Modernizing Optometric Education in Australia: Ideas from Medical Education

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Abstract

Little has changed in the delivery of optometric education in Australia for the past 40 years. In existing programs students undertake study in basic disciplines prior to gaining clinical exposure. This often occurs in university staff-student clinics, which are not necessarily representative of optometric practice in the wider community. Recently two new optometry programs have opened, both located within medical schools and comprehensive health faculties. This has enabled the new programs to benefit from some of the educational reforms in Australian medical education, including outcomes-based design, early and sustained clinical experience and use of student-centered learning models.

Key Words: *optometric education, competency-based education, case-based learning (CBL), team-based learning (TBL), outcomes-based education, backward curriculum design, clinical placements*

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Introduction: Why Change?

Optometric education in Australia, at least until recently, could be described as a small undertaking with less than 200 students per annum educated in three programs. Approximately four out of five graduates practice in the state in which they graduated[1], which may contribute to workforce shortages elsewhere, particularly in nonmetropolitan Australia[2,3].

The existing optometry programs focus on basic sciences such as biology in the early years with the subsequent introduction of applied sciences such as pharmacology. Clinical instruction and exposure generally occur deep into the curriculum. There have been recent changes of both structure and content to these programs. Changes in structure have included moving from four-or five-year undergraduate degrees to double degree combinations with science degrees as prerequisites for subsequent optometry qualifications. Content has been expanded to include prescription of therapeutic agents, a key development in Australian optometric practice.

Nevertheless, the profession of optometry itself is rapidly changing. It is becoming increasingly complex and more is required of practitioners than ever before. For instance, in Australia, optometrists are now expected to co-manage and prescribe therapeutic agents for patients who were previously referred to ophthalmologists, such as patients with open-angle glaucoma. This change in the scope of practice, combined with both the dramatic increase in the burden of chronic disease[4] and the nonmetropolitan undersupply of optometrists[2], provides compelling grounds for pedagogical and further content change. There is a need for pedagogies that will facilitate ongoing inquiry and lifelong learning and embrace new communication technologies. Indeed, technological advances, such as high-speed Internet and the facility to form networks of people in remote locations, offer much promise for training within these regions in-need[5]. In addition, as the vast majority of optometrists are either self-employed or practice owners[2], the consistent and formal delivery of courses for the commercial and managerial aspects of prac-

tice are long overdue.

There are two new programs in optometry in Australia. One began in 2011 and the other will take its first cohort of students in 2012. Significantly, the two new programs are located in medical schools that are, in turn, located within comprehensive faculties of health. This contrasts with the three existing programs, two of which are located in science faculties and the third in a health faculty without a medical school. In many ways, the practice of optometry reflects that of medicine. Optometrists contribute to the diagnosis and management of eye disease and ocular manifestations of systemic disease and as such optometry operates as an extension of medicine. In Australia optometry and general practice (family medicine) operate in similar settings and share the clinical paradigm of history → examination → investigations → impression → management. Indeed, optometry students must learn many things in common with those studying medicine.

The two new programs employ a Bachelor of Vision Science/Masters structure and have some similarities to two of the revised structures of the existing programs, one of which has a double bachelor degree structure and the other a bachelor/masters combination. The third existing program has just moved to a four-year graduate-entry doctorate.

The location of the two new programs in medical schools is significant. In Australia there has been a recent period of expansion and reform of pedagogy and content in medical education with the introduction of outcomes-based curriculum design, problem-based learning, early clinical experience in simulated and actual environments and substantial clinical placements in community and nonmetropolitan settings[6]. While some of these approaches are present in existing optometry programs, designers of the new programs were able to draw on their medical school colleagues to take a more holistic approach to incorporating the reforms in their curriculum design processes. The first author of this paper is an optometry and medical graduate and is head of one of the new programs. The second author has been associated with the two new programs and has long experience in medical education.

Table 1
Key Elements of the Proposed Framework for Optometric Education (in Australia)

1.	Begin with the end in mind - outcomes-based education
2.	Interprofessionalhealth practice, law and ethics, management and business acumen
3.	Early clinical exposure leading to extended clinical placements
4.	Case-based learning - facilitating student-centered inquiry
5.	Team-based learning

In light of this background this paper proposes a framework for the delivery of optometric education in Australia that is informed by the location of the two new programs in medical schools. The key elements are listed in **Table 1** and are discussed in the following sections of this paper.

Begin with the End in Mind: Outcomes-Based Education

The practice of optometry encompasses the assessment of the human eye and visual system as well as the management of patients with conditions of the eye and visual system. Optometrists in Australia do not currently provide surgical, laser or complex medical treatments as these are the remit of ophthalmology. Unlike those in the United States (U.S.), Australian optometrists cannot order general laboratory investigations to follow-up systemic conditions, such as blood tests for Lyme disease or sarcoidosis, nor can they order radiological investigations. However, optometrists in Australia do refer directly to ophthalmologists, as well as co-manage patients with ophthalmologists and general practitioners or family physicians.

As a vocation, optometry is unique. On a given day, Australian optometrists may perform primary visual assessments, treat advanced eye diseases and prescribe medicines and optical aids. As such, the profession shares traits with family physicians, ophthalmologists and pharmacists. At the same time, most optometrists are business owners and retailers, as approximately 80% of total revenues are generated through dispensing optical aids[7]. In Australia, optometry is regulated and is governed by a national registration board[8]. Optometric services are at present heavily subsidized by a federal Medicare scheme.

Unlike medical practitioners, who undertake several years of supervised postgraduate training, graduate optometrists in Australia are deemed fit for full registration and practice, and can do so, unsupervised and unmonitored from their first day of work. Only recently has continuing professional development become a requirement for ongoing registration[8]. The ever-increasing complexity, diversity and interprofessional commitments of optometrists in practice requires optometric educators to develop curricula that deliver the essential competencies required for modern optometric practice.

Competencies have been defined as the habitual and judicious use of communication, knowledge, technical skills, clinical reasoning, emotions, values and reflection needed in daily practice[9]. In 1997, the Optometry Council of Australia and New Zealand (OCANZ) developed entry-level competencies[10,11] that must be demonstrated in the graduates of each school in order for its optometry program to be accredited. These include professional and clinical responsibilities, patient history, patient examination, diagnosis, patient management and recording of clinical data. Likewise, the U.S. National Academies of Science (Institute of Medicine) has recommended that all healthcare clinicians possess the following competencies: patient-centered care, ability to work in interdisciplinary teams, evidence-based practice, application of quality improvements, and the use of informatics[12]. Traditionally, regulatory bodies only specify clinical competencies. Given the contemporary roles of optometrists set out here, it is argued that if these competencies are to provide the underpinnings of optometric education, they need to be extended to include interprofessional and industry perspectives, ethics and law and retail,

management and commercial skills.

A fundamental assertion of this paper is to begin curriculum development with a comprehensive set of competenciesand, therefore, a vision of "the working optometrist." Critically, it is just as important to have an understanding of what "a working optometrist" is not, and thus subject matter that is not essentially related to clinical practice is avoided. Competencies can be equated to intended learning outcomes, which in turn form the basis of each pedagogical unit.

Outcomes-based education works from the principles of "backward design."[13,14] This is a multistage process for designing curricula and associated assessments. The first stage is to articulate the goals, in terms of knowledge, skills and behavior, that must be achieved by the end of each unit of study. As it pertains to optometric education, these are planned and distributed such that at the completion of the entire program graduates have achieved all of the competencies required to commence work as optometrists, including the additional competencies in interprofessional work, ethics and law and retail and management skills. The second step is to determine what is considered to be acceptable evidence of having achieved the goals for each unit of study, hence this step is intimately linked with assessment. The third and fourth steps in backward design are to plan the curriculum and the teaching and learning materials and experiences that will deliver the goals and standards.

Interprofessional Health Practice, Law and Ethics, Management and Business Acumen

Interprofessional health practice

More so than ever, optometrists are now integrated within the greater healthcare system. In Australia, optometrists can refer directly to, and co-manage with, tertiary medical specialists such as ophthalmologists as well as family physicians. Optometrists, for instance, manage patients with low vision. Thus an understanding of the role of occupational therapists and social workers is critical to effectively manage patients in a holistic fashion. Similarly, with the ever-increasing burden of chronic disease, such as type-2 diabetes[15], optometrists work closely with family physicians, endocrinologists, diabetes nurse educators and ophthalmologists to ensure the best outcomes for their patients. For the majority of private practitioners, this typically entails coordination of care through consultation and referral. For those working in hospital and community care settings, it may involve participation in multidisciplinary meetings. Therefore, graduate optometrists need to possess an understanding of the conventions for communication and interprofessional referral and work.

Interprofessional practice is a new concept in optometry education and needs to be reflected in the curriculum framework. Curricula should contain material that is common to any contemporary healthcare profession, including dimensions of interprofessional practice such as communication, health informatics, public health medicine and evidence-based medicine.

Law and ethics

Working as a health professional is a privilege that comes with great responsibility. While individuals seeking health services are seldom aware of the various regulations and codes of conduct, there remains a level of trust for health professionals that exceeds that for those in practically any other role. Health professionals handle issues and information that is, by definition, extremely sensitive, private and personal in nature. This is a serious undertaking so the process of becoming a health professional should be well-informed and deliberate, as opposed to passive and assumed. In the context of optometry education, it is critical that all students are educated on the meaning, behaviors and code of ethics associated with being health professionals[16].

Knowledge of the legal and ethical basis of optometry is as essential to clinical practice as knowledge of basic optometric sciences. The Optometry Board of Australia (OBA) requires that optometry graduates behave according to legal and ethical principles and must know about and comply with the OBA's Code of Conduct[8]. These standards can only be achieved when the teaching and learning of bioethics, law and professionalism are fundamental to, and thoroughly integrated both vertically and horizontally throughout, the curriculum as a shared obligation of all teachers[17]. This is where optometry educators can draw on the association of the two new programs with medical education in changing existing stand-alone courses in law and ethics to a more integrated approach.

Recently, the United Kingdom Institute of Medical Ethics (IME) issued an update to its 1998 consensus statement for the teaching and learning of medical ethics for doctors[18] in which it implored educators to take a unified and formalized approach to medical ethics education. A solid understanding of health and medical ethics and local optometric regulations facilitates reflective and critical thinking, from which flow benefits to both patients and practitioners. Indeed, the argument for such teaching and learning is supported by research demonstrating that exposure of medical students to medical ethics courses measurably improves moral reasoning[19], as well as confidence, communication skills and patient-centeredness[20]. Conversely, the potential disadvantages of not teaching ethics and the law are suggested by the findings in U.S. medical students of a strong association between unprofessional conduct and "burnout"[21] as well as future disciplinary action by medical boards[22].

Management and business acumen

Just under 70% of all optometrists practicing today in Australia are self-employed, owners of, or partners in the ownership of, their own practices[2]. Indeed, several business models, such as independent, franchise and consulting-only practice exist within the industry, for which the details and differences ought to be understood by all graduates.

Along with ownership comes a requirement for at least a basic understanding of various aspects of small business management. Examples of this are basic accounting statements such as profit and loss, balance sheet, cash flow, industrial law, human resource functions such as appointments, terminations and staff entitlements, and taxation law. Those with an understanding of basic industrial psychology and best practice in recruiting will have a considerable advantage over others in establishing and managing a team of people. The

vast majority of revenue generated by Australian optometrists comes from the sale of goods[7]. Hence optometry students should undergo education and training of retail best practice. Again, medical education can provide models for doing this in an integrated way in contrast to some of the existing stand-alone approaches.

Clearly, there is more to optometric practice than pure clinical work. Members of both the industry and the community have an expectation of high service levels and that practices are well equipped and have a modern "product offering." In turn, as optometry practices are expensive to equip, maintain and manage, the sustainability of a practice and the ability to service the community is inescapably bound to revenue and profitability. Graduates that possess a framework for practice management, retail and commercial awareness are more likely to create sustainable practices, with better long-term outcomes for the community.

Early Clinical Exposure Leading to Extended Clinical Placements

Early clinical exposure

One of the challenges for existing optometry curricula in Australia is provision of clinical exposure for students. Optometry students may graduate having seen up to 100 patients in total. Medical students may see this number in two weeks during residential placements. Most existing programs rely predominantly on single clinics such asuniversity staff-student clinics. While these provide convenient sources of patients, the problems with the overall approach are considerable. For instance, university clinics draw from a small and selected population and many struggle to service enough patients to give students an adequate sample. In many cases, these clinics need to offer incentives to attract more patients as, invariably, there are nearby practices offering faster service and more suitable eye wear. In those teaching clinics that offer subsidized eye wear, the patient demographic is likely to be heavily skewed toward lower socio-economic status citizens, resulting again in the distortion of student experience and perception.

A practice that is becoming increasingly common in medical education is that of short-duration placements, of as little as three hours per week, beginning in the first year of study. This can be applied to private practice optometry, with supplemental observational placements in settings such as community optometric practice, ophthalmology clinics, low vision clinics, general practice, diabetes clinics, and perhaps even manufacturing and research settings to give a broader perspective.

Furthermore, one of the contentions of this paper is that if, before commencing clinical placements, students were already masters of the mechanics of clinical practice then they would adapt more quickly. Indeed, this is supported by research on medical students who were exposed to intensive procedural skills preparation prior to clinical placements[23]. In turn, while on clinical placement the students' attention could be freed to assimilate knowledge and clinical findings, which in traditional medical programs can be problematic[24]. The aim is for graduates who can easily make the transition from students to health professionals, which is particularly relevant for those that will work in less supported environments in rural and regional Australia and other areas of need.

Medical schools that have introduced-courses in clinical skills, which are undertaken prior to seeing patients, have found measurable changes across a range of domains. These include better adaptation, comfort levels and interpersonal and communication skills[25,26], as well as improved procedural skills, educational attitudes, initiative, attendance and dependability[27]. New optometric curricula should have dedicated clinical skills subjects beginning with fundamentals such as history-taking, basic eye examination techniques with progression through to the most technically difficult tasks, and interpretation of investigations. These fundamental skills can effectively be learned using observation and participation among the students themselves, with actors or "virtual" patients[28,29].

For medical students, the advantage of early exposure has been found to be two-fold. The first is a higher degree of motivation and confidence towards practice[30] with a greater awareness of the needs of the community, the challenges facing practitioners and the strategies that they employ to address them. The second, largely intangible, benefit is that students begin their behavioral transition to practitioners and begin to identify with the profession from a very early stage because learning clinical skills in the years before seeing real patients makes basic science feel more relevant. Early exposure to primary care medicine has been found to lower attrition rates for those with a career interest in this field[31], a finding that is relevant to Australian optometry, which is at risk of undersupply[2].

Clinical placements

In order to practice safely and productively following graduation, it is important that practitioners-in-training see an adequate volume of patients, which is why essentially every medical program uses extended clinical placements. Indeed, medical students in Australia spend between two and three-years "based" full-time in various hospitals and other clinical settings prior to graduation[32], which translates to some 1,500 hours.

Invariably, students on placement continue to receive lectures and theory-laden tutorials. However, the emphasis is on "clerking," interviewing, examining and following the progress of patients combined with bed-side tutorials and unit meeting attendance. There is a commitment to spending time on the ward or clinic during which valuable lessons are learned through the serendipity of observation and impromptu tutorials.

Due to the expansive nature of medicine, it is difficult to ensure a consistent experience for all students. All Australian medical schools aim to expose students to general medicine, general surgery, emergency medicine and general practice, as well as pediatric, obstetric and psychiatric medicine, but there is variability in the exposure to rural and indigenous health issues and specialty practice[32]. On the other hand, the relatively narrow range of optometric settings is ideal for clinical placements. Indeed, consistency of exposure during placements can, more or less, be assured. There are relatively few Australian optometrists in specialist practice where the range of conditions seen is

restricted. There are some examples in low vision, pediatrics, post-graft, rigid contact lens fitting and ophthalmic prosthetics, but these are not common.

The shortcomings of traditional clinical exposure in university staff-student clinics are set out previously. Optometry students should undertake placements that deliver on the order of 500 to 1,000 hours of practical exposure. Even allowing for long consultations and involvement in non-patient activity, students undertaking such placements will be able to interact with 1,000-3,000 patients. The opportunities for early clinical exposure and for extended placements allow the new optometry programs to build on and extend the clinical skills taught in other programs through progressive development and intensive practice and reinforcement. In addition, optometry students should use long case presentations, well-used as a clinical teaching approach across all medical disciplines, to augment the development of clinical synthesis, reasoning and communication[33].

The main challenge to this aspect of the model pertains to the identification and accreditation of practices that are willing to provide clinical placements for students, especially in Australia where almost all optometry practices are private. Receiving practices need to be equipped to accommodate students with additional consulting rooms and fit out. Students may slow down appointments, and there is no government Medicare funding for consultations performed by students.

Case-Based Learning: Facilitating Student-Centered Inquiry

Problem-based learning (PBL), pioneered in the 1960s by McMaster University in Canada, is a student-centered educational strategy[34]. It is characterized by collaborative, reflective and self-directed learning that is stimulated by open-ended and deliberately ill-defined problems (clinical cases) presented and worked on in small groups. PBL has been adopted by the majority of medical schools in Australia and is generally preferred by both students and educators to traditional teaching methods[35]. PBL has been found to deliver positive benefits for physician competency after graduation, particularly in social and cognitive domains[36].

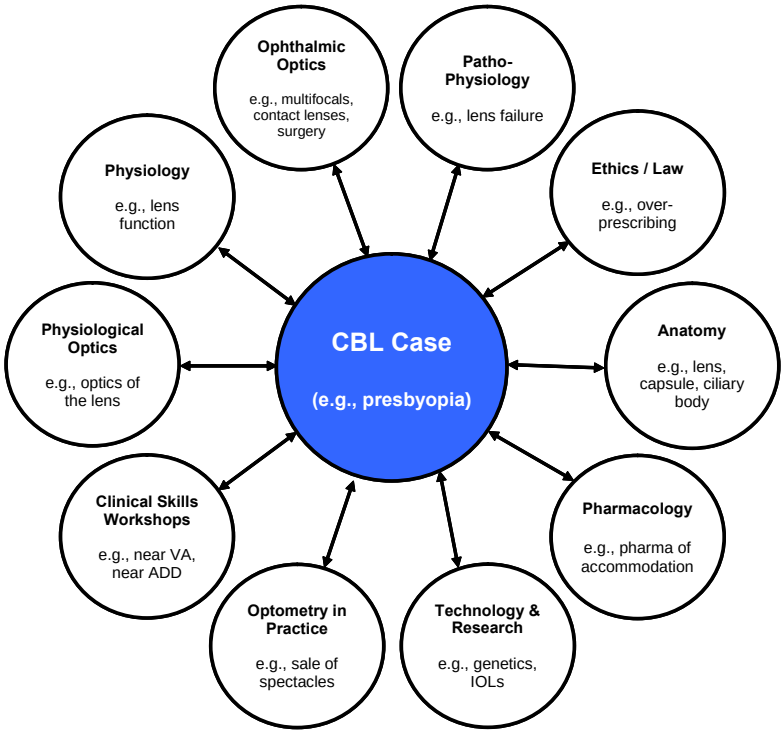
Case-based learning (CBL) is an adaptation of PBL[37] in which small groups of students solve problems creatively, with more advanced preparation than is usually found in PBL. Cases are created in such a way that, with the guidance of tutors, students uncover underlying intended learning outcomes. In practice, groups of up to 10 students attend two CBL tutorial sessions per week. One is held at the beginning of the week, and the other is held at the end. The first session introduces "the case" of a specific patient and his/her presentation. Over the course of their work, students will encounter dozens of different cases, thus enabling educators to control both the breadth and depth of conditions studied.

The task of the students, in considering the diagnosis and management of the patient in the case, is to analyze certain facts, develop hypotheses and with these identify a priority list of learning objectives. By necessity, students will encounter all relevant disciplines, including the psycho-social, legal and ethical elements of practice. CBL lends itself well to the integration of medical ethics throughout the curriculum by developing an appreciation for issues such as privacy and confidentiality, the practitioner-patient relationship, consent, negligence and potential conflicts of interest within each case.

Within a CBL session, a teacher's primary role is to facilitate discussion and debate and the prioritization of intended learning outcomes. Subsequently, students set about, over the course of a week, to meet their intended learning outcomes. This is achieved through private study and supporting sessions delivered through various media, including live and online lectures and workshops. The content of the supporting sessions is drawn from the traditional disciplines of anatomy, physiology and optics, but also includes an optometry-in-practice stream in which students are exposed to problems such as staff management, choosing the right lens for patients and over-prescribing. The second CBL session of the week is dedicated to group evaluation, integration and discussion of information, and to explaining or resolving the case[38], hence settling the intended learning outcomes.

Figure 1 illustrates a typical CBL case of presbyopia. Within the CBL sessions, students encounter the case of a patient with presbyopia as represented in

Figure 1
Case-Based Learning Prototype of Presbyopia with Contributions from Optometric Conditions



the central circle. As for a real patient, the case contains complexities within the clinical, psycho-social, ethical and commercial domains. In attempting to resolve the case, with the guidance of a tutor, students identify and record intended learning outcomes, which are subsequently achieved through a combination of private study and supporting sessions and group study. In this example, lecture topics fall within traditional optometric disciplines represented as surrounding circles.

CBL provides a learning platform for each step the students take toward becoming graduates, which can be reinforced by the supporting sessions in a so-called "hybrid" curriculum. This differs substantially from traditional curricula in which lectures represent a means of delivering self-contained units of knowledge, typically organized into disciplines. In a more traditional curriculum, optometry students may undertake studies in a discipline such as anatomy over the first two years, but not thereafter. In a CBL curriculum, specific anatomy lectures are delivered throughout the entire curriculum through vertical streaming as required to fulfill CBL learning objectives. In a CBL course, lectures build knowledge around the case, in order for students to achieve the learning objectives for the week. The obvious advantage of this structure is that information is received in the context of real clinical problems and this is how knowledge must be applied after graduation. The study of optometry is amenable, arguably moreso than medicine, to CBL because of the relatively small number of disorders and presentations. It is conceivable that a very high proportion of themes and conditions seen in practice could be covered, over three- or four-year degree programs, using CBL, with repeated coverage of the most common issues.

The key challenges for CBL are the provision of intensive faculty training and the high demand for resources for writing a large number of cases and facilitation of small group learning sessions. Furthermore, there is a need to regularly refresh cases and update intended learning outcomes, in line with changes in the competencies required for accreditation. While it is claimed that PBL is a more staff-intensive model of curriculum, the Australian medical schools that have adopted it have done so without significant increases in staffing. Rather, there has been a change of roles for staff. Indeed there is no evidence that PBL schools have substantially different student-staff ratios from those that do not use such an approach. There are additional requirements in developing the initial set of cases, which has resulted in some medical schools purchasing cases from others[39]. This is not an option for optometry schools in Australia at present and additional resources may be required in the start-up phase. At present, neither Australia nor New Zealand require optometry graduates to undertake Board examinations as the institutions themselves must be accredited. Schools that are considering the introduction of CBL would do well to recruit at least some staff with experience in PBL or CBL curricula. It is equally prudent for these schools to cross-check learning outcomes against those delivered by their existing programs to ensure no significant gaps occur.

Team-Based Learning

Team-based Learning (TBL) is a relatively new teaching technique first developed by Michaelsen[40]. It has now been applied successfully within both business and medical programs[41], where it has been demonstrated to improve learning outcomes. It comprises materials and procedures designed to develop high-performance learning teams that, in turn, dramatically improve the quality of student learning. It does this by replacing or reducing lecture time, promoting teamwork, ensuring that students are prepared and on-time to class, enhancing problem-solving skills, holding students accountable for their own learning, and creating high levels of student engagement in the classroom[42].

In TBL, learners are motivated to participate in and out of class through preparation and group discussion. As with CBL, TBL class time is shifted away from the passive reception of learning material towards the integration and application of newly learned material. Teachers retain control of content and act as both facilitators and content experts. Rather than being responsible for delivering the content, teachers guide self-managed teams through learning, and contingently teach when it is apparent that core concepts have not been grasped.

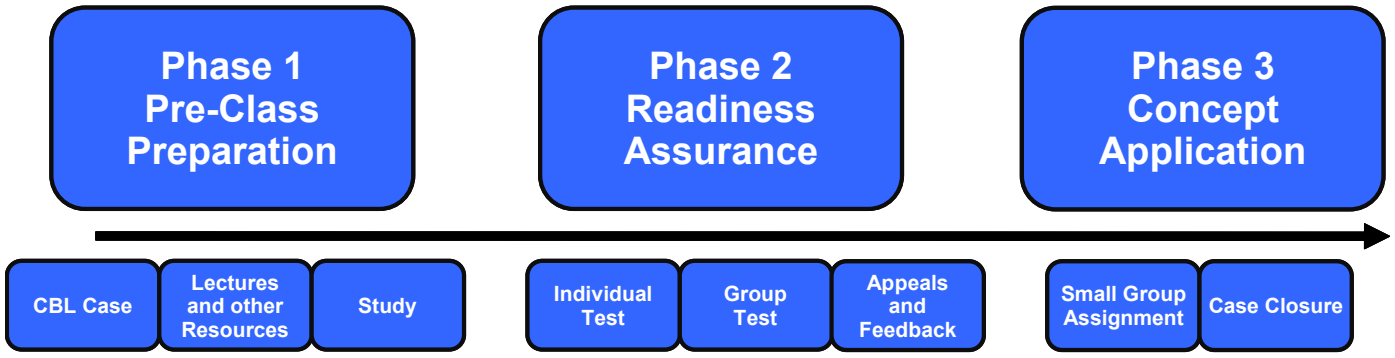
Programs that have adopted TBL report a marked increase in student attendance, student engagement and staff satisfaction[42]. It has also been found to be effective in engaging international students[40]. TBL can be applied to optometric education to effectively reduce lecture times and faculty costs while increasing student engagement. Indeed, TBL is currently being used in several U.S. optometry programs, such as the Southern College of Optometry (personal communication, J. M. Jackson, OD).

TBL consists of a three-phase sequence. In Phase 1, students are exposed to intended learning outcomes. These may, for example, be derived from a CBL case. The mastery of the intended learning outcomes comes from a variety of methods and sources, such as group and private study, traditional lectures or workshops, pre-recorded slideshows, multimedia presentations and readings.

In Phase 2, which is performed in-class, students individually complete a multiple-choice test to demonstrate their readiness to apply the material acquired in Phase 1. Individual scores are recorded but not revealed. Subsequently, teams of four to six students take the identical test together. Consensus answers are reported simultaneously, then scored and recorded immediately. Simultaneous reporting stimulates an energetic total-class discussion with groups defending their answers, thereby accelerating critical thinking and problem-solving skills. The teacher clarifies concepts and consolidates learning. This process facilitates more rapid acquisition of functioning knowledge and shared understanding of concepts and principles. It also provides time for students to access the teacher's true expertise indeclarative, procedural and functioning knowledge and assists students to learn from, and respect, their peers. Team skills such as communication, decision-making, negotiation, peer review and respect for others are inherent to TBL classes.

In Phase 3, teams collaborate in-class to solve problems that require the application of the material assessed in Phase 2. This application exercise may be scored but in many institutions this is not done

Figure 2
The Three Phases of Team-Based Learning
(adapted from Michaelsen et. al., 2004[40])



formally. The object of this phase is to extend and further consolidate prior learning. In the context of this framework, the application exercise may pertain specifically to the CBL case. TBL is illustrated in **Figure 2**.

The main challenges of delivering TBL include the need for both extensive faculty training and expert multiple-choice question writing.

Conclusion

The new optometry programs located within medical schools have provided an opportunity to adopt some of the educational reforms present in medical education. This paper describes a pedagogical and curriculum framework for optometric education in Australia derived from some of the principles of contemporary medical education. It proposes the use of backward design and outcome-based education and the incorporation of new content in interprofessional work, law and ethics, retail development, management and commercial awareness. It emphasizes the early learning of clinical skills, extended clinical placements in optometry practices and the use of case-based and team-based learning approaches. The association with medical education, which itself has undergone significant educational reform in Australia in the last two decades, is significant. It will enable optometry educators to embrace the reforms in a holistic way to provide a coherent educational program for the optometry professionals of the future. It is an important time for optometric education.

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