

Competency-based education in a clinical course in conservative dentistry

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The conceptual difference between a competency-based education and an education based upon a conventional dental curriculum is, perhaps, the starting point for the development of new curricula. The two systems are not, in themselves, exclusive. There is common ground to be found, and the concept of combining instruction with competency-based learning experiences is emerging in recent publications. This paper describes a competency-based approach applied to a clinical course in conservative dentistry. The learning outcomes of the fourth-year dental students in the new course were assessed using methods that included continuous clinical assessments, student presentations and peer-group reflective evaluations, patient management reviews, a clinical progress examination, the range and amount of work completed, and a written examination and viva voce. Different weightings were given to various elements of the assessment. A formal student assessment of the course rated it as being satisfactory.

Although not mutually exclusive, there are conceptual differences between a discipline-based and a competency-based education in dentistry.¹ Competencies describe the understanding, skills and professional values required of a student that are essential for beginning the unsupervised practice of dentistry.² Students in traditional discipline-based instructional content courses largely learn what teachers choose to teach them. The courses aim to produce a dentist with prescribed packages of knowledge, some of which will be retained upon graduation. However, a competency-based curriculum identifies what is essential for dental practice, and then provides a sequence of defined learning experiences so

that the student may graduate as a qualified beginner.¹ The differences between a discipline-based and a competency-based education must be taken into account when planning and developing curricula that are intended to provide the dental practice needs of the future.^{3,4} An integrated approach whereby competency is achieved by defining the essential knowledge that is required, and by assessing the required skills and attitudes of students, is a way forward in the development of traditional courses.⁵

In competency-based education, certain instructional objectives may help students more quickly to acquire the mental processes for learning.^{6,7} Statements of competence or attainment define what learners are expected to be able to do. The statements should also define the standards expected, to confirm that the required learning has been achieved. When the outcomes of learning are clearly specified, assessments must logically be based directly on these outcomes. Such assessments tend to be continuous and comprehensive, rather than end-of-course examinations, with more emphasis being placed on assessing performance and demonstrations of skill or competence, rather than simply of knowledge.⁸

Formative and summative evaluations of competency-based education programmes for dentists have been reported as being effective in demonstrating an increase in cognitive, psychomotor, and affective learning domains.⁹ Competency-based education affords the following advantages:

- It serves to reduce passive dependence on lectures
- It enhances student performance through active participation in learning through problem-solving
- It encourages critical assessment of competing theory and evidence
- It improves interdisciplinary understanding
- It can improve literature searches and the writing-up of clinical cases, and
- It can help establish closer links with private practice settings and public institutions for educational purposes.¹⁰

Although competency statements alone are not sufficient to deal with all the practicalities of instructional objectives, such as testing every circumstance,¹¹ ongoing and consistent assessments of competencies are required.¹²

Problem-based learning (PBL) is closely linked to dental competencies, especially in diagnosis, treatment planning and patient management. A recent report found that graduates from a PBL school felt more competent than those from a traditional curriculum school in communication, critical evaluation and identifying oral pathoses.¹³ PBL reduces passive dependence on teachers, and focuses instead on active student-centred learning with the encouragement of teamwork and critical self-appraisal.¹⁴ Although the Hong Kong Dental School introduced a total PBL curriculum for all first-year courses in 1997–98, it will not be fully implemented until 2003. Therefore, the present paper does not examine its application to a fourth-year clinical course in conservative dentistry, which is used as an example here for devising assessment methods to match an educational strategy based on defining the required competencies as learning outcomes.

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Table 1	Clinical competency statements for a course in conservative dentistry
	<ol style="list-style-type: none"> 1. Satisfactorily perform the professional obligations of a dentist. 2. Understand how the biological and chronological ageing process affects oral tissues and the delivery of oral healthcare. 3. Undertake the satisfactory dental treatment management of patients with systemic diseases and receiving medication. 4. Recognise, adequately manage, and maintain the preventive care and treatment of patients who are particularly susceptible to plaque-related diseases. 5. Understand the biological and biomechanical interactions that may occur between the oral environment and materials used in oral rehabilitation and in tissue regeneration. 6. Use effective pain control and cross-infection control. 7. Select and use satisfactorily, appropriate materials for all clinical and laboratory stages of procedures for operative dentistry, including endodontics and single crowns. 8. Undertake the management of dental trauma. 9. Recognise when tooth wear may give rise to biological, functional and aesthetic problems, and be able to institute appropriate measures to prevent further loss of tooth substance, and perform simple measures to correct deficiencies. 10. Understand the role of the oral healthcare provider in the management of patients requiring surgical treatment for orofacial conditions. 11. Manage patients requiring simple adjunctive orthodontic treatment confined to one arch, usually restricted to the tipping of teeth and amenable to completion within 9 months. 12. Provide comprehensive, supportive, continuing care for patients who are undergoing treatment and who have completed a course of oral healthcare. 13. Be able to critically evaluate her/his own performance and standards relative to those of other students.

component in a competency-based dental curriculum. Several workers have published details of the assessment proformas used in their own institutions.^{15,16} Reference is made in this paper to several of the proformas designed for use at The University of Hong Kong Dental School, and these are shown as examples. The competency-based assessment, using criteria that aim to reflect the organisation, preparation, patient management, and clinical work in all aspects of patient treatment during clinical sessions in conservative dentistry, has been modelled on methods used at the dental schools in Adelaide, Sydney and Dundee.¹⁷

Patient-instruction,¹⁸ and student journals^{19,20} also aid deep reflective learning and improved performance. Such formative assessments have been claimed to lead

Description of course

The fourth-year conservative dentistry course consists of both laboratory and clinical studies. Clinical practice consists of one supervised session per week involving operative dentistry and endodontics. Small group seminar sessions for one half hour on advanced conservative dentistry topics are presented, with peer group assessments, before the start of the three-hour clinic sessions. Case discussions, treatment planning, and trouble-shooting sessions are held at the end of the clinic sessions. There are only three to four formal lectures given each year.

Assessment of competency

The competencies used were originally derived from the instructional objectives of the existing course in conservative dentistry, and from recommendations of the Task Force for the PBL curriculum that such competencies will allow the graduate to meet the requirements for registration in Hong Kong upon completion of a five-year undergraduate course (Table 1). The competencies are based on those that are often used to describe the understanding, skills and professional values of an individual for beginning independent oral health care practice.²

Continuous assessment is an important

Table 2	Clinical progress examination in conservative dentistry
<p>Clinical Progress Examination Conservative Dentistry (Please bring this form with you to the examination)</p>	
Students's name: _____ Group: _____	
Clinical procedure: _____ PPDH No. _____ Date: _____	
A: Distinction, B: Credit, C: Pass, D: Conceded pass, F: Unsatisfactory	
<u>Rating</u>	<u>Comment</u>
Professionalism/Organisation: _____	
Infection control: _____	
Pain control/Management: _____	
Preventive/Oral health: _____	
Clinical judgement: _____	
Practical skills: _____	
Advice/Assistance required and why: _____	
Any extenuating circumstances: _____	
Overall assessment: _____	
Comments: _____	
Signature: _____	

Table 3 Criteria for continuous clinical assessment of students in conservative dentistry

Score	Clinical Skill (overall)	Patient Management/Professionalism	
A	Outcome achieved to an excellent standard where the treatment is minimally compromised by affordability, time or the patient's wishes. Student did not require advice and was able to complete the task by herself or himself.	<i>Time:</i>	Good use of the time available.
		<i>Empathy:</i>	Attended to the patient's complaint/request; showed care and consideration.
		<i>Professionalism:</i>	Treated ancillary staff well; good professional attitude; clean uniform; prioritised preventative over operative management.
		<i>Cross-infection control:</i>	Observed and practised cross-infection control guidelines.
B (or above)	Outcome achieved to a commendable standard where the treatment is minimally compromised by affordability, time or the patient's wishes. Student may have required advice but was able to complete the task by herself or himself.	<i>Time:</i>	Managed the time well.
		<i>Empathy:</i>	Attended to the patient's complaint/request; showed care and consideration.
		<i>Professionalism:</i>	Treated ancillary staff well; good professional attitude; clean uniform; proper preventive management.
		<i>Cross-infection control:</i>	Observed and practised cross-infection control guidelines.
C	Outcomes achieved the minimum acceptable standard, below which there is a chance of potential damage to the patient. Some help was required by the student to complete the task and avoid further damage.	<i>Time:</i>	Just acceptable.
		<i>Empathy:</i>	
		<i>Professionalism:</i>	
		<i>Cross-infection control:</i>	
D (or below)	Unsatisfactory outcomes as a result of treatment which has already caused damage to the integrity of the pulp (where applicable), neighbouring tooth and/or supporting tissues, or will cause problems in the future. Instructor had to take over and complete the task on behalf of the student.	<i>Time:</i>	Late for appointments; kept patients waiting unnecessarily.
		<i>Empathy:</i>	Treated patient unprofessionally.
		<i>Professionalism:</i>	Treated ancillary staff impolitely; dirty uniform; poor preventive management.
		<i>Cross-infection control:</i>	Behaved in a way that promoted cross infection.
U	Unclassified; patient did not attend.	Unclassified; patient did not attend.	

dental graduates, as a future generation of professionals, to an enthusiasm for dentistry and an ability to be independent learners.

Assessment methods

Assessments should record the achievement of defined competencies as objectively as possible. The list of competencies derived for the fourth-year clinical course in conservative dentistry at The University of Hong Kong is shown in Table 1. Apart from using written and viva voce assessment methods to evaluate knowledge, other assessment methods are required to evaluate clinical skills and

professional behaviour. Various assessment proformas can be used for such purposes.

1. *To encourage constructive criticism:* Peer-group assessment allows students to assess their fellow student colleagues at case presentations and at seminar presentations. The assessments are related to clinical activities and can provide a good indicator of the academic expectations and demands of the students.
2. *To encourage continuous self-reflection:* This provides an opportunity for students to reflect on and to assess their own performance immediately after a task, and encourages experiential learning — a

critical component of clinical practice.

The use of such proformas helps students reflect upon their presentation and other skills. In consultation with their supervisors, they can record their plans to improve their performance. This is best done immediately on completion of a task, while the experience is still fresh in their minds.^{15,16}

3. *To assess clinical competency in a more structured manner* (Table 2): The clinical progress examination in fourth-year conservative dentistry is a one- or two-session assessment of student clinical performance held during the usual teaching sessions. The clinical procedures tested,

Table 5 Undergraduate conservative dentistry assessment weightings of clinical competency

BDS Year	Progress Assessments							Terminal assessments			
	Class Tests			Continuous*		Work Completed		Patient Managemt	Written / Vivas	Laboratory	Clinical
	Laboratory	Clinical	Written	Laboratory	Clinical	Laboratory	Clinical				
II	30% (15% x 2) Endo & Operative	–	30% (15% x 2)	25%	15%	–	5 Amalg. 10 Tooth Coloured	–	–	–	–
III	–	–	–	20%	20%	–	15 Amalg. 25 Tooth Coloured 2 Ind. Rest. 3 Endo.	10% S1	25%	25%	–
IV	–	10%	–	–	35%	–	25 Amalg. 40 Tooth Coloured 8 Indirect Rests. 6 Endo. (2 Molar)	10% S1, 2	30%	15%	–

* Includes attendances at all classes, including seminars. S = Semester

A = 75+, B = 65+, C = 50+, D = 45+, F = 30 per cent

5. *To review the amount and range of treatments given:* Computer records are used to document and monitor the quantity and range of clinical work required to be undertaken throughout the interdisciplinary training phase of the undergraduate course. By the end of fourth year, students are expected to have cumulatively completed 40 tooth-coloured, 25 amalgam and 8 indirect restorations, and 2 molar and 4 other endodontic treatments. In many cases, analysis of the records shows an early shortfall in the range of experience and numerical achievement, which are subsequently made good.

6. *To review patient care:* A computerised list, reviewing aspects of the clinical management and supportive care of all the patients treated in the conservative dentistry clinic by individual students, is used to assess patient care (Table 4). To achieve this, every patient's case note folder from the family of patients for each student is reviewed by a designated teacher on two separate occasions. The students are informed about the objectives of the assessment, and are also given a one-page checklist of requirements. The standard of the entries can be assessed, but their accuracy cannot always be determined simply from observation of the patients' records.

The continuous assessment programme has two very important landmarks, namely, the end of semesters I and II, at which time teachers summarise and grade perfor-

mances, conduct practical and written tests, and determine the need for remedial teaching. The changes in teaching protocol were discussed with students and teachers before implementation, and few students have been required to undertake additional remedial training.

Various components of the assessments are weighted to reflect time spent and the relative perceived importance of the teaching method to clinical competency (Table 5). The quota of clinical work completed is not a rigid requirement, and the final assessments are fine-tuned according to the range and amount of satisfactory work completed, and student progress. The relative weightings were determined before the commencement of the course, and were resolved through discussion with teaching staff and with the external examiner in the subject. However, it is anticipated that these weightings will change over time, with less emphasis being placed on traditional end-of-course written examinations.

Course evaluation

The course was evaluated by using a student course questionnaire that is a mandatory university requirement. A formal student evaluation of the course was obtained in July 1999. Around 80% of the 45 students thought that the course level and workload were about right. Some 70% thought that overall the course was either satisfactory or good, with various objec-

tives and aspects of the course receiving from 73–91% support. Some 88% of students thought that they received sufficient feedback, and 84% helpful assistance. These findings compared favourably with those from other courses, and were possibly reflected by an increased pass rate. (Only one student was required to repeat the course in 1999–2000, because of personal family circumstances). However, the mandatory course evaluation questionnaire is inadequate to evaluate the attainment of all course objectives in a clinical discipline.

Discussion

The recently developed continuous assessment programme in conservative dentistry has allowed teachers to monitor the clinical progress of fourth-year students more closely and effectively. Certain points along this line of continuous assessment, such as the patient management reviews, the clinical progress examination, and the range and amount of work completed, have been identified for feedback to the students and the need for any remedial teaching.

The students were assessed on the clinical competencies required in Table 1, by using various criteria set out in Tables 2–4. There is not always complete agreement on the range of desirable clinical competencies required in any course, and of their methods of assessment and weightings. However, the

self-perception by alumni of competencies by means of questionnaires appears to be an effective means of identifying strengths and weaknesses of undergraduate programmes.²¹⁻²³

Competency is a point on a continuum, and becoming a professional means going through a predictable sequence of qualitatively different patterns of knowledge, skills and values.²⁴ This is the point where responsibility for learning is transferred from teachers to learners in a dental course programme. It is the role of the learner to take the continuum beyond this point.²⁵ Student self-assessment has an important role in making this transition.²⁶

In 1994-95, partially in response to the UK's proposal for a one-year vocational training period in dentistry, the undergraduate course in Hong Kong was extended from four years and one term in duration to a full five-year programme.²⁷ The fifth-year curriculum was intended to be as close to vocational training in nature as possible. The use of competency-based teaching was not emphasised but, following the implementation in 1997-98 of integrated PBL from the first year of the undergraduate dental programme, competency-based teaching now forms part of the overall aims of the new initiative. However, some courses have yet to become more competency-based in their content, and the assessment methods for the various competencies required in the undergraduate dental course have not yet been fully developed and evaluated. Student-staff and teaching staff meetings have shown a consensus for the adoption of PBL with the use of case-based learning, real patient demonstrations using intra-oral video cameras, digital imaging and virtual reality for laboratory exercises. Undoubtedly, following additional evaluations of staff and recent graduate feedback, further course changes will be introduced.

Conclusions

The advantages to students and teachers of using learning outcomes for developing curricula are multiple. Competency-based education focuses on what students must

be able to do when they begin independent practice. It also focuses the minds of educators and facilitates the integration of teaching, rather than promoting departmental curricula in isolation. Learning is viewed as continuous and holistic, while discipline-based education has tended to bloat curricula and predispose students to mechanical rote learning. This paper presents the first steps in developing a competency-based fourth-year dental course programme in conservative dentistry at The University of Hong Kong.

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