever the curriculum, staff need assistance to develop their skills as teachers. Most are selected for their research or clinical performance rather than skills in teaching. Few have engaged with modern educational theory and practice. Many are unaware of the growing literature on good-quality medical education and will have only limited time to devote to updating their educational skills. It is now widely accepted that institutions have an obligation to assist all staff in their teaching, whether from a central university unit or one that deals specifically with the complexity of medical education. Well-grounded books on university teaching [8, 54] are very helpful.

Policies need to be in place to ensure that the teaching programme's content and processes are of the highest contemporary standard. It is essential that staff understand the philosophy of the programme in which they teach, its goals or outcomes, the nature of the students, the teaching strategies to be used and the resources available. Teachers

need to work together to reduce unnecessary duplication and redundancy and to ensure a consistent approach to encouraging student learning. They need to be confident in using a range of different educational strategies [109].

Faculty development is crucial, as a result of new environments for learning, including the use of computers, changes in skills training (including sensitive communication) and early clinical contact. Older skills (e.g. in lecturing) may still need to be developed [56]. In a comprehensive review of the subject, it has been argued cogently that professional development should orient new staff broadly to their academic roles [110]. Assistance and support, specifically for teaching in changing environments, is essential. Those who lead and manage curriculum design and change need to be able to evaluate and advance medical education in a scholarly way. An immersion programme for experienced staff can be effective in enhancing both teaching skills and educational reforms [111]. New models have been developed to support staff who are committed to professionalism in teaching within highly respected institutions [112, 113].

As will be apparent from earlier sections of this review, consistency across the medical curriculum is needed to build progressive understanding and skills. If there is to be genuine integration, including the implementation of newer strategies like problem-based learning, collaboration and effective management become particularly important. A recent review [114] provides valuable insights into these issues.

Summary and Future Directions

Teaching medical students is a complex responsibility and there is a growing acceptance of the need to adopt modern practices to ensure effective learning. Medical teachers, with competing demands on their time for clinical work, research and keeping up to date with knowledge, need assistance to maintain and enhance the quality of their teaching. They are now supported by a growing liter-

ature that offers some guidance on effective strategies. Specific educational units, the growing literature and educational conferences or workshops enhance their understanding of students' learning and encourage the development of evidence-based practice in teaching. Problem-based learning is clearly very effective when it is applied thoughtfully. Institutional measures must support good collaborative management of the curriculum, including planning, mapping and critically evaluating the processes and the outcomes to support continuous improvement. Key curricular elements go beyond defining content to a systematic development of the students' communication and clinical skills, critical reasoning, and teamwork. Assessment must embrace all of the desired outcomes.

What are the issues for the future? The growing literature in all medical fields as well as in university education provides a mass of information, but finding time to read even a fraction of it remains a challenge. The further development of the Best Evidence Medical Education movement will encourage the writing of systematic reviews and provide guidelines on best practice. Interprofessional education [115–117], aiming to enhance clinical teamwork and understanding, is a 'new frontier'. The explosion in the use of information technology in education continues, and there is an increasing understanding of what makes it effective [69]. A greater sharing of high-quality learning resources [73] may relieve teachers of some of the burden of development, but staff need time to review and evaluate them for local use.

Local, national and international workshops in medical education (including some that are discipline-based) are becoming more common [85], and those who attend find them valuable for sharing ideas, seeing strategies first-hand and evaluating the likely impact of particular interventions. I hope that some of those activities can be generated for on-line delivery to allow a wider audience to participate. There is now a wide variety of good journals, some on line. Higher degrees in medical education are more generally available.

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