An innovative outcomes-based medical education program built on adult learning principles

H. PATRICK McNEIL, CHRIS S. HUGHES, SUSAN M. TOOHEY & S. BRUCE DOWTON
University of New South Wales, Sydney, Australia

ABSTRACT An innovative medical curriculum at the University of New South Wales (UNSW) has been developed through a highly collaborative process aimed at building faculty ownership and ongoing sustainability. The result is a novel capability-based program that features early clinical experience and small-group teaching, which offers students considerable flexibility and achieves a high degree of alignment between graduate outcomes, learning activities and assessments. Graduate capabilities that focus student learning on generic outcomes are described (critical evaluation, reflection, communication and teamwork) along with traditional outcomes in biomedical science, social aspects, clinical performance and ethics. Each two-year phase promotes a distinctive learning process to support and develop autonomous learning across six years. The approaches emphasize important adult education themes: student autonomy; learning from experience; collaborative learning; and adult teacher–learner relationships. Teaching in each phase draws on stages of the human life cycle to provide an explicit organization for the vertical integration of knowledge and skills. A learning environment that values the social nature of learning is fostered through the program’s design and assessment system, which supports interdisciplinary integration and rewards students who exhibit self-direction. Assessment incorporates criterion referencing, interdisciplinary examinations, a balance between continuous and barrier assessments, peer feedback and performance assessments of clinical competence. A portfolio examination in each phase, in which students submit evidence of reflection and achievement for each capability, ensures overall alignment.

Introduction

After 200 years of continual reform in medical education (Papa & Harasym, 1999; Carraccio et al., 2002), there is now an emerging and explicit emphasis on programmatic outcomes (Smith & Fuller, 1996; Harden et al., 1997; Harden, 2002a). This change towards outcomes-based education (Harden et al., 1999), contrasts with previous innovations that focused on the learning process rather than disciplinary content, and which, over 30 years, has seen widespread adoption of problem-based learning (PBL). Evaluations of PBL process-focused curricula (Albanese & Mitchell, 1993; Vernon & Blake, 1993; Colliver, 2000) may have contributed to a renewed focus on outcomes-focused learning, but other factors include ensuring competence of practicing physicians by accreditation bodies (Australian Medical Council, 2002; Simpson et al., 2002) and establishing a common set of standards for doctors in a globalized medical workforce (Schwartz & Wojtczak, 2002).

At the University of New South Wales (UNSW) we reformed a discipline-based curriculum without a priori preconceptions as to product, process or curricular structure. Rather than adopting existing curricular models, and recognizing that sustainability and ownership of a new curriculum were important factors in successful change (Bland et al., 2000), we engaged our large, complex and geographically dispersed faculty staff in an extended period of highly collaborative, cross-disciplinary dialogue, innovative thinking and iterative planning. Early in the design work, a number of key values became apparent that related to product and process, as well as the learning environment (Table 1). Planning started with a ‘blue skies’ approach to define characteristics of a graduate needed to practice in future medical environments. From these considerations, two themes dominated initial thinking: the program should ensure the development of lifelong learners, and it should explicitly address the personal and professional development of students and graduates.

Practice points

- An outcomes-based approach was used to design an innovative three-phase medical education program where the staged achievement of eight primary capabilities served as the blueprint for subsequent program design.
- The development of generic capabilities (communication, teamwork, self-direction, reflection) represents an explicit curricular core upon which applied medical knowledge and skills are built.
- Alignment between teaching and learning activities and outcomes was ensured by early design of an integrated assessment system linked by criterion referencing to the achievement of all eight capabilities, and which includes portfolio examinations in each phase.
- The focus on outcomes is matched by significant emphasis on the learning process, which evolves through each phase of the program to match the learning needs of students, and is built on contemporary understanding of adult learning.
- A learning environment that values the social nature of learning is explicitly fostered through the design of learning activities, vertical integration of students, and elements of the assessment system.

Correspondence: H. Patrick McNeil, Faculty of Medicine, Office of Medical Education, University of New South Wales, Sydney, NSW, Australia, 2052. Tel: (61) 2 9828 4088; fax: (61) 2 9828 3561; email: p.mcneil@unsw.edu.au

ISSN 0142-159X print/ISSN 1466-187X online/06/060527-8 © 2006 Informa UK Ltd.
DOI: 10.1080/01421590600834229
At the same time, it was agreed that the learning process should emphasize key aspects of adult learning; student autonomy, the use of personal experience in learning, presentation of content within authentic (meaningful) contexts, and catering for diverse learning styles (Kolb, 1984; Knowles, 1994; Brookfield, 1996). Significant value was also placed on the social or collaborative nature of learning (Brown et al., 1989), and a need to establish adult teacher–learner relationships. Finally, a program with significant flexibility was called for, to permit enhanced student choice, cater for diverse learning styles, and allow future adaptation in response to evaluations or changed external drivers. After a lengthy development process, the new program started in 2004.

Importance of lifelong learning

An important influence was recommendations of Candy and colleagues (1994, 1999) that all degree granting programs “should aim to have at their heart, the development of lifelong learning competencies, and that disciplinary content should be wrapped around the core” (Candy & Worrall-Carter, 1999). Development of the relatively generic competences of lifelong learners is variably prominent in the integrated new curricula of many process-focused medical schools, but they typically sit alongside biomedical, psychosocial and clinical elements, or are emphasized outside the core curriculum. In a radical departure from this practice, the core of the UNSW curriculum is not content-based, but an explicit development of lifelong learning and other generic capabilities, upon which the construction of biomedical and psychosocial knowledge and clinical capabilities is built.

An outcomes- or capabilities-based program

The commitment that all UNSW medical students would graduate as effective lifelong learners, able to continue to develop personally and professionally, demanded adoption of an outcomes-based educational model. We have chosen to refer to the program outcomes as ‘capabilities’ rather than competences. Competence has a somewhat mechanistic overtone and suggests a level of technical skill. We preferred the idea of capability as put forward by the Capability in Higher Education movement in the United Kingdom, which suggests that ‘capability’ should encompass not only knowledge and skill but the capacity to take effective action in unfamiliar and changing circumstances, to be able to explain what one is about, work effectively with others and continue to learn from one's experiences (Stephenson, 1992)—a concept essential for twenty-first-century medical graduates.

At UNSW eight primary educational capabilities are grouped into three broad areas (Figure 1). The capabilities were developed from the initially defined key values (see Table 1), literature searches, consultations with other medical schools and panels of experts. Candy et al.’s model (1994) was adapted to conceptually depict development of lifelong learning and other generic capabilities as an explicit core of the curriculum. For each capability, a set of approximately 17 indicator statements was developed, grouped into three levels that define the expectations of achievement of each capability by the end of each of the three phases of the six-year program. Overall, there are 138 indicator statements for the eight capabilities, or an average of 46 per phase. An example for two of the capabilities is given in Table 2 (available on Medical Teacher website, http://www.medicalteacher.org), and the full ‘Graduate Capability’ document can be accessed at: http://www.med.unsw.edu.au/medweb.nsf/page/Graduate%20Capabilities.

The indicators are not instructional objectives but broad statements of what students should achieve and what will be assessed by the end of each phase of the program (Harden, 2002b). They represent minimum expectations but are not intended as checklists for performance assessments: rather they indicate the expected range and depth of acceptable performances. To ensure alignment of the program aims, learning activities and assessments, the Graduate Capability document has served as a blueprint for ongoing design of the curriculum and assessment system. All capabilities are equal in importance, and students must demonstrate achievement of all eight capabilities at the appropriate level to progress through each phase and graduate.

A modular six-year, three-phase structure

The program has a modular structure with a series of fully integrated eight-week courses studied over 27 teaching
periods, and is divided into three phases, each of approximately two years duration (Figure 2). Phase 1 consists of nine eight-week blocks; phase 2 of four clinical periods plus an Independent Learning Project; and phase 3 of 10 entirely clinical rotations. Students are also required to take courses in other faculties to encourage breadth of learning during their university experience.

Integrated curricula require broad organizing domains to structure content presentation. At UNSW, the human life cycle was chosen as it is highly relevant to health and life sciences and it facilitates design of a spiral curriculum. One consequence has been a much earlier exposure to reproductive medicine and child health than occurs in traditional medical programs. Learning and teaching is organized around three stages of the human life cycle plus society—the human environment, reflected in the names of the four fundamental domains of the program (Table 3). Each domain has four themes, which provide a focus for its concerns. In phases 1 and 2 the courses are explicitly linked to these domains and provide vertical integration of issues, albeit with different content. Students revisit the domain themes many times over six years to ensure they develop a rich understanding of how the themes apply to medical practice across a range of contexts. Phase 3 courses are aligned with more traditional clinical disciplines, though the four domains continue to exert an organizing function for learning.

A learning process using principles of adult learning
Defining the educational outcomes was a critical starting point to provide an ongoing design blueprint for all aspects of the curriculum. In attending to the learning process, learning environment and assessment system, a number of innovations have occurred, especially for elements that emphasize core generic and personal capabilities as follows.

Different learning processes for each phase
Each of the three phases utilizes a different learning process. In phase 1, ‘scenario-based learning’ uses constructed health scenarios to contextualize presentation of fundamental biological, behavioral and social sciences. Early clinical experiences reinforce the contexts and provide learning in clinical and communication skills. In Phase 2 (practice-based learning), students spend two days per week on campus and three days per week in clinical environments, from which actual experiences are used as the context for learning. In phase 3 the process of ‘independent reflective learning’ recognizes that by this stage students are well prepared to learn more independently by being active and reflecting on their experiences.

The use of different learning processes for each phase recognizes the gradual maturation of university students, most well researched by William Perry (1970). The development of self-directed learning needs to be a deliberate, structured and explicit process no different, for example, from the way clinical skill development is traditionally structured. As stated by Candy, the development of self-directed learning, “is not the same thing as dropping students in at the ‘deep end’, and forcing them to ‘sink or swim’.... There are compelling reasons for believing that this skill should be intentionally and progressively developed throughout the undergraduate experience.... The ‘staged withdrawal’ of faculty [support] over a period of three or four years should be both explicit and agreed, so that students recognize this as a legitimate part of the educational experience” (Candy & Worrall-Carter, 1999).

Combined with a staged increase in student autonomy, personal and shared experiences are increasingly prominent as the primary stimulus for learning from phase 1 to 3. Adults learn best when experiences are a starting point for learning (Knowles, 1994; Brookfield, 1996) but reflection on those experiences and linking them to emerging knowledge structures are critical for students to make the best use of experience (Kolb, 1984). Such a process is not innate in students but needs to be developed explicitly. In junior students, experiences should be used in more structured ways with explicit facilitated reflection time to offer conceptual scaffolding to help students make sense of their experiences. As they become more confident in engaging independently in activity, structure and scaffolding can be gradually withdrawn...
as students, through practice, develop their own abilities to reflect on and learn from experience (Brown et al., 1989; Irby, 1994).

In phase 1, all learning activities link to the relevant health scenario experienced by students at the start of the two- to three-week learning cycle. Scenario group facilitators also encourage students to reflect on personal life experiences of their own, family or friends’ interactions with the healthcare system. Once weekly clinical and communication skills tutorials alternate clinical experiences with campus tutorials, providing opportunities for reflection, generalization and further application in a new experience. Clinical experiences in teaching hospitals and community settings dominate learning in phase 2, and provide a context to understand and apply biomedical and social sciences learned contemporaneously in the same week on campus. Structured activities on campus encourage students to reflect on their experiences in the clinic. In phase 3, all learning is embedded in students’ experiences, and structured teaching activities have been reduced to allow ample opportunities for students to engage in meaningful experiences to build their emerging expertise through personal and collaborative reflection.

**Scenario-based learning: a variation of student-centered small-group learning**

Scenario-based learning has similarities to and differences from traditional PBL, but both are based around student-centered small-group collaborative learning. The primary learning group consists of 12 students who meet twice weekly in facilitated sessions that assist students to determine learning tasks arising from scenarios. The larger group size has resource benefits compared with a traditional PBL group size of six to eight. Like PBL, the sessions provide a venue for the development of the generic capabilities of teamwork, communication skills, peer support/mentoring, and collaborative learning and peer teaching. However, scenario group sessions are more structured than PBL and individual
sessions are instructionally designed and vary in the types of teacher and student tasks planned for each session.

Health scenarios are not designed as problem-solving exercises—the diagnosis is usually supplied or evident and motivation to learn is not based on diagnostic solution. The style of student-centered learning does not equate with students being completely independent in their learning, and facilitators do more than manage student activity. If appropriate, they can convey their understanding of a topic, they can correct misconceptions, and they do encourage student inquiry. The approach approximates an integrated theory of teaching and learning described by Ramsden (1992) as “teaching as making learning possible”. Scenario group facilitators work as a team, meeting together every week to provide educational and content area support to each other. Each week, students are offered 11 hours of resource learning activities (six lectures, four hours of practical classes and one content-specific tutorial) in addition to four hours of scenario group sessions.

Innovations in phase 2

The sudden change in learning style and environment faced by students when moving from a campus-based preclinical phase to clinical learning in teaching hospitals in traditional two-phase preclinical/clinical programs is a significant problem. Furthermore, students’ substantial knowledge of biomedical sciences generated in the preclinical years is insufficiently accessed, reinforced and enhanced during subsequent clinical learning. In response to these challenges, the UNSW phase 2 allows campus-based teaching and learning to extend into year 4, where biomedical and psychosocial content is presented during the same week relevant to the students’ clinical experiences. A defined weekly topic (based on a clinical presentation) organizes campus-based teaching and links formal learning to exemplar cases seen by students in clinical settings. A list of the clinical presentations in the Health Maintenance-3 course is given in Table 4. Each weekly cycle concludes with a business school-style case method tutorial (Christensen, 1987) using pre-circulated written cases. Students are required to come to this tutorial having read the written cases and researched issues of relevance.

During phase 2, all students undertake an independent learning project, which requires students to engage in an in-depth study, thereby engendering an approach to medicine that is constantly questioning and critical. This experience aims to enhance development of lifelong learning skills by experiencing formal processes of research, literature appraisal, data collection, analysis and presentation.

Table 3. Organizing domains and themes of the UNSW medicine program.

| Society and Health: Emphasizes the interrelationship between the health of the individual or population and the environment in which they live. Its themes are: |
| Society, cultures and genes |
| Socioeconomic determinants of health |
| Health delivery systems |
| Health and human rights |

| Beginnings Growth and Development: Involves study of the biological and social science principles relevant to the life cycle from conception to adolescence and adulthood. Its themes are: |
| Conception, pregnancy and birth |
| Childhood growth and development |
| Puberty, adolescence, sexuality and relationships |
| Nutrition, growth and body image |

| Health Maintenance: Focuses on the internal and external processes that maintain a state of health in ‘middle life’, and how the disturbance of these leads to disease. Its themes are: |
| Homeostasis, sustenance and equilibrium |
| Education, health promotion and disease prevention |
| Host defense |
| Lifestyle factors that risk health |

| Ageing and Endings: Focuses on health issues that arise as people age. Its themes are: |
| Menopause |
| The ageing process |
| Degenerative disease |
| Death, dying and palliative care |

Table 4. Clinical presentation topics of the phase 2 course, Health Maintenance-3.

| Week 1 – Exercise and health |
| Week 2 – Syncope |
| Week 3 – Chest pain and dyspnea |
| Week 4 – Leg ulcers and peripheral edema |
| Week 5 – Hematuria |
| Week 6 – Abdominal pain and peripheral edema |
| Week 7 – Gastrointestinal bleeding |
| Week 8 – Trauma |
Vertical integration of learners

An innovative aspect of the UNSW curriculum is deliberate vertical integration of learners. In each phase, learning occurs in small groups of students drawn from two different years. For example, a phase 1 scenario group comprises six students from each of years 1 and 2, a phase 2 tutorial group comprises a mix of students from years 3 and 4, and in phase 3, students enrolled in a particular clinical course may be from either year 5 or year 6.

The phase 1 program has a modular two-year structure with two ‘halves’ (‘A’ and ‘B’). Each ‘half’ is based on study of the same domains and themes but differs in the health scenarios and content. The ‘A’ component is offered in each even-numbered calendar year, and the ‘B’ component in odd-numbered years, and all phase 1 students, whether year 1 or year 2, study that component. This arrangement is linear from a content perspective but iterative or spiral, since the themes to be studied are common to both A and B components. As an example, in the phase 1 Health Maintenance courses, students study the theme of ‘Homeostasis, sustenance and equilibrium’ by exploring the circulatory system in the ‘A’ component, and the digestive/metabolic/excretion systems in the ‘B’ component. Regardless of whether they are in their first or second year, phase 1 students work together within the program and encounter the same scenarios, content topics, learning resources, learning activities, and assessments. In phases 2 and 3, vertical integration arises from flexibility in how students choose to sequence their programs—for example, half of the student cohort completing phase 1 take their phase 2 clinical courses in year 3 and independent learning project in year 4, and the other half sequence these components in reverse.

The educational aims of vertical integration of learners include encouraging collaborative learning, providing peer support and mentoring, supporting reiteration and refinement of knowledge in the light of new experience, peer-modeling of behavior and learning approaches, and mirroring real healthcare teams where different levels of postgraduate trainees work and learn. Although cross-year enrollment of students in the same course is frequent in many programs, there appears to be limited study of its potential advantages in medical teaching. Topping and colleagues (Topping, 1996; Topping et al., 1997) have reviewed cross-year small learning groups in the setting of peer-assisted learning and reported significantly positive educational outcomes, particularly for development of generic and interpersonal capabilities. A recent study by Sobral (2002) has reinforced the positive effects of cross-year tutoring on educational outcomes in medicine programs.

A learning environment that recognizes the social aspects of learning

The social nature of learning is well recognized in the educational literature (Vygotsky, 1978; Bandura, 1986), yet appears to be rarely acknowledged explicitly in curricular designs. Numerous educators have emphasized the importance of both the social and physical context in learning, especially in professional education (Brown et al., 1989; Topping et al., 1997; Candy & Worrall-Carter, 1999). The ‘informal’ or ‘hidden’ curriculum has been well described as representing forms of knowledge, understanding and behavior acquired in social contexts of university experience rather than through formal teaching (Hundert et al., 1996; Hafferty, 1998).

The learning process at UNSW explicitly requires social learning and student collaboration. In each phase 1 course, students must complete a group project conducted in project teams of four to six students. The project is graded and all students in the team share the same grade. However, differential contributions are recognized by peer feedback entered into an electronic teamwork system at the completion of each project. As part of development of the ‘teamwork’ capability, students are expected to be able to give and receive constructive feedback. Comments that students make about other team members and the comments made about them are recorded for use by students in preparation of their reflective portfolios, which are examined at the end of each phase.

An assessment system aligned with outcomes

Since assessment is recognized as an important determinant of students’ learning (Miller & Parlett, 1974; Ramsden, 1992; Lindblom-Ylanne & Lonka, 2001; Biggs, 2003), it was critical that the assessment scheme should support the kinds of learning promoted in the program and not undermine its essential educational philosophy. Clarity about what is expected, a degree of autonomy, freedom of choice in assessable work and regular formative feedback are all factors that have been found to encourage students into taking a deeper approach to learning (Trigwell & Prosser, 1991; Gibbs, 1992; Biggs, 2003).

To this end, assessment was planned with a number of key principles in mind (Tooley & Kumar, 2003). The graduate capabilities provide the framework for assessment with all assessable work linked to one or more of the eight capabilities. Assessment tasks are not discipline based but integrate knowledge from a range of disciplines and generally require students to apply what they have learned to a scenario (for a written or oral examination) or actual experience (for a clinical examination). Assessment is criterion referenced and performance standards are specified. Students receive feedback on all assignments and projects and feedback is linked to graduate capability indicator statements so that students understand their strengths and weaknesses in relation to each of the capabilities. Effective collaboration and teamwork are assessed through group projects in every course. Finally, the assessment scheme encourages self-assessment and helps students take responsibility for their own learning.

The assessment system places a greater emphasis on continuous small assessments, with feedback and less emphasis on large end-of-year examinations. In every course, students are required to complete individual assignments and/or group projects. The level of self-direction increases across the three phases. In phase 1, students have a choice of individual assignments and group projects of which they must choose one each per course. In phase 2, the assignments or projects are based on personal clinical experiences, and in phase 3 assignments or projects are embedded in the work of the clinical team to which they are attached. Students also have an obligation to propose their
own assignment topic at least once in each phase and must negotiate the work which is to be undertaken and the assessment criteria with their tutor.

Through completion of assignments and projects, students develop a portfolio of assessment tasks stored in an electronic system that can be accessed by students at any time. At the end of each phase students are required to write a reflective self-assessment of their progress in each of the capabilities, select supporting examples of their assignment and project work as evidence of their progress, and submit this portfolio for examination. For the capability of teamwork, peer evaluations made by students’ team members are also included in the portfolio. Portfolio examinations are becoming increasingly popular in medical education (Challis, 2001; Friedman Ben-David et al., 2001). The portfolio at UNSW has at least three major purposes: (a) a tool to help students take responsibility for planning and managing their own learning; (b) a way to assess students’ progress in developing capability in reflective practice, self-direction and critical and evaluative thinking; and (c) a means for examiners to assess progress in all eight capabilities. When the student submits the portfolio, the examiner receives a computer-generated listing of all grades and comments received by the student, organized according to the capability to which they relate. This makes it possible to review the student’s overall performance in relation to a particular capability, alongside examples of work he or she has selected for that capability, together with reflections on learning in this area and self-evaluation.

In addition to portfolio examinations, clinical, oral and written examinations complete the set of assessments that must be passed before progression to the next phase. Courses in phase one have an end-of-course examination, which is specifically intended to assess learning in basic science and social science capabilities. The only major large written examination is at the end of phase 1, when students are assessed on all learning in the phase in an integrated, scenario-based multiple-choice question examination.

Content that respects disciplines

Evaluations of integrated curricula have identified evidence of ‘knowledge gaps’ in major biomedical science disciplines that have been attributed to the patchy nature of disciplinary inputs into the design of curricula and assessments (Albanese & Mitchell, 1993). We initiated three mechanisms to attempt to avoid this problem. First, although each course was designed by multidisciplinary groups, we formed ‘content stream’ groups charged with taking a program-wide view of the presentation and arrangement of their respective disciplinary content. Negotiation between the multidisciplinary course design groups and the discipline-based ‘content stream’ groups helped with the choice and sequencing of scenarios, clinical presentations and relevant resource learning activities.

Second, an electronic curriculum map assists course designers, content stream groups, teachers and students visualize places and times in the curriculum where specific content is encountered, and graduate capabilities developed. Every learning activity (small-group session, lecture, laboratory session etc.) is indexed in a web-based searchable database that is accessible by staff and students. Third, an emphasis on the learning of biomedical sciences is maintained in all phases through the assessment scheme. Phase 1 end-of-course examinations include questions from all major biomedical science disciplines. In phase 2, the projects and assignments focus on a clinical experience or population health issue, but require integrated discussion of one perspective related to the biomedical sciences, and one related to social/ethical/healthcare policy issues for each project. In phase 3, the final assessment includes a multi-station oral examination correlating biomedical sciences and clinical work, involving clinicians and scientists examining in teams.

Evaluation and improvement

The curricular design process has been gradual, iterative, experiential and reflective, not unlike the curricular structure itself—initial designs and plans were sequentially modified following pilot trials and reflection on internal and external feedback. This ‘organic’ approach has been deliberately adopted and will continue as an ongoing programmatic evaluation and improvement strategy. The new program commenced in 2004 and initial evaluation of the student experience of the first 2 years of phase 1 indicates that we are achieving the primary aims articulated as key values for the program (see Table 1). Student responses to standard UNSW-wide questionnaires administered at the end of the second, fifth and sixth courses have shown strong endorsement that the program encouraged active student learning (86% agreement); developed student critical thinking (76%); utilized collaborative learning (87%); involved useful clinical experiences (77%); and was challenging and interesting (82%). Overall, 81% of student responses indicated satisfaction with the quality of the three courses evaluated.

Conclusion

In summary, UNSW has implemented an innovative medical curriculum in which educational outcomes have been developed as a blueprint for program design, with the achievement of generic capabilities representing an explicit curricular core. This outcomes-based approach has been matched by significant emphasis on the learning process, which has been tailored to match the learning needs of students at different stages of the program, and is built on contemporary understanding of adult learning. A learning environment that values the social nature of learning is being fostered through the overall design of learning activities and elements of the assessment system. Preliminary evaluation results are showing that the program is successful in focusing student attention on all of the graduate capabilities which form the core of the program design.

Acknowledgements

The authors wish to acknowledge the large number of members of staff of the UNSW Medical School and its associated hospitals and institutes who have contributed to design and delivery of the new UNSW curriculum.
Notes on contributors

H. PATRICK MCNEIL, MBBS PhD, is a former associate dean for medical education and professor of rheumatology.

CHRIS S. HUGHES, PhD, is a senior lecturer and medical educator in the Office of Medical Education.

SUSAN M. TOOLEY, MA, is a senior lecturer and medical educator in the Office of Medical Education.

S. BRUCE DOWTON, MBBS, MD, is a former dean and professor of pediatrics in the Faculty of Medicine.

All the authors are from the University of New South Wales, Sydney, Australia.

References


