

21st century medical education

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Abstract

Australian universities provide good examples of how to meet the growing challenges to the training of doctors that have resulted from information overload in traditional curricula, new models of care, including multidisciplinary team dynamics, and the rigours of evidence-based practice.

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... there is a difference between knowing and doing, and the focus of learning in medicine is to produce a set of informed behaviours.¹

Richard Hays

FROM THE TIME of the often itinerant barber-surgeon,² medicine has been seen as a synthesis of science and art.^{3,4} While the conceptualisation of medicine has become more sophisticated,⁵ the major focus in the training of doctors⁶ has continued to be the science base, increasingly influenced by the development of an extensive evidence base defining sound practice.

As the medical knowledge base has grown, it has become increasingly difficult to fit all the knowledge that is considered necessary in the training of a doctor into the time available within a curriculum.⁷ The traditional approach to curriculum development has been questioned, primarily in light of new teaching methods such as problem-based learning (PBL), content overload, and a growing perception that the human side of medicine, history taking, empathy, and seeing the

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What is known about the topic?

Several areas of innovation in medical education have been adopted in recent decades.

What does this paper add?

This paper reviews successes in curriculum innovation and highlights successful implementation in Australian universities.

What are the implications for practitioners?

Universities undertaking design or reform of medical curricula can use this reference to look for successful innovative curriculum enhancements.

patient as a whole person, was being short-changed.

Consequently, medical curricula began to experiment with new, sometimes radical, approaches to training doctors. This paper reviews some of these trends in Australia and describes a new model in northern New South Wales.

Educational strategies

The integration of philosophical thinking into the educational process is ... hampered by its apparent incompatibility with the scientific/reductionist mindset preeminent in modern medicine.³

James Brawer

The fundamental challenge in the evolution of educational pedagogy has been to identify the changes needed. In a recent editorial,⁸ Prideaux challenged designers of medical programs to consider the demands of projected workforce and skill shortages. He itemised a list of attributes that a "symbiotic curriculum"^{9,10} ought to embody (Box 1).

Writing with the perspective of a recently graduated medical student, Skinner identified flexible delivery, an outcomes-based curriculum, and a

I Values of a new core medical curriculum

- a commitment to working in areas of need for some or all of subsequent careers
- a commitment to working in and improving the public health system
- a commitment to continued self-learning
- a commitment to (supporting) the learning of new entrants to the profession, particularly workforce obligations
- a commitment to maintaining contact with and supporting the program of medical schools and associated health services

(Prideaux, 2006⁸)

focus on future workforce needs as fundamental to a future-oriented medical education program.¹¹

The United Kingdom (UK) has long argued for clinical skills to be the focus of medical education.¹² Likewise, the Association of American Medical Colleges (AAMC) Task Force on the Clinical Skills Education of Medical Students developed the term “clinical method” to define that set of universal competencies that all doctors must acquire through their formal education. Each competency in turn comprises a set of discrete skills, and the AAMC determined that the focus of medical education should be mastery of these skills.¹³

Learning environment

The relationship between teachers and learners can be viewed as a set of filters, interpretive screens, or expectations that determine the effectiveness of interaction between teacher and student . . . learning is contextual, and one of the most important contexts for human beings is other people who said it and what is the relationship of the learner to the teacher.¹⁴

Richard Tiberius

Medical curricula are developed through opinion-based consensus-building processes, driven pri-

marily by the most influential discipline groups involved.¹⁵ In each institution, a set of attitudes, beliefs, and customs evolves around the formal learning plans developed by a faculty. This set of largely unwritten rules influences, and often governs, the day-to-day interactions among faculty, administrators, and students. This is referred to as the “hidden curriculum,”¹⁶ which can be measured using a validated instrument.¹⁷ Understanding these agenda-driven, cultural aspects of the learning environment is critical to the success of medical education, particularly in identifying areas where frictions may emerge between different cultural elements, and where curriculum components may be retained through institutional inertia rather than true educational need.

Transdisciplinary education

Learning is a continuous process grounded in experience, not an outcome.¹⁸

Phillip G Clark

One of the long acknowledged, but unsolved, problems in medical training is how to develop the complex relationships between disciplines that make up a health care team. Doctors, nurses, and allied health professionals earn their qualifications in isolation from each other, and then are expected to work closely as a team providing patient care.

Some medical education programs have begun to develop an integrated¹⁹ approach to clinical problem solving that unites health professionals.²⁰⁻²⁷ Ideally, this should include the active involvement of the wider community as well as the whole of the health service provision community.²⁶ Describing the ultimate goal of such efforts as transdisciplinary practice connotes a merger of efforts that conveys true mutual benefits.

Efforts to achieve true transdisciplinary education have faced serious logistical and philosophical problems. Reeves and Freeth²⁸ identified these as:

- Parity of numbers of students across disciplines in integrated learning environments;
- Timetable conflicts between professional discipline programs;

2 Flinders University

Flinders University has developed the Parallel Rural Community Curriculum (PRCC), launched in 1997.³⁰ The PRCC curriculum offers a full year (year 3) of clinical experience and learning based in rural general practice as an option to replace clinical rotation based largely in a tertiary hospital. The program emphasises vertical integration and has defined five elements for successful integration:³¹

- raised educational stakes;
- local ownership;
- broad university role;
- longer attachments; and
- shared workforce vision.

Flinders compared differences in student perspective gained from the PRCC program compared with students on the traditional clinical rotation set.⁹ Among the findings, students involved in the PRCC curriculum displayed a marked sense of ownership of their education, direct personal involvement with patients, and an increased sense of autonomy and self-directedness as compared with their city-based peers.

Rural placements, especially when built around transdisciplinary curricula, are resource intensive.²³ Flinders cautions that the rural clinical experience needs to be integrated over a continuum of care, rather than compartmentalised into discrete, discipline-based learning experiences. A consequence of this is that the student's initial impression of the rural curriculum can be one of confusion and disorganisation. This is compensated for as the year goes along by the immersion experience of the rural placement, the collegial relationship with teaching faculty and the real-time continuity of care for individual patients.³²

- Issues of validation, accreditation, and content for cross-discipline units of instruction;
- Equitable apportionment of costs and resources.

Mayers and colleagues offer five principles to guide development of a transdisciplinary curriculum:²⁹

- Commitment to promoting health and wellness in the context of the individual, family, and community;
- Commitment to practising "whole person care";
- Commitment to being a reflective practitioner;
- Commitment to health, human rights and social responsibility;

- Commitment to practice within a health team.

Australian medical schools have begun to explore this, particularly through rural placements, where the smaller population base naturally drives professional cooperation and integration over specialisation. Flinders University has documented some successes with this approach (Box 2).

Problem-based learning

Students find PBL to be an effective learning tool, depending on the enthusiasm and expertise of the tutor.^{33,34} In studies that have compared PBL with traditional teaching/learning models on the development of diagnostic competence, PBL has shown an advantage.³⁵ Online or virtual reality tutorials may supplant problem-based learning as a central component of medical education.³⁶ Students become more focused on the discussion components of PBL than on the literature as they progress through their medical education, so that PBL is effective in developing self-directed learning and critical analytical skills.³⁷

While students prefer small group PBL sessions, the effectiveness seems to be equal to that of large PBL sessions held in lecture-theatre format.³⁸ Currently, PBL is an essential component of medical education in Australia, and is being applied in other disciplines, such as public health.³⁹

Use of simulations

The ideal educational experience allows students to engage with real patients and participate in decision making in a structured, well-supervised environment from the earliest practical safe point in their education. However, an exact mix of patients to provide all experiences a student will need to become a well-rounded doctor is not always available. Further, some doctor-patient encounters are unsuitable for undergraduate learning experiences due to real dangers posed to patients and/or students. Consequently, patient simulation has evolved as an effective tool in medical education,^{40,41} with tested and proven techniques for implementation.⁴²⁻⁴⁹

3 The North Coast Medical Education Collaboration (NCMEC)

NCMEC is a new joint initiative of the University of Western Sydney (UWS), the University of Wollongong (UW) and the University of Sydney (USyd) medical schools. It aims to develop a shared program for training medical students in regional and rural settings on the NSW North Coast. Interested and eligible students from the three schools will study at rural NCMEC sites in placements lasting up to a full academic year.

Each of the three partner universities has a curriculum designed to be vertically integrated with an increased emphasis on primary care and the links between primary, secondary and tertiary care. The patient-orientated clinical encounter is the main focus of education throughout each course. NCMEC learning objectives will focus on building clinical skills and on integrating technical competence with the ability to work effectively in a trans-disciplinary team environment. The emphases are on general practice and rural practice settings.

Delivery of the shared educational program will rely heavily on local practitioners in the Northern Rivers region. A recent literature search found scant data on what works in educational partnerships between universities and clinicians, especially in rural areas.⁶³ To succeed, NCMEC will need to quantify the amount of time local clinicians have available to teach, how teaching will affect their practice, what types of educational support and training clinicians will need, and what resources NCMEC will deliver to support teaching.

Research on satisfaction and performance of students and faculty, spin-off research projects initiated by faculty or students, and a mixed qualitative and quantitative assessment of program components will be among the ways that the three universities will attempt to capture the successes of NCMEC for the wider medical education and health care provision community.

Simulation may be the preferred medium to train students in how to break bad news,⁵⁰ how to respond to clinical situations where the potential of sexual impropriety arises,⁵¹ in general clinical skill building using standardised patients,^{52,53} and even in giving students a condensed but realistic sense of the experience of the changing needs and orientations of individual patients as they age in a doctor's client population.⁵⁴ Simulation tools include computer-based systems,^{55,56} manikins⁵⁷ and biometric body

parts for practice of invasive procedures,⁵⁸ and actors playing the role of patients to provide both training and assessment.⁵⁹ Patient simulation is used to some extent in virtually all Australian curricula.

A recent Best Evidence in Medical Education (BEME) systematic review found that the overall quality of published research on high-fidelity (exactness of duplication) medical simulation research was weak.⁶⁰ However, it also concluded that there was sufficient justification under the best available evidence to conclude that under the right conditions, simulation-facilitated learning had the potential to contribute to medical education.

Research in primary care

To date, there has been limited research performed in the primary health care setting, despite much discussion about the desirability of building capacity in this setting.^{61,62} For general medical practice to evolve and improve, general practitioners will need to actively engage in research that develops and captures practice improvements in a systematic fashion. To achieve this, the way that research is addressed in medical curricula must change, commencing early in medical training. The curriculum should include modules designed to impart basic research skills and a good mental model of how doctors can engage in research while retaining their identity as primary care providers (Box 3).

Flinders University has tested a model (personal communication, Farmer L, Director of Education, National Primary Care Collaboratives Program, 2007) where students conduct research projects in the communities in which they are placed, involving community leaders in the process. Most such research involves straightforward surveys of health-related knowledge and behaviours. A fast-tracked ethics approval system was set up for the purpose, and students present their results to peers, faculty and community members.

Research networks, as developed in North America⁶⁴ and the UK,⁶⁵ have shown the most promise in instilling and expanding a research

4 James Cook University (JCU)

JCU holds the distinction of being the first medical school in northern Australia and the only stand-alone rural medical school in Australia. Established in 1999, and growing out of the North Queensland Clinical School that was founded 7 years earlier, the JCU medical education program focuses on rural and remote health, tropical basic and clinical science health, and indigenous health issues, built on an integrated framework of basic and clinical science taught with emphasis on a problem-based mode of learning. Community groups are involved in program design.⁷⁰ In responding to regional health workforce needs, JCU believes that supported students who are trained to appreciate the benefits of rural/remote practice will be more likely to choose rural practice settings.⁷¹

agenda on primary care practices. In Australia, the Commonwealth-funded Primary Health Care Research and Evaluation Development (PHCRED) strategy has been the centre of activity in developing research potential in systems that deliver health care.^{66,67}

Community/rural placements

Curricula, the basis of education, are devised by committees of faculty members according to their own concept of what is best, from their own outlook and at their level of knowledge ... Little thought is given to what students must go through — people who are one-third to one-half the age of the faculty, differently educated, from a different culture, with different goals. No one on the faculty experiences what students actually go through.⁶⁸

Ludwig Eichna

As described in Australia,⁶⁹ and confirmed by systematic review,³² students embedded in rural practice situations develop a sense of themselves as practitioners earlier than their city-trained counterparts. One explanation for this may be the earlier and more direct integration of technical skills with consulting skills. The historic artificial separation of the scientific aspects of medicine (generally taught in the metropolitan

hospitals) from the skills required to become an empathetic caring healer (generally passively acquired in the community/clinical setting), while optimal for the development of students intending to specialise, is less effective for grooming balanced general practitioners. While all Australian medical schools now host some form of rural placement opportunity, James Cook University has arguably advanced the concepts the farthest (Box 4).

A recent BEME systematic review³² provides a comprehensive and definitive assessment of the value of community-based clinical experiences as part of early medical education. Community-based education also provides unique opportunities to maximise learning, especially in the field of chronic care, and may improve quality of community residential care,⁷² which further emphasises the symbiotic nature of teaching and community development. Shared patient–doctor decision making and patient management plans for chronic disease, long undervalued in campus-based medical education,^{73,74} can be realised more effectively in a community-based medical educational environment.

The perspective that students gain from community-based health delivery systems grooms them to become change agents for those systems. With fresh eyes, they can readily identify areas for improvement of unhealthy processes as well as patients, paralleling development of their skills in provision of care with skills in assuring better, well-integrated care delivery processes.⁷⁵

In rural placements, local preceptors serve as teachers and role models to students in the areas of medical expert, professional, scholar, communicator, collaborator, patient advocate, and manager.⁷⁶ Practising doctors devote time to student training for the professional and personal satisfaction that the activity brings.⁷⁷ In order for community placement programs to be sustainable, it is necessary to provide an ongoing program component designed to develop teaching skills in local rural doctors.⁷⁸ Simpson et al provide the following principles as keys to the 15 year success of their program:

- support and endorsement by department leadership;

- alignment of educator roles, institutional needs, and excellence;
- creation and recognition of durable educational materials linked to institutional needs;
- a multidisciplinary faculty development team; and
- use of extramural funding to enhance program structure and local creditability.⁷⁹

Conflicting demands may be placed on clinical supervisors/preceptors, especially in rural areas, with workforce shortages and students from multiple universities with different curriculum foci and assessment methods.⁸⁰

Rural medical practice is different from urban practice in the context, content, and process of provision of health care,⁸¹ placing greater demands on the rural supervisor to deliver diversity in training. Research by the Consumers' Health Forum of Australia⁸² indicates rural health consumers expect to have access to anaesthetic, obstetric, minor surgical and other minor procedural services through their local general practitioners, again increasing the complexity of teaching requirements and clinical case mix.

Evaluation

Assessment of effectiveness of a teaching program should be developed in parallel with development or revision of the curriculum. This evaluation process should be ongoing, part of student, preceptor, and administration routine, rigorous, and set against objective, measurable standards. Spiel and colleagues have published a comprehensive framework for planning and carrying out a comprehensive, systematic evaluation⁸³ including:

- baseline evaluation of the existing curriculum;
- prospective conceptual evaluation of the new/revised curriculum;
- formative evaluation of process and teaching methods of the new/revised curriculum;
- summative evaluation of the results of the new/revised curriculum;
- impact evaluation of long-term consequences of the new/revised curriculum.

5 University of Western Australia (UWA)

UWA commenced a rural placement program in 2003. The placement is for year 5 of an MB BS, and is community based. Community preceptor faculty members were recruited from the GP and specialist population and trained to make up the teaching workforce. The curriculum was not varied for rural placement students relative to home-based students, but delivery mode and "program of learning" are different.⁶⁹

UWA found, as have others,⁸⁴ that their rural placement students did at least as well as their urban-based counterparts.⁶⁹ Rural students thrived on being "embedded" in the daily provision of care to patients, as opposed to the more distinct dichotomy between student and teachers/patients that traditionally is found in urban teaching hospital clinical rotations.

The rural experience also was found to be more "interdisciplinary" and team-focused than the urban clinical experience. A 2-week orientation to the community has been beneficial to orienting students to their new environment. One of the more interesting things that UWA found is that student appreciation for this orientation was not immediate. Rather, after an initial period of scepticism regarding its value, students came to the realisation that their placement had been made richer by it.⁸⁵ UWA uses a system of asynchronous, continually available online learning, both web-based and on CD, that they have dubbed FlyingFish.⁶⁹

The University of Western Australia medical school has evaluated their programs with an emphasis on some of the teaching methods we have examined (Box 5).

An independent external evaluation is worthwhile to ensure an objective process that captures all relative aspects of the learning experience. This evaluation should cover student and teacher satisfaction, student performance, lessons learned for future program years, feasibility, community impact, and cost effectiveness. Patient feedback can also play an important role. While patients are not able to evaluate a clinician's technical performance, they provide a key perspective to the behavioural factors that lead to success as a practitioner and as a teacher.⁷⁶

The Australian Medical Council (AMC) sets national standards that apply to every medical school.⁸⁶ However, each school is encouraged to devise a program of learning that reflects the particular workforce needs of their geographic region, while retaining the ability for a graduate to work anywhere in Australia. This creates diversity in training, with inevitable competition between the delivery of core sciences and humanities, ethics, and community service. Over time this has led some to question whether appropriate AMC standards are still being met for pharmacology, pathology and anatomy, in particular. This resulted in the Council of Australian Governments agreeing to consider national standards for assessment, registration and accreditation.⁸⁷

Conclusion

In an age of increasing workforce shortages, the modern medical curriculum needs to incorporate proven teaching methods that produce better doctors. Australian universities provide good examples of how to meet the growing challenges resulting from information overload, new models of care and multidisciplinary team dynamics, and the rigours of evidence-based practice. Retaining the human face of medicine is critical to meeting the complex demands that more informed patients and a more expectant society place on practising doctors.

Medical education in Australia has entered an era of growth. New medical schools have been launched at the University of Wollongong, University of Western Australia, Bond University, and elsewhere, while long-standing programs have been subject to thorough reviews and revisions of their approach.

In this paper we have provided brief frameworks for best practice in the areas where the training of doctors can develop, with reference to literature appropriate to Australian curriculum development or revision. The incoming generation of doctors will face demands in changed casemix, technologies, and clinical redesign. Their practising clinical teachers must

therefore create a learning experience that is different from their own. There are two key challenges described in this text. The first is to integrate disparate approaches to learning into integrated learning packages, by overcoming the sequestering of curriculum content in discipline areas. The next is to advance medical education research, capturing areas in need of ongoing improvement and successes.

Competing interests

The authors declare that they have no competing interests.

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