Review of competency-based education in dentistry

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Dental education was previously structured in such a way that students largely learned what teachers chose to teach them. The aim was to produce a dentist with prescribed packages of knowledge upon graduation. This traditional approach was mainly disciplined-based. Increasingly, the current trend is towards competency-based education, which provides a sequence of defined learning experiences to students so that on graduation they may be considered as qualified beginners in dental practice. The adoption of competency-based learning requires the re-assessment and revision of old curricula, but there remains some common ground between traditional and competency-based education.

In brief

- Competency-based dental education focuses on the knowledge, professional skills and behaviour required of new graduates.
- Extensive, discipline-based dental curricula can be reduced when essential learning outcomes are identified.
- Appropriate student assessment methods are required to evaluate the defined competencies.
- Competency-bases dental education is closely linked to problem-based learning, to reduce passive dependence on teachers, and to encourage student teamwork and critical self-assessment.

In the past, educational practice has been to teach students increments of prescribed subject matter, the traditional curriculum, in the hope of instilling and retaining knowledge. However, the essence of competency-based education is that the success of dental or allied-dental health curricula should be judged in terms of its impact on students, expressed as competency outcomes. Competency-based education is based upon the early identification, at the course-planning stage, of clearly specified outcomes of learning. Statements of competence and attainment define what students are expected to learn.

It is also necessary to audit the process and confirm that learning has actually been achieved. Outcome-based assessment lends itself to continuous assessment rather than to end-of-course examination. Emphasis is given to the assessment of performance and the demonstration of skill or competence, rather than merely written evidence of knowledge.[1] Outcome-based assessment is comprehensive and covers broad outcomes rather than a few narrow areas of knowledge within a prescribed educational sphere.

The difference between discipline-based education and competency-based education must be taken into account when planning and developing curricula that are intended to provide the practice needs of the future.[2] However, the two approaches are not mutually exclusive and there is some common ground between them.[3]

An important landmark in dental education was the report of the Evidence-Based Medicine Working Group of the American Medical Association.[4] This report was followed by similar calls for the development of evidence-based dentistry in dental education. Since then, there has been a slow but steady change in the way dental students are being taught. The literature is extensive, but this short review presents the current consensus.

What is competency?

New graduates are competent when they are capable of functioning (independently) in realistic practice settings.[5] A definition of competency has been made by the working party of the Competencies for Dental Licensure in Canada, as follows:

> Competency is most often used to describe the skills, understanding and professional values of an individual ready for beginning independent dental or allied oral health care practice.[6]

Competencies combine the attributes of appropriate supporting knowledge and professional attitudes, and reliable performance undertaken in natural settings without assistance.

An education based upon competency offers several advantages, namely, enhancement of the students' performance through active participation in problem-solving learning, encouragement of critical assessment faculties, improvement of interdisciplinary understanding, better research skills and record-keeping, and improved links with practice settings and public institutions regarding dental educational matters. Problem-based learning (PBL) is closely linked to dental competencies, especially in diagnosis and treatment planning. PBL reduces passive dependence on teachers, and focuses instead on active student-centred learning with the encouragement of teamwork and critical self-appraisal. A recent report comparing two classes of graduating dental students found that those from the problem-based learning school felt more competent than those from the traditional curriculum school in communication, critical evaluation and identifying oral pathoses.[7]

Becoming a professional means going through a predictable sequence of qualitatively different patterns of skill, knowledge and values.[8] Competency includes the development of behaviour patterns that are open to broader evaluation protocols than are traditionally used in formal teaching. This being so, instructional and behavioural objectives must be clearly defined so that teachers can help students achieve competence. The challenge of a competency-based

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education is to integrate objectives with key-task competency statements.[9] A 1990 survey of UK dental schools confirmed a general trend towards competency-based teaching, the courses most often taught in this way being those related to human disease.[10] In the UK, the undergraduate dental curricula requirements are stated by the General Dental Council.[11] Although the document, *The First Five Years*, is not competency based, it is possible to interpret and reword parts to encompass the concept of competencies.

Teaching and learning for competency

Competency is not achieved immediately, but is gained in stages, as described by Chambers and Glassman[3] (Figure 1).

Increasingly, in dental education, the primary learning objective is for the learner to become progressively autonomous and for self-directed learning to take over from teaching.[3] Certain instructional objectives may help students more quickly to acquire the mental processes necessary for learning.[12,13] A successful strategy instruction may include practice on specific task-appropriate skills (cognitive aspect). Students may have to be given explicit instructions on how to undertake and monitor the skills that they are acquiring (meta-cognitive aspect), and to be given explanations of why and how the skills that they are acquiring work (informed instruction).[14] For instance, Cognitive: minimal Class II cavity preparation for a resin composite, Meta-cognitive: step-by-step acceptable quality operative procedures, and Informed: evidence-based explanation of why and how the skills the dental students acquire actually work.

Evaluation of competency

Three elements of competency in dentistry have been described, namely, intellectual competence, physical-technical competence, and interpersonal competence.[15] In a recent review, Hendricson and Kleffner[16] provided a detailed picture of competency-based dental education. They emphasised that it is important not to focus exclusively on the evaluation aspect of competency-based education, with failure to address the curricular and instructional implications.

Chambers[3] has proposed two methods of evaluation for competency-based education, namely, authentic and portfolio evaluations.

Authentic evaluation

Authentic evaluation includes any class of examination in which the test is similar to the work to be done after passing the test. Rather than a standardised performance, authentic evaluation is a judgment about an individual's capacity to perform in realistic settings. In the clinical context, students are required to perform independently and account for their choice of treatment for a range of patients. Competency-based education also offers opportunities for clinical aspects to be evaluated through case presentations, community and outreach projects, and multidisciplinary courses. While competency-based education and authentic evaluation have now been successfully adopted for the teaching of conservative dentistry in several schools, including The University of Hong Kong Dental School, there remains the argument that deficiencies in the evaluation of clinical performance remain. Portfolio evaluation has been advocated to counter this criticism.[3]

Portfolio evaluation

A portfolio is a collection of evidence demonstrating the clinical competency of a dental student. A competent student might present a portfolio or logbook of completed cases meeting certain criteria, letters or forms attesting to the student's capacity in various disciplines signed by the Heads of Departments, video tapes of his/her performance in the clinic, and research papers or abstracts. This evaluation system is created in four steps:

1 The development of a set of competency statements and their dissemination to the faculty and students.
2 The listing of the types of evidence sought in order to determine whether competency has been achieved.
3 The identification of standards whereby competency can be inferred from the evidence.
4 The specification of the mechanics necessary to undertake the evaluation, such as the form in which evidence is to be presented, the dates by which evidence is required, remedial paths, and the provision for legalistic challenges to the system.

Figure 1 Stages of Competancy[3]

- **Novice** The first of the learning steps on the learning path can be confusion and rote mimicking of instructors in the simulation laboratory or diagnostic clinic.
- **Beginner** With further instruction and practice, students gain some control of parts of a competency and become able to demonstrate this control in ideal, simulated situations when asked to do so. This signifies the transition from novice to beginner. Students master foundation knowledge and performance at this stage.
- **Competent** Now able to understand the basis for their decisions, and possess appropriate professional values and the ability to provide the dental needs of most patients.

According to the evaluation, the students can be classified into four categories:

1 **Passed** Student does not require additional instruction of the type they have been receiving.
2 **(i) Not yet passed** Student to continue in the current environment, or
(ii) **Not yet passed** An accommodation is to be made to the way the student is being taught which will allow the student to achieve competency.
3 **Failed** No reasonable accommodation in the educational experience will lead to the student becoming competent.

Structured clinical operative tests and objective structured clinical examinations[17,18] have also been proposed to improve the evaluation of clinical performance, but should not be merely added to existing evaluation methods without course restructuring.[16]

Assessments of student performance can be both formative to encourage further progress by feedback of results, and summative where the results are final for subsequent progression. Such assessments were found to be effective in competency-based education programmes for dentists for improving knowledge, professional attitudes and performance skills.[19] Laboratory and clinical learning tasks readily lend themselves to continuous formative assessments.[17] Immediately after each lesson, each student should write down his/her learning experiences, and self-assess his/her levels of knowledge, professional behaviour and performance skills. Although it is the experience of the authors that some students tend to over-estimate their abilities, a

more realistic perspective develops with increased maturity. Several other issues regarding student self-assessment have been discussed elsewhere.[20]

Competency continuum

Chambers[21] has argued that competency is a point on a continuum. It is the point where responsibility for learning is transferred from teachers to learners. Once basic competency has been achieved, the dental graduate must take the continuum to higher levels of competency, through continuing education and postgraduate dental programmes.

A newly-qualified dentist will progress through a predictable pattern of practice problems which he or she will solve in successive stages during the first years of practice.[22] The introduction, after protracted discussion, of a mandatory vocational training period for general dental practice on graduation in the UK formally addressed this situation. It has been hypothesized that dentists' continuous development of their knowledge and skills only begins to plateau five or six years into their practices.[23]

It has been suggested that a set of competency statements also be formulated for graduates undertaking postdoctoral training in general dentistry.[24] Such competencies relate to the need for recent graduates to integrate knowledge and skills into comprehensive patient care, to acquire advanced knowledge and skills, and to begin the transition from undergraduate education to dental practice. Systems of care delivery must also promote an integration of oral health with general health care so as to care for the community as well as the individual, emphasis being placed upon the collaboration of interdisciplinary primary health care teams. The evaluation of clinical competency in postgraduate general dentistry is now widely adopted in current postgraduate teaching.[24,25] The self-perception of competencies by alumni of such postdoctoral general dentistry programmes by means of questionnaires is an effective means of identifying strengths and weakness of the programmes.[26]

Competency continuum initiatives have been implemented by a number of educational establishments. The Faculty of Dentistry, The University of Hong Kong, has recently developed a one-year postgraduate diploma course in general dentistry. Colleges in the United Kingdom have established diploma and membership examinations for general dental practitioners, while the Royal Australasian College of Dental Surgeons has recently initiated an open examination for a diploma certificate in general dentistry. Postdoctoral programmes with community-based clinical care settings have also been developed, in which the factors and conditions essential to successful programme linkages have been identified.[27]

Conclusions

The advantages to learners and teachers of learning outcomes are multiple. These competencies offer a different way of looking at the dental and allied-dental curricula, and view learning as continuous and holistic. Discipline-based education reduced to instructional objectives has, in the past, served to bloat curricula and has led students to a mechanical approach to learning. On the other hand, competency-based education focuses on the essentials that students must be able to do on their own when they begin practice, and forms the basis for a career in which continuing education is self-directed and ongoing.

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