Perspectives

Assessing Dental Students’ Competence: Best Practice Recommendations in the Performance Assessment Literature and Investigation of Current Practices in Predoctoral Dental Education


Abstract: In this article, the Task Force on Student Outcomes Assessment of the American Dental Education Association’s Commission on Change and Innovation in Dental Education describes the current status of student outcomes assessment in U.S. dental education. This review is divided into six sections. The first summarizes the literature on assessment of dental students’ performance. Section two discusses catalysts, with a focus on problem-based learning, for development of new assessment methods, while the third section presents several resources and guides that can be used to inform selection of assessment techniques for various domains of competence. The fourth section describes the methodology and results of a 2008 survey of current assessment practices in U.S. dental schools. In the fifth section, findings from this survey are discussed within the context of competency-based education, the educational model for the predoctoral curriculum endorsed by the American Dental Education Association and prescribed by the Commission on Dental Accreditation. The article concludes with a summary of assessments recommended as optimal strategies to measure three components of professional competence based on the triangulation model. The survey of assessment practices in predoctoral education was completed by 931 course directors, representing 45 percent of course directors nationwide, from fifty-three of the fifty-six U.S. dental schools. Survey findings indicate that five traditional mainstays of student performance evaluation—multiple-choice testing, lab practicals, daily grades, clinical competency exams, and procedural requirements—still comprise the primary assessment tools in dental education. The survey revealed that a group of newer assessment techniques, although frequently identified as best practices in the literature and commonly used in other areas of health professions education, are rarely employed in predoctoral dental education.

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This article is one in a series of invited contributions by members of the dental and dental education community that have been commissioned by the American Dental Education Association’s Commission on Change and Innovation in Dental Education (ADEA CCI) to address the environment surrounding dental education and affecting the need for, or process of, curricular change. This article was written at the request of the ADEA CCI but does not necessarily reflect the views of ADEA, the ADEA CCI, or individual members of the ADEA CCI. The perspectives communicated here are those of the authors.

Key words: dental education, dental students, competency, assessment, OSCE, triple jump exercise, critical appraisal, portfolios, competency-based education
Assessment represents a critical component of successful education in the skills, knowledge, affective processes, and professional values that define the competent practice of dentistry. In recent years, there have been reports in the dental education literature of pedagogical innovations such as problem-based or case-reinforced learning, patient simulations, web-based learning, service-learning, and other strategies designed to help students develop critical appraisal skills and gain an appreciation for the concepts of evidence-based oral health care. This movement toward a broader spectrum of teaching and learning methods in predoctoral dental education underscores the importance of utilizing appropriate assessment strategies that are consistent with the level of cognitive skills that can be developed with these new techniques. Virtually all commentaries and expert opinion on performance assessment in health professions education indicate that we must evaluate not only the recall and recognition of specific facts and the demonstration of technical skills, but also students’ capacity to synthesize information within a given context and apply it in unique situations that require critical thinking and problem-solving. Ultimately, the goal of assessment in health professions education is to determine students’ capacity to integrate and implement the various domains of learning that collectively define competent practice, over an extended period of time, with day-to-day consistency, in a work environment that approximates the actual work setting where health care providers interact with patients. Yet the literature on assessment methodologies for these purposes in dental education is relatively sparse.

Revisiting strategies employed to determine dental students’ readiness to graduate and begin providing health care services to the public, or to progress to a higher level of training, is particularly critical in light of recent developments at the national level that are likely to have a dramatic effect on curriculum content and, accordingly, methods of assessment in the future. In April 2008, the American Dental Education Association (ADEA) House of Delegates approved an updated set of outcomes for predoctoral dental education, “Competencies for the New General Dentist,” which define the domains of competence needed for entry-level general dentistry (see the Appendix). This document replaces the original set of predoctoral competencies approved in 1997 by ADEA.) The 2008 competencies provide a forward-looking outline of the components of general dentistry with increased emphasis on cultivating dental students’ capacity for critical thinking, now the first domain in the updated document. The accreditation standards for predoctoral dental education also are undergoing a process of substantial revision, with parallel emphasis on promoting and measuring students’ critical thinking capabilities and capacity for self-assessment. We hypothesize that, as the curricular implications of these revised competencies and educational standards are pondered at U.S. dental schools, there will be similar consideration of what these new directions mean for the appraisal of students’ progression toward competence.

This review is divided into six sections. The first summarizes the literature on assessment of dental students’ performance. Section two discusses catalysts, with a focus on problem-based learning, for development of new assessment methods, while the third section presents resources and guides that can be used to inform selection of assessment techniques for various domains of competence. The fourth section describes the methodology and results of a 2008 survey of current assessment practices in U.S. dental schools. In the fifth section, findings from this survey are discussed within the context of competency-based education, the educational model for predoctoral curriculum endorsed by ADEA and prescribed by the Commission on Dental Accreditation (CODA). The article concludes with a summary of assessments recommended as optimal strategies to measure three components of professional competence based on the triangulation model.

Literature on Assessment of Dental Students’ Performance

Approximately 150 articles (not including editorials, commentaries, and brief case reports) over the past thirty years have addressed aspects of student assessment in dental school. This is a relatively small volume of literature, considering the number of dental schools worldwide. Roughly half of these articles are described below, with emphasis on the past ten to fifteen years.

Much of the literature on assessment in dental schools has focused on strategies to improve calibration among raters in preclinical laboratory courses and the clinic. Some of these articles also have addressed the technical design of rating scales used to grade students’ performance on procedural
tasks, including number of rating points, number of observers for clinical competence examinations, strategies for developing rating criteria, discussion of the level of detail that should be included in rating scales, and descriptions of processes for calculating students’ evaluations including weighting systems but with substantial emphasis on calibration techniques to increase consistency among evaluators and making adjustments for “hawk” (hard) and “dove” (easy) raters.4-12 These are important issues that directly influence the assessment responsibilities of clinical faculty members, but few articles have addressed the overall purposes of assessment in dental education and asked questions such as the following: what learner outcomes should be emphasized; what techniques can best measure these respective outcomes; are we evaluating acquisition of knowledge, skills, and behaviors that are meaningful for the contemporary practice of general dentistry; and do all the assessment data obtained throughout the predoctoral curriculum in classroom-based courses, labs, and clinics predict which students will be safe practitioners who add value to their communities—or do these data simply predict who can navigate the rigors of the dental school curriculum? These questions have been the subject of extensive consideration in other health professions,13 but a similar dialogue has only begun to emerge within academic dentistry. Further, if “evaluations drive the curriculum and dictate students’ study habits and priorities,” what is the influence of these measurements on our students’ intellectual development and attitudes about learning, and what is their influence on students’ approaches to studying?

A substantial number of articles dating back to the 1960s have reported the results of studies that explored the correlation between prematriculation predictors and dental students’ in-school academic performance; this has been a more substantial area of research than investigating methods for assessment of students after they matriculate.15-25 Several studies have been conducted to explore the relationship between aspects of students’ in-school academic record and National Board or licensure examination performance, with generally inconsistent results.25-31 A small group of studies compared students’ performance and clinical productivity when they function in clinical education systems that stress procurement of procedural requirements versus non requirement-driven systems.22-27 Several studies investigated students’ impressions of assessment strategies employed by faculty with emphasis on issues of faculty consistency in clinical grading and the resulting effect on student attitudes and performance.38-42 One investigator, David Chambers, conducted with his coauthors a series of studies to investigate approaches to measuring students’ acquisition of clinical competence and other issues related to competency assessment.43-46 Berrong et al. examined the relationship between daily grades—a mainstay of evaluation in the clinic, in which students receive a rating for each patient procedure, typically on a 0 (unacceptable) to 4 (excellent) scale—and performance on twenty-six clinical competency exams in which students work without instructor coaching.47 These investigators found that the hundreds of daily grades that each senior student received in an academic year were poorly correlated with performance during competency exams in which students worked without instructor “rescue” unless the patient was in danger of irreversible damage. Berrong et al. concluded that daily grades were positively skewed: the average grade was in the 3.0 to 3.5 range, a solid “B,” with minimal distinction between students at the high and low ends of the cumulative dental school grade point average (GPA). This study suggested that competency exams were a more reliable assessment of students’ capacity to perform core skills than the traditional daily grade.

Licari and Knight, as well as Taleghani et al., described efforts by dental schools to design assessment systems for evaluating dental students’ performance in ways that are consistent with the principles of competency-based education using objective structured clinical examinations (OSCEs), portfolios, and student self-assessment and emphasizing formative (nongraded) feedback.48-50 Recently, Prihoda et al. described a technique to correct scores for student guessing on multiple-choice examinations administered in dental school.51 Karl et al. compared dental student performance on computer-aided testing and traditional multiple-choice examinations.52 These latter two articles are among a handful in the dental education literature over the past twenty-five years that have addressed issues and techniques related to multiple-choice testing. A few articles published in the 1970s and early 1980s addressed assessment with multiple-choice formats, but the literature has been limited since that time.53-55

Several authors have described the use of OSCEs and standardized patients (also known as patient-instructors or simulated patients) in dental education, and a couple of these publications reported the findings of research studies designed to assess the use of OSCEs as an evaluation tool.56-63 Curtis et al. and
Denney et al. compared students’ performance on OSCEs to traditional assessments.52,64 Schoonheim-Klein et al. recently published an analysis of the reliability of a dental school OSCE and studied the number of stations needed for optimal reliability.65 Licari and Knight, Gadbury-Amyot et al., and Chambers have reported the use of portfolios for student assessment and discussed implementation of this technique.48,60-68 There have been several reviews of the literature on uses of portfolios for assessment, including an excellent summary by Friedman Ben David et al.69 Durham et al. reported use of a logbook approach for assessment of dental students’ clinical competence.70 A research team led by von Bergmann studied the relationship between problem-based learning process grades, using a triple jump assessment technique (a method to assess students’ capacity to explore, appraise, and apply biomedical information to problems) and traditional content acquisition measurements (multiple-choice examinations).71 Bondemark et al. studied dental students’ use of a self-directed examination technique similar to the triple jump.72 Leisnert and Mattheos, Curtis et al., and Thammasitboon et al. reported the only studies we could identify on the effects of dental student self-assessment,73-77 although the journal Medical Teacher has published two reviews of the literature on student self-assessment including a recent (2008) comprehensive summary by Colthart et al. in the Best Evidence in Medical Education (BEME) series published in that journal.76,77 There have been numerous articles published in the dental education literature that describe applications of computer-aided learning (CAL), including a few that reported findings from studies investigating the influence of CAL on students’ performance. The focus of most of these articles was on instruction or strategies for incorporation of CAL into the curriculum, rather than on assessment, which was often mentioned as a potential application. For this reason, we elected not to review that literature here.

In summary, our review of the available literature describing strategies for assessment of dental student performance, as well as the experiences of members of the Task Force at their own institutions, suggests that five methods have been the mainstays of dental student evaluation: multiple-choice exams, laboratory “practicals,” completion of specified units (numbers) of procedural requirements, daily grades, and clinical “comps” (i.e., competency patients). The latter two involve faculty observation of students’ interactions with patients and inspection of the process and outcomes of dental treatment to restore or replace tooth structure and function. Two of the purposes of the survey described below were to determine the accuracy of this perception about the predominance of the traditional data sources for student performance evaluation and to determine the extent to which a number of “new” assessment techniques, frequently described and/or employed in other areas of health professions education, are being used in predoctoral dental education. Of course, a principle mechanism for assessing dental students’ progress toward graduation and certification of their readiness for graduation in the United States is the National Board Dental Examination (NBDE), Parts I and II. However, since this review focuses on assessment strategies implemented by dental schools, the NBDE will not be addressed in detail other than to acknowledge that all U.S. dental schools use Parts I and II as major indicators of students’ progress.

Catalysts for New Assessment Methods in Dental Education

In dental education, alternative methods for assessment of student performance have tended to emerge as more innovative teaching methodologies have opened doors to new thinking about educational processes, including assessment. Certainly, one of the most important curricular innovations in dental education over the past forty years has been problem-based learning (PBL), in which students are engaged in working with others to structure solutions to contextualized problems and thus acquire biomedical knowledge in an inquiry-learning mode.78 PBL is rarely employed as a primary curricular strategy in U.S. dental education, and thus the dental education literature reveals few efforts focused on assessment designed specifically for PBL.79 Moreover, most reports evaluating PBL in both medicine80 and dentistry81 have relied on traditional methodologies for assessing student performance rather than evaluation techniques that are consistent with the inquiry-learning structure of PBL, which are designed to assess students’ capacity for self-directed analysis and application of biomedical information.82 In fact, some of the early criticisms of PBL were that there were no major changes in “standard performance indicators.”83 Such criticism ignored the probability that
standard performance indicators such as multiple-choice tests may not measure the more sophisticated cognitive functions (application, synthesis, evaluation, critical appraisal) that PBL is intended to develop in students.

Fincham and Shuler’s report on the adoption of problem-based learning in dental education included a section on assessment in which they asserted the dual purposes of assessment in this context: 1) feedback for self-direction of learning and 2) assessment of abilities in the process. They pointed out that assessment methods chosen will influence what is learned and that in PBL those methods must measure “student achievement in the process of problem dissection, identification of learning objectives, and development of critical thinking skills” as well as, later on, “the application of these skills in problem-solving situations.” They suggested that a variety of approaches to assessment are useful for PBL, including faculty, self-, and peer/subjective assessments, problem-solving exercises, case-based multiple-choice tests that are written to assess students’ comprehension of the association between symptoms and pathophysiology, OSCEs, clinical competency assessments, and the triple jump exercise, which requires self-directed learning skills. The multimethod approach advocated by Fincham and Shuler may not be employed in many programs using PBL, but the message that assessment must be an integral part of the educational experience is now being recognized by dental educators.

**Resources and Guides to Inform Selection of Assessment Techniques**

Decisions regarding which assessment methods to use for various purposes in dental education can be difficult in an educational environment that values and sustains traditions, operates largely in isolation from other health professions educational programs, and has not meaningfully altered teaching methods or fundamental curriculum structure for fifty years. New techniques are emerging, many borrowed from the other health professions, though most are largely untried in dental schools by “in the trenches” faculty. Moving to alternative techniques and away from the seemingly tried-and-true comfort zone of traditional methods requires confidence that appropriate performance measurements are being selected. Of course, the optimal assessment plan is to use the right technique for the right reasons, at the right time, and with the right group of students in order to make the right decisions about the right competencies that the student will need to function independently after graduation from dental school. Fortunately, several guides and resources exist to help faculty members make decisions about assessment methods. In a valuable review published in 1997, Chambers and Glassman described assessment techniques available to measure dental students’ attainment of competence and summarized the strengths and weaknesses of these techniques. The Accreditation Council for Graduate Medical Education (ACGME) produced a toolkit that recommends strategies for measuring attainment of professional competence. This toolkit is available at the ACGME website at www.aacme.org/Outcome/assess/Toolbox.pdf. Another excellent resource is the All Ireland Society for Higher Education (AISHE), which periodically publishes Case Studies of Good Practices of Assessment of Student Learning in Higher Education. The AISHE website is at www.aisque.org.

The journal *Medical Teacher* has published valuable reviews of the evidence pertaining to many aspects of health professions education in its AMEE (Association for Medical Education in Europe) series of Advancing Medical Education Guides. Recommended resources from this series include AMEE Guides No. 18, 25, and 31, which address, respectively, standard setting for student evaluation, assessment of learning outcomes for the competent and reflective physician, and workplace-based assessments.

The Task Force on Student Outcomes Assessment of the ADEA CCI has prepared a comprehensive assessment toolkit, specifically geared to dental education, which reviews the capacity of sixteen assessment methods to measure student attainment of the new ADEA predoctoral competencies. This toolkit, which was developed by Dr. Gene Kramer of the American Dental Association, will appear in the January 2009 issue of the *Journal of Dental Education*. The ADEA CCI Dental Assessment Toolkit highlights the strengths and weaknesses of each technique and provides key references.

The hierarchy of cognitive skills and levels of intellectual sophistication that can be assessed is described in Figure 1, which displays Benjamin Bloom’s cognitive taxonomy that has guided test developers in all areas of education since the 1950s. Bloom’s taxonomy can help faculty members in their efforts...
to plan learning experiences to help dental students achieve desired outcomes and to plan assessments that sample a range of cognitive capacities. The right column in Figure 1 provides illustrative examples of assessment tasks that students can be asked to perform at each cognitive level.

We developed Figure 2 to summarize recommendations derived from a number of reviews of performance appraisal strategies that are appropriate to assess acquisition of competencies common to many health care professions including dentistry.\textsuperscript{1,89,91,93,95-100}

The left column of Figure 2 lists ten domains of competence identified by virtually all health professions as core components of professional functioning. Seven techniques commonly described in the literature on competency assessment in the health professions ap-

<table>
<thead>
<tr>
<th>Level of Cognitive Function</th>
<th>Student’s Mental Task</th>
<th>Examples of Assessment Tasks</th>
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<tbody>
<tr>
<td>Recall (recognize)</td>
<td>Label a structure.</td>
<td>Identify, by labeling, the temporal and infratemporal fossae.</td>
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<td></td>
<td>Recognize a feature on a slide.</td>
<td>From a list of options, identify the primary cause of Wilson’s disease.</td>
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<td>Select a best response from a list.</td>
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<tr>
<td>Comprehension (short answer essay response or verbal response on an oral exam)</td>
<td>Explain etiology. Describe manifestations and characteristics.</td>
<td>Explain the pathophysiology of . . . Describe the symptoms of . . .</td>
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<td>Application (solve problems)</td>
<td>Use information to analyze and solve problems.</td>
<td>Identify the cause of this patient’s pain. Write a treatment plan for a patient with these symptoms and examination findings.</td>
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<tr>
<td>Analysis</td>
<td>Compare and contrast concepts, models, or techniques. Discern relationships between phenomena or events. Interpret information.</td>
<td>Compare the merits of approaches to providing care for this patient. Analyze which of the factors in this case scenario may have been related to each other and contributed to the outcome. What are the implications of this combination of lab findings for the patient’s prognosis?</td>
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<td>Synthesis (planning)</td>
<td>Develop a new plan. Identify alternative actions or responses to a situation.</td>
<td>Create a plan to remove barriers to implementation of . . . Propose an alternative plan for . . .</td>
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Figure 1. Levels of learning and assessment described in Bloom’s cognitive taxonomy
peared as column heads: multiple-choice tests; essays; oral (verbal) examinations; ratings based on direct observation of specific student interactions with patients; longitudinal faculty evaluations of students’ overall performance across many domains of competence over an extended period of time (i.e., not based on a single encounter with a patient but on numerous encounters over several months); retrospective record review (often called chart-stimulated evaluation); and OSCEs (discussed in detail below) designed to assess students’ performance in a variety of skills during one exam in which students rotate among a series of stations.101 In medical education, variations of OSCEs are often referred to as CPEX (Clinical Performance Exam), CPX, or mini-CPX for an abbreviated version of this assessment involving an observed student interaction with a single patient in which all aspects of performance are comprehensively assessed.

The ratings shown in Figure 2 reinforce that faculty observations of students’ performance during actual interactions with patients—both single encounters with one specific patient and long-term across many patient encounters—are most valued by experts in performance measurement. Both observation of single patient encounters and longitudinal assessments that reflect a student’s all-around performance over two to three months can be used to measure most of the ten domains. Longitudinal evaluation across many patients may be a better data source for professional demeanor, personal attributes, and capacity to use clinic resources appropriately than are available in single encounter evaluations, which might capture “best day” or “worst day” snapshots of students that are not representative. However, single encounter assessments may be better for monitoring specific skills such as interviewing and examining patients and performing technical procedures that can be rated against criteria on checklists. In contrast to faculty observation, testing via multiple-choice questions is limited to three of the ten domains as part of this study provides a description and examples of this assessment format.

Multiple-choice question (MCQ) testing is a valuable resource for certifying students’ capacity to remember core principles and facts or to demonstrate recognition of fundamental associations and relationships. Such testing assesses only a limited range of the overall cognitive taxonomy depicted in Figure 1, however, and is not optimal to assess many of the competency domains considered critical for adequate professional performance. The MCQ format can be used to assess higher-level cognitive processes when case-based formats are used so that students must identify key data from a patient scenario and interpret these data in order to respond to questions written at the application level of Bloom’s taxonomy.94 For example, questions based on case scenarios can be designed to request identification of pathophysiological mechanisms that account for patient symptoms, select appropriate diagnostic tests to confirm assessments, and recognize the most suitable treatment approach from a list of options.92,102 The National Board Dental Examination (NBDE) has adroitly incorporated case-based questions, also known as testlets or case-cluster items (in which several questions are linked to a case scenario), to stimulate students to respond at the “application” level. The Dental Assessment Toolkit developed as part of this study provides a description and examples of this assessment format.93 When skillfully executed to assess at cognitive levels beyond sheer rote memorization, multiple-choice and other written examination formats such as short-answer essays can play a critical role in educational assessment.

The NBDE uses the multiple-choice question format with variations. The underlying content selection process for the Part I and Part II exams has become increasingly sophisticated over the past decade. The Joint Commission on National Dental Examinations has taken a thoughtful and proactive approach to populating test construction committees to obtain greater input from general dentists and, accordingly, to focus examination topics on knowledge pertinent to contemporary general dentistry.103,104 For clinical skills, dental educators primarily use observation with a focus on the products of technical procedures. The practice of using completion of a specified number of clinical procedures as a proxy for competence has been criticized in recent years. Dental students have identified “requirement-chasing” as a major source of anxiety and have expressed concerns about the ethical implications of using patients as educational tools.39,42 In the traditional model of clinical education, dental stu-
<table>
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<tr>
<th>Domains</th>
<th>MCQ</th>
<th>Essay</th>
<th>Oral (verbal) exam</th>
<th>Single encounter direct observation by faculty(^a)</th>
<th>Longitudinal assessment by faculty across many domains(^b)</th>
<th>Record review/chart-stimulated review(^c)</th>
<th>Standardized examinations (OSCE/CPEX)</th>
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<td>Biomedical knowledge (recall and recognition level of cognition)</td>
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<td>Problem assessment</td>
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<td>Professional behavior</td>
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<td>Personal qualities</td>
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<td>Concern for patient’s well-being</td>
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<td>Patient examination skills</td>
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<td>Patient interviewing and communication skills</td>
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<td>Ordering/interpreting diagnostic (lab) tests</td>
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<td>Performing technical procedures</td>
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<td>Resource use and functioning within health care system</td>
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\(^a\)Single encounter direct observation: Faculty member observes and assesses student’s interaction with and treatment of one patient, i.e., a single clinic appointment with one patient.

\(^b\)Longitudinal assessment: Comprehensive (summary) assessment of many aspects of performance and across several competency domains over an extended period (8–12 weeks) of observation of a student’s performance by faculty members who have daily interactions with the student. Sometimes this type of assessment is called “global” or “comprehensive” evaluation to denote the focus on students’ overall performance versus focus on a single patient encounter or a single procedure.

\(^c\)Record review: Faculty and students retrospectively review a student’s clinical work as evidenced in the charts of patients who received treatment by that student. Record review is often called “chart-stimulated review” because the format gives faculty members an opportunity to ask students to explain and self-assess their diagnostic and treatment decisions and thus measure the students’ 1) understanding of clinical principles and 2) capacity to articulate reasonable rationales for patient treatment decisions.

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**Figure 2.** What domains of competence can be evaluated with assessment methods commonly used in health professions education?
dentists are required to complete a designated number of repetitions of specified dental procedures within calendar deadlines as evidence of clinical competence (various types of amalgam, gold, and composite restorations, crowns, dentures, root canals, extractions, quadrants of periodontal scaling, etc.). In the requirement system, students’ behavior in the clinic often depends on finding patients who have oral health problems that provide opportunities to perform required repetitions of the designated procedures. Some dental educators have expressed concern that overreliance on numerical requirements creates an environment in which students are encouraged to place their own training needs ahead of the patient’s health needs (e.g., talking patients into procedures the student needs to perform but which the patient may not need).  

Several studies have demonstrated that dental students operating without requirements are equally or more productive than their peers in requirement-driven systems, receive an equally diverse clinical experience, perform as well or better on indices of clinical performance, and report lower levels of stress.  

Although dental faculty appeared to be moving away from the requirement system in the 1990s, anecdotal evidence and student reports suggest that this method for determining clinical competency is making a comeback.  

One of the goals of the ADEA CCI survey of assessment practices described below was to determine the extent to which dental schools are still relying on “competency by numbers.” We were also interested in the extent to which clinical faculty members continue to rely on the process of assigning one or more grades for each patient treated by a student, often at the primary faculty check-off or signature points (indicating permission to proceed), leading to the hundreds of “daily grades” that historically have been added up and averaged to provide an important data source for students’ clinical evaluation.

**Survey Methodology**

The ADEA CCI online survey was conducted in the spring semester of 2008, with participation by fifty-three of fifty-six U.S. dental schools (93 percent). Course directors were asked to report how their students’ competence is assessed. Nearly 1,000 faculty members responded, which comprises approximately 45 percent of U.S. dental school course directors and represents the most extensive study of dental school assessment strategies to date.  

Members of the Task Force developed the initial version of the survey in the fall of 2007. The survey had three objectives. The first and primary objective was to determine what assessment strategies dental school course directors use to measure their students’ progress within each of the six domains of general dentistry competence identified in the 2008 ADEA “Competencies for the New General Dentist.” The domains and associated competencies appear in the Appendix.) The second objective was to determine how dental schools assess students’ overall readiness for graduation and entry into unsupervised dental practice. The third objective was to determine faculty members’ perceptions of several assessment issues that are unique to predoctoral dental education. The twenty-one-item online questionnaire was pilot-tested in December 2007 by eighty-nine faculty members at three U.S. dental schools who completed the survey and provided recommendations for modifications; changes suggested in wording and other clarifications were incorporated into the final survey instrument. To assess test-retest reliability of the instrument, thirty-three faculty members at one U.S. dental school also completed the survey twice at a ten-day interval. Reliability for responses for each of the six competency domains ranged from 0.78 to 0.93, and reliability for responses to the questions addressing general assessment issues was 0.84—more than acceptable levels of reliability. The survey link was emailed to dental school deans for distribution to course directors on March 17, 2008, and again on April 7. Nonresponding schools received a third email on April 21. Between May 5 and 12, personal
follow-up contacts were made with the remaining nonrespondents.

Five questions in the survey elicited information about respondents’ demographics. The next seven questions asked respondents to identify assessment methods their school used for the ADEA competencies from among seventeen options. Eight questions asked for information about each school’s overall student assessment processes including final determination of readiness for graduation and subsequent entry into unsupervised practice. The final question was an open-ended invitation to submit written comments pertaining to dental student assessment strategies.

For the questions designed to elicit primary assessment techniques linked to each competency domain, respondents were given the name of each of the six domains listed in the “Competencies for the New General Dentist” and, for each domain, the full text of the specific competencies comprising that domain. Respondents then were asked, “Which of the methods listed below are the most important and most frequently used sources of information to assess students’ competence in this domain?” Nineteen response options followed; seventeen of these options were assessment strategies shown in Figure 3. Respondents were asked to indicate all assessment techniques they use to measure students’ attainment of competence, but were encouraged to designate only those methods that they routinely use. In addition to selecting one or more of the seventeen assessment techniques, respondents could also indicate that the competency is not addressed in their courses or that the competency domain is included in the curriculum but students’ learning is not formally assessed.

The seventeen assessment strategies included in the survey were identified from a review of the literature, including available assessment toolkits. However, a primary source for designation of the assessments that comprised the response options was Miller’s Pyramid of Professional Competence, which appears in Figure 4. Miller’s four-layer categorization of levels of knowing and associated assessments is probably the best-known hierarchy for describing the learning and measurement continuum in health

<table>
<thead>
<tr>
<th>Assessment Method</th>
<th>Features Provided to Survey Respondents</th>
</tr>
</thead>
<tbody>
<tr>
<td>Context-Free Multiple-Choice Questions (MCQ)</td>
<td>One-best-response questions that are not linked to a clinical context designed to assess recognition or recall of specific pieces of information, i.e., not linked to a patient care situation.</td>
</tr>
<tr>
<td>Case-Based Multiple-Choice Questions (MCQ)</td>
<td>Multiple-choice questions linked to scenarios describing patients’ oral health and/or medical problems.</td>
</tr>
<tr>
<td>Essay</td>
<td>Open-ended assessment format whereby students respond in writing, with or without structural guidance, to assess their capacity to apply information to biomedical problems or to the assessment and resolution of patients’ health problems.</td>
</tr>
<tr>
<td>Oral Examination</td>
<td>Format requiring students to respond verbally to instructors’ questions, but used for similar purposes as the written essay.</td>
</tr>
<tr>
<td>Research Report and Presentation</td>
<td>Students investigate an assigned topic/question and prepare a report or presentation, which is graded for quality and thoroughness.</td>
</tr>
<tr>
<td>Critical Appraisal Task (also known as Critically Appraised Topic Summary or CATS)</td>
<td>Evidence-based format requiring generation of a research question and a review of the available literature, with critical appraisal of evidence presented in a written summary.</td>
</tr>
<tr>
<td>Computer-Based Simulation</td>
<td>Appraisal of students’ performance on web-based simulations depicting patient care scenarios, usually involving tasks such as assessment, diagnosis, and treatment planning.</td>
</tr>
</tbody>
</table>

Figure 3. Seventeen assessment strategies included in the 2008 survey of assessment practices in U.S. dental schools
Laboratory Exercise (Practical) | Direct evaluation of students’ performance of technical/procedural skills in preclinical laboratory courses and appraisal of the products of their work.
---|---
Chart-Stimulated Evaluation | Review of patient care using charts (medical/dental records) as the basis for instructors’ questions intended to explore students’ capacity to explain rationales for treatment decisions, show comprehension of key concepts, and stimulate students’ self-assessment and reflection.
Objective Structured Clinical Examination (OSCE) | Students rotate from one station to another to perform specified tasks under time restrictions, such as interpreting radiographs, assembling equipment, interviewing patients, writing an assessment, conducting a head and neck examination, and measuring vital signs.
Triple Jump Exercise (TJE) | In the clinical variation of the TJE included on this survey, students are observed as they interview and examine a patient (first jump); then, they write an assessment and propose a treatment plan with justifying rationale (second jump); and, finally, they explain the assessment and treatment plan and respond to faculty questions (third jump). Students receive component scores of each jump and overall scores. (Note: An alternative TJE version, often used in the preclinical years and described in the section below on CBE, was not included in this survey.)
Longitudinal Evaluation (over an extended period of time) | Also called “comprehensive,” “global,” or “summary” evaluations, this type of assessment considers student performance in all relevant dimensions and disciplines over an extended period of time to allow assessment of reproducibility and consistency of performance, typically eight to twelve weeks in duration. Longitudinal evaluations include appraisal of students’ ability to integrate knowledge and skills into relatively seamless performance that is equivalent across various disciplines that comprise a profession.
Daily Evaluation | Students’ performance with each patient and/or each procedure is evaluated by the supervising instructor, resulting in a “daily grade.” This is similar to the single encounter evaluation shown in Figure 2.
Student Self-Assessment | Critical assessment of one’s own performance and reflection on ways to enhance subsequent performance.
Portfolio-Driven Assessment | Students present their work over time through a variety of methods, including photographic documentation, patient charts, reports and projects, posters and abstracts, copies of evaluations, and self-comment and reflection on the learning process. Portfolios are periodically reviewed to determine extent of progress toward specified competencies.
Unit Requirements | Number of procedural units performed by students or number of points awarded for completion of procedures that are used as indicators of competence.
Clinical Competency Examination | Students perform designated tasks and procedures on a patient in the clinic without instructor assistance. The process of care and the products (e.g., in-mouth procedures such as an amalgam restoration) are assessed by faculty observers typically guided by a rating scale.
professions education and provides the conceptual basis for many of the prominent reviews of assessment strategies. As discussed by Wass et al., much of the research in performance assessment in the health professions over the past twenty years has been directed at determining optimal strategies to assess students’ capacities at each of the four levels of this hierarchy.78

The base level of competence in the pyramid is “knows”—the straight factual recall or recognition of information without reference to a patient care context, typically measured by multiple-choice questions. At the subsequent “knows how” level, students are expected to demonstrate the ability to apply biomedical information to the analysis and resolution of problems presented in written cases and simulations based on real-life patient care situations (i.e., during the preclinical phase of training) and to use their accumulated knowledge to make the decisions requested in these cases/simulations. At the “knows how” level, students should also be able to explain, in their own words, how basic pathophysiological mechanisms work and how health abnormalities occur. Essays, MCQs based on scenarios, oral evaluations (questions and answers between instructor and students), and more sophisticated techniques such as the triple-jump exercise (a problem-solving simulation) are appropriate assessment tools. At the “shows how” level, students are expected to demonstrate the capacity to apply patient care skills in laboratories and simulations that approximate clinical facilities and the dynamics of provider-patient interactions. As shown in Figure 4, at this stage, more sophisticated assessment methods are used that place students in reasonably high-fidelity simulations of health care providers’ actual working conditions to determine if students can apply knowledge and skills under controlled, well-supervised conditions. At the ultimate “does” level, the student is expected to execute the core tasks and responsibilities of a health care provider in “real” or very realistic working conditions with limited instructor support over an extended period of time; the aim is to determine whether the student has mastered the fundamental competencies necessary for unsupervised practice and can reproduce these skills with a consistent level of performance over several weeks to several months. Assessment techniques at this level emphasize direct observation of performance and review of representative work samples by various techniques, including the portfolio and clinical competency examinations in a variety of formats.

The Task Force used Miller’s conceptualization of the Pyramid of Professional Competence to identify assessment techniques that were unique to dental education yet consistent with Miller’s definitions of levels and associated measurement strategies. We dis-

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**Figure 4. Miller’s Pyramid of Professional Competence with examples of assessment techniques used in medical education**

tributed these techniques among Miller’s hierarchical categories of knowing and doing as shown in Figure 5 to encourage respondents to consider the entire spectrum of learning as students progress toward competence. Four techniques were designated for the “does” level; six for the “shows how” level; five for the “knows how” level; and two for “knows.”

To help determine the extent to which the traditional assessment techniques (MCQs, lab practicals, clinical competency exams, daily grades, and procedural unit requirements) persist as mainstays of student evaluation in relation to other potential techniques, we included several assessment strategies that are being incorporated as evaluation methods into the other health professions and are often advocated in the literature as best practices: the triple jump exercise, critical appraisal tasks (CATs), OSCEs, portfolios, chart-stimulated evaluations, and global assessment (long-term/longitudinal assessment across many components of competence).

**Results of the Survey**

A total of 1,025 responses from faculty members were obtained, with 931 deemed usable by virtue of completeness and acceptability of response format. Most of the responses (90 percent) were from course directors (N=841), with an additional forty-nine responses (5 percent) from academic affairs deans, all but three of whom indicated that they also serve as course directors, and forty-one (4 percent) that were unidentifiable with respect to positions. Table 1 shows the distribution of respondents by discipline.

The dental school curriculum with a clinical training phase that is largely conducted at a school-operated clinic located within the dental school facility (unlike clinical training in other health professions) places dental school course directors in a unique position to provide perspectives about the longitudinal assessment of students’ movement toward competence. In most of the other health professions, one group of faculty provide the biomedical foundations and theoretical concepts for professional practice and then another group of individuals, who are primarily practitioners in health care facilities in the community, often geographically distant, supervise students’ clinical education. In contrast, many dental school faculty members are able to interact with students throughout the curriculum and track their progress. For example, it would not be unusual for a faculty member in restorative dentistry to work with freshman students in the dental anatomy course, present lectures in an entry-level operative course later in the first year or in biomaterials, teach and assess students in sophomore operative laboratory courses, and then supervise students and provide evaluations in the clinic during their junior and senior years. This is a major strength of dental education and, for purposes of this survey, allowed respondents

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**Figure 5. Distribution of seventeen assessment methods in the 2008 survey of assessment practices in U.S. dental schools among Miller’s Pyramid of Professional Competence levels**

- **Does** (4):
  - Longitudinal evaluations (assessment of overall performance over a period of time), daily evaluations (based on single patient encounters), portfolios, clinical competency exams

- **Shows How** (6):
  - Lab practicals, chart-stimulated evaluation, OSCEs, computer-based simulations, students’ self-assessment, unit requirements
  - Case-based MCQs, essay, oral exams, critical appraisal tasks, triple jump exercise

- **Knows How** (5):
  - Context-free MCQs, student reports (based on research)

- **Knows** (2):
to consider the entire pathway toward competence in many of the domains.

Almost 80 percent of the roughly 100 unusable responses were from respondents who identified themselves as basic scientists. Most of these individuals started the survey but submitted their response without selecting assessment methods for most of the competency domains. As noted subsequently in the summary of write-in comments, it appears that many of the basic science faculty perceived they did not have sufficient insight into the domains and/or did not see their component of the curriculum (the basic sciences) in these competencies and thus were reluctant to respond.

Overall, the respondents reported a total of 14,667 assessment techniques across all six domains of competency and across all seventeen evaluation methods. The average number of selected assessment methods for all six domains combined was sixteen items per respondent; thus, most of the respondents designated one to three assessment methods for each competency. Table 2 shows the overall distribution of the nearly 15,000 assessment reports from these respondents. Somewhat surprisingly to the Task Force, Critical Thinking (Domain 1) was evaluated the most frequently, with 90 percent of the respondents reporting that assessment is attempted for this domain of competency. Notably, only 62 percent of course directors reported that they assess Professionalism, an area in which dental schools have experienced some well-publicized breaches in academic integrity over the past several years.

Table 3 shows the overall reported use of the seventeen assessment methods, in order of reported use from highest to lowest, across all domains of competency. Approximately 1 percent (n=126) of the 14,667 reports of assessment techniques could not be classified into one of the seventeen categories and thus are indicated as “Other” in Table 3. Two percent of the responses were “have this competency, but do not assess students’ attainment at the present time.” For those data representing course directors’ reports of assessment strategies across all competency domains, testing by multiple-choice questions (MCQs) was far and away the most commonly used technique; 4,186 of the 14,667 (28 percent) total responses were for MCQs.

Overall, the traditional assessments in dental education (MCQs, clinical competency exams, laboratory practicals, daily grades, and procedural unit requirements) comprised 62 percent. However, only 3 percent of the respondents designated procedural requirements as an assessment technique; this was unexpected and also inconsistent with other survey data. Six new competency assessments, advocated
in the literature and often included in best practice reports (OSCE, CAT, portfolio, triple jump exercise, chart-stimulated evaluation, and longitudinal/global evaluation) comprised 13 percent of the respondents’ reports.

Reviews of assessment techniques used for each of the domains were consistent with patterns evident in the overall data for all areas of competence. For Domain 1, Critical Thinking, the most frequently used methods were case-based and context-free MCQ (45 percent combined), and the least frequently used were chart-stimulated evaluations (4 percent), portfolios (3 percent), and triple jump (3 percent). For Domain 2, Professionalism, the most frequently used methods were daily evaluations (15 percent), case-based MCQs (14 percent), and clinical competency exams (13 percent), while portfolios (2 percent) and triple jump (1 percent) were the least used. For Domain 3, Communication and Interpersonal Skills, the most frequently used methods were daily evaluations (13 percent) and clinical competency exams (11 percent), with portfolios (2 percent) and triple jump (1 percent) used the least. For Domain 4, Health Promotion, case-based and context-free MCQs (35 percent combined) were the most frequently used, while computer simulations, chart-stimulated evaluations, and others were less frequently used.

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### Table 2. Distribution of 931 U.S. dental school course directors’ reports of assessment strategies among domains of the 2008 ADEA “Competencies for the New General Dentist”

<table>
<thead>
<tr>
<th>ADEA Competency Domain</th>
<th>Total Reports of Assessment Methods</th>
<th>Percentage of Total Reports</th>
<th>Percentage of Respondents who Attempted Assessment</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Critical Thinking</td>
<td>2,813</td>
<td>19%</td>
<td>90%</td>
</tr>
<tr>
<td>2. Professionalism</td>
<td>1,830</td>
<td>12%</td>
<td>62%</td>
</tr>
<tr>
<td>3. Communication and Interpersonal Skills</td>
<td>1,702</td>
<td>12%</td>
<td>59%</td>
</tr>
<tr>
<td>4. Health Promotion</td>
<td>1,827</td>
<td>12%</td>
<td>61%</td>
</tr>
<tr>
<td>5. Practice Management and Informatics</td>
<td>1,536</td>
<td>10%</td>
<td>46%</td>
</tr>
<tr>
<td>6a. Assessment, Diagnosis, and Treatment Planning</td>
<td>2,461</td>
<td>17%</td>
<td>79%</td>
</tr>
<tr>
<td>6b. Establishment and Maintenance of Oral Health</td>
<td>2,498</td>
<td>17%</td>
<td>78%</td>
</tr>
</tbody>
</table>

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### Table 3. Reported use of seventeen assessment methods by 931 U.S. dental school course directors to measure students’ performance for the 2008 ADEA “Competencies for the New General Dentist”

<table>
<thead>
<tr>
<th>Assessment Method</th>
<th>Reports</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Case-based MCQ</td>
<td>2,375</td>
<td>16%</td>
</tr>
<tr>
<td>Context-free MCQ</td>
<td>1,811</td>
<td>12%</td>
</tr>
<tr>
<td>Daily evaluation in clinic</td>
<td>1,758</td>
<td>12%</td>
</tr>
<tr>
<td>Clinical competency examination</td>
<td>1,628</td>
<td>11%</td>
</tr>
<tr>
<td>Technical skill evaluation in labs (practical)</td>
<td>1,166</td>
<td>8%</td>
</tr>
<tr>
<td>Student self-assessment</td>
<td>1,021</td>
<td>7%</td>
</tr>
<tr>
<td>Essay</td>
<td>559</td>
<td>4%</td>
</tr>
<tr>
<td>Oral (verbal) exam</td>
<td>557</td>
<td>4%</td>
</tr>
<tr>
<td>Longitudinal evaluation in clinic</td>
<td>537</td>
<td>4%</td>
</tr>
<tr>
<td>Research project and report</td>
<td>511</td>
<td>3%</td>
</tr>
<tr>
<td>Procedural unit requirements</td>
<td>509</td>
<td>3%</td>
</tr>
<tr>
<td>Computer-based simulation</td>
<td>439</td>
<td>3%</td>
</tr>
<tr>
<td>OSCE</td>
<td>431</td>
<td>3%</td>
</tr>
<tr>
<td>Have competency, but no assessment method</td>
<td>339</td>
<td>2%</td>
</tr>
<tr>
<td>Critical appraisal task (CAT)</td>
<td>332</td>
<td>2%</td>
</tr>
<tr>
<td>Chart-stimulated evaluation</td>
<td>291</td>
<td>2%</td>
</tr>
<tr>
<td>Portfolio</td>
<td>148</td>
<td>1%</td>
</tr>
<tr>
<td>Triple jump</td>
<td>129</td>
<td>1%</td>
</tr>
<tr>
<td>Other assessment methods</td>
<td>126</td>
<td>1%</td>
</tr>
<tr>
<td>Total</td>
<td>14,667</td>
<td></td>
</tr>
</tbody>
</table>

Note: Percentages do not total 100% because of rounding.
and research reports (each at 3 percent), portfolios (2 percent), and triple jump (1 percent) were the least frequently used. For Domain 5, Practice Management and Informatics, the most frequently used methods were case-based and context-free MCQs, while the least frequently used were portfolios (2 percent) and triple jump (1 percent). For Domain 6a, Patient Care: Assessment, Diagnosis, and Treatment Planning, the most frequently used methods were case-based and context-free MCQs (48 percent combined), and portfolios and triple jump (2 percent each) were the least used. For Domain 6b, Patient Care: Establishment and Maintenance of Oral Health, case-based and context-free MCQs (46 percent combined) represented the most frequently used assessment method, followed by clinical competency exams (18 percent). The least used assessment methods for this domain were OSCEs and critical appraisal tasks at 4 percent each, portfolios (3 percent), and triple jump (2 percent).

Survey respondents were asked to answer a series of questions related to the overall processes by which their dental school determines the readiness of students for graduation and for entry into professional practice in the community. Responses to these questions related to overall, schoolwide assessment strategies suggest that some dental schools have begun to change their approaches to evaluating student performance and practice readiness, but many aspects of the tried and true prevail. The number of respondents indicated in the table does not equal 931 for the remaining survey items, since some course directors and/or academic affairs deans elected not to answer certain questions.

Table 4 shows responses to the question “How does your school make a comprehensive, overall assessment of students’ readiness for graduation/entry to practice?” The majority of respondents (67 percent) responded that their school employs a check-off approach whereby a student is certified as ready to graduate if he or she has passed all courses, completed all requirements and rotations, passed all comprehensive exams, completed and submitted all assignments, met the expectations of each department, and fulfilled financial obligations. Notably, 15 percent of the respondents indicated that they did not have sufficient information to answer this question.

On the question “Is your competency assessment process ‘requirement-driven’?” 29 percent reported that their competency assessment process is, for the most part, “requirement-driven,” and 43 percent indicated that “it’s a mixture; in some departments ‘yes,’ and ‘no’ in other departments.” Only 21 percent of the course directors responded, “No; competency assessment is not requirement-driven in any area.” Seven percent of the respondents indicated that they did not have sufficient information to answer this question. As a crosscheck for this question, we analyzed the responses of the associate deans for academic affairs (ADAAIs) who participated in this study. Approximately 73 percent of the ADAAIs indicated that their competency assessment process is mostly driven by requirements or “a mixture,” which is similar to the response pattern of the course directors. Responses to this question about the role of procedural requirements in the student assessment process are inconsistent with the data reported in Table 3; it could be speculated that respondents interpreted the meaning of “requirement-driven” in this particular question differently than the Task Force intended—for example, construing “requirements” to mean all expectations stipulated by courses, not just counting procedural units completed in the clinic.

Table 5 presents responses for the question “Are students assigned to clinical group practices..."
and when during the curriculum?” Typically, a group practice in the dental school clinic represents an organizational structure in which a relatively small group of five to eight faculty members, often multidisciplinary but generally coordinated by a general dentist, work with a group of approximately twenty-five to thirty junior and/or senior students over an extended period of time (e.g., all year). The group structure provides some collective functions and support for both students and faculty, including screening and designation of patient families for the group, patient triage so students handle cases appropriate to their training level, case conferences and other opportunities for students and faculty to interact in small groups, and collective assessment of students’ progress by the group faculty. Because of the high percentage of “don’t know” answers by the course directors (20 percent), responses from the ADAAs are also shown for comparison based on the assumption that the academic deans may have a better understanding of the organizational structure of clinical education than individual faculty members. Indeed, there were differences between the responses of the course directors and the ADAAs for this question as shown in Table 5. For example, 33 percent of the ADAAs reported that their schools had clinical group practices during all four years of the curriculum, while only 12 percent of the course directors selected this option. However, 38 percent of both respondent groups reported that their school had group practices that included some combination of sophomore, junior, and senior students.

Table 6 shows the responses of the course directors and ADAAs to the question “Does your school employ gateway competency exams that students must pass to advance from year to year or to graduate?” Gateway exams are another frequently advocated assessment strategy,199,100 typically designed to measure students’ capacity to perform core skills prior to being certified to move ahead to a subsequent level in the curriculum or, in some cases, before being certified for graduation. Gateways are often conducted in an OSCE format. A majority of the ADAAs (57 percent) reported that their school did not use high-stakes gateway exams, although 22 percent of both the academic deans and course directors reported such use at the end of several years. A high percentage of course directors (43 percent) responded that they did not have sufficient information to answer this question.

Table 7 presents the responses of course directors and ADAAs to the question “How is your mock board used for student assessment?” Following a pattern evident in other questions about schoolwide assessment methods, a high percentage of the course directors (36 percent) indicated they did not have sufficient information to answer this question. Nearly 60 percent of the ADAAs indicated that senior students must pass the mock board to graduate. ADAAs at one-third of the responding schools reported that their mock board is either mandatory or voluntary but not formally evaluated.

The final forced-choice survey item asked respondents to answer this question: “What is your level of confidence that your school makes accurate decisions about students’ readiness to function as beginning general dentists after graduation?” All of the ADAAs responded, “I have high confidence” (70 percent) or “I am somewhat confident” (30 percent), while 85 percent of the course directors selected high confidence (44 percent) or somewhat confident (41 percent). Only 5 percent of the course directors indicated they had low confidence or were not con-

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**Table 5. Responses of 853 U.S. dental school course directors and 48 associate deans for academic affairs (ADAAs) to the question “Are students assigned to clinical group practices and when?”**

<table>
<thead>
<tr>
<th></th>
<th>Course Directors</th>
<th>ADAAs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes; all four years</td>
<td>12%</td>
<td>33%</td>
</tr>
<tr>
<td>Yes; sophomore, junior, and senior years</td>
<td>13%</td>
<td>19%</td>
</tr>
<tr>
<td>Yes; junior and senior years only</td>
<td>25%</td>
<td>19%</td>
</tr>
<tr>
<td>Yes; junior year only</td>
<td>1%</td>
<td>0</td>
</tr>
<tr>
<td>Yes; senior year only</td>
<td>8%</td>
<td>3%</td>
</tr>
<tr>
<td>No; don’t have group practices</td>
<td>21%</td>
<td>26%</td>
</tr>
<tr>
<td>Do not have sufficient information to answer</td>
<td>20%</td>
<td>0</td>
</tr>
</tbody>
</table>

**Table 6. Responses of 861 U.S. dental school course directors and 47 associate deans for academic affairs (ADAAs) to the question “Does your school employ gateway competency exams that students must pass to advance from year to year or to graduate?”**

<table>
<thead>
<tr>
<th></th>
<th>Course Directors</th>
<th>ADAAs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes; end of freshman year</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Yes; end of sophomore year</td>
<td>6%</td>
<td>11%</td>
</tr>
<tr>
<td>Yes; end of junior year</td>
<td>4%</td>
<td>7%</td>
</tr>
<tr>
<td>Yes; end of several years</td>
<td>22%</td>
<td>22%</td>
</tr>
<tr>
<td>No gateway exams for any year</td>
<td>25%</td>
<td>57%</td>
</tr>
<tr>
<td>Do not have sufficient information to answer</td>
<td>43%</td>
<td>3%</td>
</tr>
</tbody>
</table>
fident. None of the ADAAs indicated that they had low confidence or were not confident. Ten percent of the course directors indicated that they did not have sufficient information to answer this question. These data are notable: it can be conjectured that the longitudinal interaction of many dental school clinical faculty members with students from freshman year to senior year allows faculty members to feel confident in their appraisal of students’ capacities by the time of graduation. However, there is no evidence in this survey to verify this observation, and survey respondents were not requested to identify reasons for their level of confidence.

Respondents were invited to submit write-in comments about the assessment of students’ competence and readiness to graduate at their school. Ten of the twenty-one questions on the survey requested write-in comments, and the final item was an open-ended invitation for comments: “Please provide comments about assessment techniques employed or not employed at your dental school to measure students’ readiness to enter general dentistry as a beginning, entry-level practitioner.” Nearly 700 comments were submitted. The methodology employed for identifying major themes within these written comments was based on recommendations for qualitative data analysis by Denzin and Lincoln.105

Table 8 displays six prevailing themes that emerged from this analysis, in order of the frequency of expression by survey respondents. The right column provides a synopsis of the issues embedded in each theme and illustrative statements by respondents to exemplify these issues.

Concern about the “focus” of student assessment efforts (i.e., are the right skills being assessed) was the most frequent response category (theme), with twice as many comments as the other five themes which were: what is general dentistry, pride in efforts to diversify assessments, how can holistic evaluation be accomplished, lack of awareness of the assessment methods throughout the school, and what is competency-based education. These five themes were discussed with equivalent frequency.

Overall, the results of the survey confirmed what our review of the dental literature on assessment suggested. The most frequently used assessment methods in 2008 are those that have been used in dental education for many years: multiple-choice testing, laboratory practicals, daily grades in the clinic, clinical competency exams (i.e., competency patients), and procedural unit requirements, although there was conflicting data in this survey about the extent to which student assessment is still based on requirements. While there was some indication (primarily from respondents’ written comments rather than their answers to survey questions) that innovative approaches to assessment are occasionally being used, the findings of this study indicate there is no groundswell in the adoption of these new methods—even though there is evidence, and persistent advocacy by performance appraisal experts, that some mental processes and patient care skills are poorly evaluated using traditional methods.

Assessment Within Competency-Based Education

In this section, we’ll consider the findings of this study in light of the principles of competency-based education (CBE), which is the designated curriculum model for dental school in the United States. As indicated in the thematic analysis of respondents’ comments and research conducted recently by Licari and Chambers,106 CBE principles, including issues and techniques of competency assessment, are not uniformly understood by dental educators.

Assessment strategies in predoctoral dental education should be implemented in a manner consistent with the philosophy of competency-based education. Two questions are especially germane to this assertion: 1) what is competency-based education? and 2) what are best practices for assessing students’ readiness to provide dental care in the public domain without supervision and under their own license?
Table 8. Most frequently expressed themes among 691 written comments by 931 U.S. dental school course directors in response to the question “Please provide comments about assessment techniques employed or not employed at your dental school to measure students’ readiness to enter general dentistry as a beginning, entry-level practitioner” and to requests for written comments for nine of the twenty-one survey questions

<table>
<thead>
<tr>
<th>Theme</th>
<th>Summary and Illustrative Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Focus of evaluation efforts: are the right skills being assessed?</td>
<td>Some competencies are assessed too much and others not enough. Tendency to focus on what is most convenient to assess. For example: We tend to focus on “low hanging fruit.” We ask students to play the numbers game. Too much emphasis on “line of sight” evaluation; we assess what we can see. What we evaluate we do the right way. But I’m not sure we’re right in what we choose to evaluate.</td>
</tr>
<tr>
<td>What is general dentistry?</td>
<td>The amount of time that students and their supervising faculty spend on tasks and clinical requirements tends to shape student and faculty concepts of what constitutes general dentistry. For example: General dentistry, as an entity, has not been defined for faculty. What is the inventory of knowledge and skills that constitutes general dentistry? Faculty do not necessarily see relationship between the school’s stated graduation competencies and the practice of general dentistry.</td>
</tr>
<tr>
<td>Pride in efforts to diversify assessment techniques</td>
<td>Perception that faculty members are “trying new things.” For example: I’m basing students’ grades on several assessments now; it’s more work and number crunching, but it probably provides a better overall picture of their learning. Many faculty are trying to move away from rote testing in classroom courses and counting units in the clinic.</td>
</tr>
<tr>
<td>How to achieve holistic, big picture appraisal of students’ overall competence</td>
<td>Awareness that scope of assessment should be widened to focus more on students’ overall abilities instead of concentrating on the pieces. For example: Getting consensus from all departments on what to evaluate is hard. Major examinations in which many departments participate are difficult to plan and conduct. Our silos have been in place for a long time; it’s hard to get cooperation across specialty and specialty-generalist boundaries.</td>
</tr>
<tr>
<td>Lack of awareness of overall assessment plan at the school</td>
<td>I know “my piece of the pie,” but don’t see the big picture. For example: Couldn’t answer some of the questions about overall methods of evaluating students because I just don’t know what is happening outside my own department. I imagine there is a vision somewhere of the “product” we are trying to graduate and the various evaluations to determine if this product is being produced, but most faculty are not aware of this information.</td>
</tr>
<tr>
<td>What is competency-based education? What does it mean to say that a dental student is competent?</td>
<td>Lack of familiarity or comfort with the concept of competency-based education and with the school’s definition of competencies needed for graduation. For example: Is a competency the same as what we used to call objectives? Can a student really be called “competent” after doing a procedure once or twice? How is treatment of a comp patient different from what the student does for any patient? Does doing well on a comp make you competent? Most of us do not know who wrote the competency list for our school or when it was written and what it was based on.</td>
</tr>
</tbody>
</table>
What Is Competency-Based Education?

Competency-based education came into prominence in the United States during the 1950s as a post-Sputnik reaction by the educational community to demands for better outcomes in our universities—demands motivated by concern that the United States was falling behind the Soviet Union in the “space race” and in science. Four characteristics distinguish CBE: 1) trainee outcomes are based on analysis of the job responsibilities and tasks of practitioners; 2) the curriculum is focused on what students need to learn to perform these on-the-job responsibilities versus organizing the curriculum around the traditional subject matter prerogatives of disciplines; 3) hierarchically sequenced modules allow students to proceed through the curriculum at their own pace; and 4) assessment techniques measure unassisted learner performance in settings approximating real-world work environments.²,¹⁰⁷,¹⁰⁸ CBE was first mentioned by the Commission on Dental Accreditation (CODA) as a philosophy for dental education in the 1995 predoctoral standards and first described as a desired curriculum model by ADEA in 1997, when the initial set of competencies was published to define the outcomes of predoctoral education.¹⁰⁹ The 2008 revisions of the CODA predoctoral standards, now undergoing scrutiny by dental communities of interest, and the “Competencies for the New General Dentist” adopted by the ADEA House of Delegates in April 2008 both endorse CBE as the model for the predoctoral curriculum, and both organizations now clearly identify a “general dental practitioner” as the expected outcome of dental school.

The preamble to the 2008 ADEA competencies states that a competency is “a complex behavior or ability essential for the general dentist to begin independent, unsupervised dental practice. Competency includes knowledge, experience, critical thinking and problem-solving skills, professionalism, ethical values, and technical and procedural skills. These components become an integrated whole during the delivery of patient care by the competent general dentist.” The final sentence of this definition is critical for understanding competency assessment strategies in CBE.

What Assessment Methods Are Consistent with CBE?

Eleven sources and the assessment toolkits described above were primary sources for the following summary of recommendations for assessment of practice readiness.⁸⁹,⁹¹,⁹²,⁹⁸-¹⁰⁰,¹¹⁰-¹¹⁴

In CBE, the highest priority is determining students’ readiness for practice. Appraisal of practice readiness is based on 1) assessing students’ overall competence, or the capacity to “put it all together,” also known as “general competence,” versus focusing on individual skills, known as component competencies, which are often taught and evaluated in isolation in the disciplinary silos of the curriculum; and 2) employing multiple data sources based on the principle of triangulation.¹¹⁵ In dental education, the concept of general competence was first articulated by Chambers in 2001.¹¹⁶

One of the leaders in competency-based education, Paul Pottinger, observed: “Competence cannot be meaningfully defined by endless reductions of specific skills, tasks, and actions which, in the end, fall short of real world requirements for effective performance. In fact, the more essential characteristics for success often turn out to be broad or generalized abilities which are sometimes more easily operationally defined and measured than an array of subskills that do not add up to a general competence.”¹¹⁷

A key question on the survey of assessment practices in U.S. dental schools was the following: how does your school make a comprehensive assessment of students’ readiness for entry into unsupervised practice? In other words, we were asking: how does your school assess Pottinger’s general competence? The response options were 1) a checklist system on which students are certified for graduation if they pass all courses, meet GPA standards, complete all clinical requirements, meet all departmental expectations, complete all rotations, submit all assignments, and pay their bills; 2) an in-school internship in which a small group of faculty work with each student for several months to observe daily performance across all competency domains; 3) gatekeeper examinations to credential accomplishment of core competencies; and 4) departments certify that students are competent in areas of dentistry germane to their disciplines. As we have seen, two-thirds of the respondents selected option 1, the checklist approach. Only a handful of respondents selected options 2 and 3 (7 percent each) to comprehensively assess their seniors’ readiness for general dentistry. Options 2 and 3 are the practice readiness assessments most consistent with CBE.

Figure 6 illustrates the difference between assessing component or silo competencies (the individual skills, represented by ovals inside the circle, in
the general dentist’s toolkit) and the new concept of general competence (the outer circle), which represents the capacity to “put it all together, consistently.” Current performance measurement theory indicates that primary emphasis should be placed on assessing students’ overall package of skills (the outer ring) in working conditions that approximate “authentic practice.”99,92,110 From our experience with many health professions, dental education does the best job of assessing the silo components of competence. However, as articulated by Eraut in Professional Knowledge and Competence, “Professional competence is more than demonstration of isolated competencies. When we see the whole, we see its parts differently than when we see them in isolation.”118

The prevailing recommendation for measuring general competence is a pregraduation internship of at least two months’ duration that resembles the work environment, tasks, and responsibilities of entry-level practitioners. During the internship, students work under daily supervision by a small group of the same faculty (for coaching consistency), who observe and assess reproducibility of component competencies, seamless transition between silo competencies during patient care, nature of the student’s fund of knowledge (is it superficial or deep?), punctuality, decorum, appearance, stress management, and capacity for self-assessment and self-correction. Many dental faculty are concerned about the qualitative or subjective nature of this type of assessment, but Miller96 asserted that “the collective wisdom of faculty who have consistent opportunities to observe and interact with the student is the essential core of performance assessment”—a perspective endorsed by virtually every review of assessment best practices in health professions education.

A fundamental principle of competency-based assessment is to measure students’ practice readiness as represented by general competence (i.e., capacity to “put it all together” over an extended period of time).

**Recommendations for Competency Assessment Based on Triangulation**

The final section of this article describes several assessment strategies that are currently considered state of the art for measuring readiness for professional responsibilities, including in-school internships, OSCEs, triple jump exercises, and CATS (critically appraised topic summary, known generically as critical appraisal tasks), in the context of the triangulation model of competency assessment. Readiness assessment based on multiple data sources is more likely to be accurate than single-source measures or disproportionate reliance on one measure over other potential sources of information about students’ practice readiness.115 This best practice is referred to as “triangulation” and has been recently described in the Journal of Dental Education by Jahangiri et al.85

Figure 7 depicts a model of triangulation. The P in the model represents performance, including the 3 Ps: process (human factors including communication, diligence, organization, compassion, ethical behavior), product (outcomes of patient care), and procedure (technical skills necessary to provide patient care). A&R represents appraisal and reflection (i.e., self-assessment and self-correction), and K represents knowledge.

In 2008, there is consensus in the literature on performance measurement about optimal assessment strategies for each leg of the triangle. For practice readiness relative to the performance leg, the pregraduation internship is considered to be an optimal approach. Internships answer this question: can senior students put it all together and function in an environment that approximates general dentistry including field experience in community clinics where they don’t have three hours for one appointment, but are expected to function acceptably during four to five appointments daily? In most health professions education programs, the internship is supported by the OSCE, a technique for readiness assessment that is used for gateway examinations that students must pass in order to advance to a higher academic level, graduate, or obtain a license.51,65 For example, the National Dental Examining Board (NDEB) of Canada implements an OSCE as a core component of the licensure process in that nation.119

In OSCEs, students rotate through twenty to thirty stations at timed intervals that provide a representative sampling of patient problems or clinical tasks. At action or task stations, students perform procedures under observation by trained evaluators. For instance, OSCEs typically contain several stations where students interview and examine patients trained to portray oral health problems, often with comorbidities that may influence decision making. At subsequent assessment stations, students report clinical findings to a faculty member, propose and justify a diagnosis, and compare and contrast
therapeutic options. During OSCEs, students may be asked to demonstrate comprehension of underlying basic science principles by linking the patient’s symptoms to pathophysiological mechanisms. This is accomplished by verbal questioning from a station proctor, or students may respond in writing by short answer essays or answering multiple-choice questions. At other OSCE stations, students may be asked to study case scenarios and then select answers to multiple-choice questions about diagnostic tests, assessment, and treatment planning, a format used in the OSCE administered by the NDEB of Canada.119

Most OSCEs contain radiographic interpretation stations as well as stations where students assess laboratory findings and measure a patient’s vital signs. Students’ overall scores on the OSCE are derived from their understanding of pathophysiology, use and comprehension of assessment techniques, capacity to interpret clinical findings, ability to make appropriate treatment planning decisions, performance of patient examination skills, and interpersonal skills. Trained patients known as “standardized patients” (who provide a “standard” experience for all students rotating through the station) are often used to assess
patient examination skills and interpersonal skills.\textsuperscript{56,57} The integrative nature of the OSCE, which samples a broad spectrum of competencies, is consistent with CBE assessment principles.

For the A&R leg, Self-Appraisal and Reflection, portfolios are recommended.\textsuperscript{69} In a competency attainment portfolio, students collect evidence that demonstrates their progress toward and accomplishment of specified competencies, including longitudinal documentation of patient care, performance on competency exams, case presentations, literature reviews, reports, formative evaluations, formal performance reviews by supervising faculty, and, most importantly, students’ own appraisal of their performance and reflections on needed improvements, lessons learned, and insights about dentistry or the learning process. The reflection component allows faculty members to appraise the student’s level of self-awareness and capacity for reflection. Review of the portfolio content provides an opportunity for student-teacher dialogue centered on students’ work products and assessment of progress. Without self-assessment and reflection, portfolios can digress to “scrapbooking.”

The 2006 accreditation standards for U.S. professional programs in pharmacy (developed by the American Council for Pharmaceutical Education) stipulate use of portfolios as a principal technique to measure students’ attainment of competencies for the doctor of pharmacy degree.\textsuperscript{120} Many doctoral programs, in the sciences and other fields as well, now employ portfolios instead of qualifying examinations and other types of grading.

For the Knowledge leg, the triple jump exercise (TJE) is widely used in health professions education to evaluate students’ capacity to access, analyze, and apply biomedical knowledge to health care problems.\textsuperscript{121} When coupled with multiple-choice testing in the case-based “testlet” format such as now used on the NBDE (several multiple-choice questions linked to a patient scenario), triple jumps provide a mechanism for assessment of students’ capacity to function at the “application” level of Bloom’s cognitive taxonomy.\textsuperscript{94} There are several variations of TJEs. Clinical TJEs consist of three phases (thus, the “jumps”) completed in one or two days in which students 1) interview and examine patients while observed by faculty, or are videotaped for retrospective review including student self-assessment; 2) write an assessment of the findings using the “SOAP” format (subjective data, objective data, assessment, plans) with emphasis on providing evidence from the literature to support assessment and therapeutic decisions and submit this document to the faculty member(s) who observed jump one; and 3) participate in an oral examination conducted by the observing faculty member(s) at which students are questioned about pathophysiology, diagnosis, and treatment of

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Figure 7. Triangulation model to provide multiple sources of data for three legs of competency assessment
the patient’s problems and asked to review research evidence related to treatment options and outcomes. Students receive an evaluation for each jump and a cumulative score across all three jumps. TJEs implemented in the preclinical curriculum focus on students’ literature-searching skills to find evidence that answers student-developed research questions pertinent to health problems. In TJEs for freshman or sophomore students, the first jump involves reading a scenario depicting a patient with an oral health problem, then identifying key issues in the case and writing a researchable question in the PICO format (patient with problem, intervention, comparison, and outcome). For the second jump, students explore literature to find evidence pertinent to their question, and in the third jump, students report their findings, answer the research question, and critically appraise the quality of the evidence. As with clinical TJEs, students receive evaluations for each jump and a cumulative score across all three jumps. Both types of TJEs emphasize accessing pertinent information, application of this information to health problems, and appraisal of the quality of knowledge available to answer clinical questions.

The CATS (critically appraised topic summary) is a new technique to assess students’ capacity to use biomedical knowledge to make reasoned decisions. CATS is a cousin to the triple jump in that students start by reviewing a case scenario or an actual patient’s clinical presentation, identify unknowns that need to be explored, write a researchable question in the PICO format, explore the literature to find and analyze the evidence, and then write a summary that indicates an answer to the question and recommendations based on appraisal of the research. Like the TJE and aspects of OSCEs, the CATS evaluates how students access, analyze, and apply biomedical knowledge and measures the capacity for self-directed learning.

In summary, the good news is that there are several techniques, relatively new to dental education, that can provide comprehensive assessment of several competency domains and thus are consistent with CBE emphasis on practice readiness. Because internships, OSCEs, gateways, portfolios, triple jumps, and CATS are new to academic dentistry, there are few examples to provide implementation heuristics. The findings of the survey of assessment practices in U.S. dental schools reported in this article revealed that a small percentage of dental school course directors use any of these techniques, while traditional techniques such as multiple-choice testing, procedural requirements, lab practicals, clinical comps, and daily grades still predominate, representing almost 30 percent of all evaluations across all domains of competency. These data reveal important challenges ahead for dental educators and underscore the urgency of charting new directions in our approaches to assessment.

In embracing a competency-based model for dental education, we must also incorporate into the curriculum evaluation strategies and assessment methodologies that will ensure the achievement of our ultimate goal: the education of competent general dentists.

REFERENCES


44. Chambers DW. Faculty ratings as part of a competency-based evaluation clinic grading system. Eval Health Prof 1999;22(1):86–106.


52. Karl M, Graef F, Eitner S, Beck N, Wichman M, Holst S. Comparison of computer-aided testing and traditional


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Preamble

The general dentist is the primary oral health care provider, supported by dental specialists, allied dental professionals, and other health care providers. The general dentist will address health care issues beyond traditional oral health care and must be able to independently and collaboratively practice evidence-based comprehensive dentistry with the ultimate goal of improving the health of society. The general dentist must have a broad biomedical and clinical education and be able to demonstrate professional and ethical behavior as well as effective communication and interpersonal skills. In addition, he or she must have the ability to evaluate and utilize emerging technologies, continuing professional development opportunities, and problem-solving and critical thinking skills to effectively address current and future issues in health care.

As used in this document, a “competency” is a complex behavior or ability essential for the general dentist to begin independent, unsupervised dental practice. Competency includes knowledge, experience, critical thinking and problem-solving skills, professionalism, ethical values, and technical and procedural skills. These components become an integrated whole during the delivery of patient care by the competent general dentist. Competency assumes that all behaviors are performed with a degree of quality consistent with patient well-being and that the general dentist can self-evaluate treatment effectiveness. In competency-based dental education, what students learn is based upon clearly articulated competencies and further assumes that all behaviors/abilities are supported by foundation knowledge and psychomotor skills in biomedical, behavioral, ethical, clinical dental science, and informatics areas that are essential for independent and unsupervised performance as an entry-level general dentist. In creating curricula, dental faculty must consider the competencies to be developed through the educational process, the learning experiences that will lead to the development of these competencies, and ways to assess or measure the attainment of competencies.

The purpose of this document and the proposed foundation knowledge concepts are to:

- Define the competencies necessary for entry into the dental profession as a general dentist. Competencies must be relevant and important to the patient care responsibilities of the general dentist, directly linked to the oral health care needs of the public, realistic, and understandable by other health care professionals;
- Reflect (in contrast to the 1997 competencies) the 2002 Institute of Medicine core set of competencies for enhancing patient care quality and safety, and illustrate current and emerging trends in the dental practice environment; they are divided into domains, are broader and less prescriptive in nature, are fewer in number, and, most importantly, will be linked to requisite foundation knowledge and skills;
- Serve as a central resource, both nationally for the American Dental Education Association (ADEA) and locally for individual dental schools, to promote change and innovation in predoctoral dental school curricula;
- Inform and recommend to the Commission on Dental Accreditation standards for predoctoral dental education;
- Provide a framework for the change, innovation, and construction of national dental examinations, including those provided through the Joint Commission on National Dental Examinations and clinical testing agencies;
- Assist in the development of curriculum guidelines, both nationally for ADEA and locally for individual dental schools, for both foundation knowledge and clinical instruction;
- Provide methods for assessing competencies for the general dentist; and
- Through periodic review and update, serve as a document for benchmarking, best practices, and interprofessional collaboration and, additionally, as a mechanism to inform educators in other health care professions about curricular priorities of dental education and entry-level competencies of general dentists.

APPENDIX

Competencies for the New General Dentist
(As approved by the 2008 ADEA House of Delegates)
Domains

1. Critical Thinking
2. Professionalism
3. Communication and Interpersonal Skills
4. Health Promotion
5. Practice Management and Informatics
6. Patient Care
   A. Assessment, Diagnosis, and Treatment Planning
   B. Establishment and Maintenance of Oral Health

The statements below define the entry-level competencies for the beginning general dentist.

1. Critical Thinking
   **Graduates must be competent to:**
   1.1 Evaluate and integrate emerging trends in health care as appropriate.
   1.2 Utilize critical thinking and problem-solving skills.
   1.3 Evaluate and integrate best research outcomes with clinical expertise and patient values for evidence-based practice.

2. Professionalism
   **Graduates must be competent to:**
   2.1 Apply ethical and legal standards in the provision of dental care.
   2.2 Practice within one’s scope of competence and consult with or refer to professional colleagues when indicated.

3. Communication and Interpersonal Skills
   **Graduates must be competent to:**
   3.1 Apply appropriate interpersonal and communication skills.
   3.2 Apply psychosocial and behavioral principles in patient-centered health care.
   3.3 Communicate effectively with individuals from diverse populations.

4. Health Promotion
   **Graduates must be competent to:**
   4.1 Provide prevention, intervention, and educational strategies.
   4.2 Participate with dental team members and other health care professionals in the management and health promotion for all patients.
   4.3 Recognize and appreciate the need to contribute to the improvement of oral health beyond those served in traditional practice settings.

5. Practice Management and Informatics
   **Graduates must be competent to:**
   5.1 Evaluate and apply contemporary and emerging information including clinical and practice management technology resources.
   5.2 Evaluate and manage current models of oral health care management and delivery.
   5.3 Apply principles of risk management, including informed consent and appropriate record keeping in patient care.
   5.4 Demonstrate effective business, financial management, and human resource skills.
   5.5 Apply quality assurance, assessment, and improvement concepts.
   5.6 Comply with local, state, and federal regulations including OSHA and HIPAA.
   5.7 Develop a catastrophe preparedness plan for the dental practice.
6. Patient Care

A. Assessment, Diagnosis, and Treatment Planning

Graduates must be competent to:

6.1 Manage the oral health care of the infant, child, adolescent, and adult, as well as the unique needs of women, geriatric, and special needs patients.

6.2 Prevent, identify, and manage trauma, oral diseases, and other disorders.

6.3 Obtain and interpret patient/medical data, including a thorough intra/extra oral examination, and use these findings to accurately assess and manage all patients.

6.4 Select, obtain, and interpret diagnostic images for the individual patient.

6.5 Recognize the manifestations of systemic disease and how the disease and its management may affect the delivery of dental care.

6.6 Formulate a comprehensive diagnosis, treatment, and/or referral plan for the management of patients.

B. Establishment and Maintenance of Oral Health

Graduates must be competent to:

6.7 Utilize universal infection control guidelines for all clinical procedures.

6.8 Prevent, diagnose, and manage pain and anxiety in the dental patient.

6.9 Prevent, diagnose, and manage temporomandibular disorders.

6.10 Prevent, diagnose, and manage periodontal diseases.

6.11 Develop and implement strategies for the clinical assessment and management of caries.

6.12 Manage restorative procedures that preserve tooth structure, replace missing or defective tooth structure, maintain function, are esthetic, and promote soft and hard tissue health.

6.13 Diagnose and manage developmental or acquired occlusal abnormalities.

6.14 Manage the replacement of teeth for the partially or completely edentulous patient.

6.15 Diagnose, identify, and manage pulpal and periradicular diseases.

6.16 Diagnose and manage oral surgical treatment needs.

6.17 Prevent, recognize, and manage medical and dental emergencies.

6.18 Recognize and manage patient abuse and/or neglect.

6.19 Recognize and manage substance abuse.

6.20 Evaluate outcomes of comprehensive dental care.

6.21 Diagnose, identify, and manage oral mucosal and osseous diseases.
Competency: a complex behavior or ability essential for the general dentist to begin independent, unsupervised dental practice; it assumes that all behaviors and skills are performed with a degree of quality consistent with patient well-being and that the general dentist can self-evaluate treatment effectiveness.

Critical thinking: the process of assimilating and analyzing information; this encompasses an interest in finding new solutions, a curiosity with an ability to admit to a lack of understanding, a willingness to examine beliefs and assumptions and to search for evidence to support these beliefs and assumptions, and the ability to distinguish between fact and opinion.

Curriculum guidelines (content): the relevant and fundamental information that is taught for each category of foundation knowledge; these are to be used as curriculum development aids and should not be construed as recommendations for restrictive requirements.

Domain: a broad, critical category of activity for the general dentist.

Emerging technologies: current and future technologies used in patient care, including technologies for biomedical information storage and retrieval, clinical care information, and technologies for use at the point of care.

Evidence-based dentistry: an approach to oral health care that requires the judicious integration of systematic assessments of clinically relevant scientific evidence relating to the patient’s oral and medical condition and history integrated with the dentist’s clinical expertise and the patient’s treatment needs and preferences.

Foundation knowledge and skills: the basic essential knowledge and skills linked to and necessary to support a given competency; these would serve to help guide curriculum in dental schools, assist educators in removing irrelevant, archaic information from current curricula, aid in including important new information, and help test construction committees develop examinations based upon generally accepted, contemporary information.

General dentist: the primary dental care provider for patients in all age groups who is responsible for the diagnosis, treatment, management, and overall coordination of services related to patients’ oral health needs.

Health promotion: public health actions to protect or improve oral health and promote oral well-being through behavioral, educational, and enabling socioeconomic, legal, fiscal, environmental, and social measures; it involves the process of enabling individuals and communities to increase control over the determinants of health and thereby improve their health; includes education of the public to prevent chronic oral disease.

Informatics: applications associated with information and technology used in health care delivery; the data and knowledge needed for problem-solving and decision making; and the administration and management of information and technology in support of patient care, education, and research.

Interprofessional health care: the delivery of health care by a variety of health care practitioners in a cooperative, collaborative, and integrative manner to ensure care is continuous and reliable.

Management: includes all actions performed by a health care provider that are designed to alter the course of a patient’s condition; such actions may include providing education, advice, treatment by the general dentist, treatment by the general dentist after consultation with another health care professional, referral of a patient to another health care professional, and monitoring the treatment provided; it may also include providing no treatment or observation.

Patient-centered care: the ability to identify, respect, and care about patients’ differences, values, preferences, and expressed needs; relieve pain and suffering; coordinate continuous care; listen to, clearly inform, communicate with, and educate patients; share decision making and management; and continuously advocate disease prevention, wellness, and promotion of healthy lifestyles, including a focus on population health.

Problem-solving: the process of answering a question or achieving a goal when the path or answer is not immediately obvious, using an acceptable heuristic or strategy such as the scientific method.

Special needs care: an approach to oral health management tailored to the individual needs of people with a variety of medical conditions or physical and mental limitations that require more than routine delivery of oral care; special care encompasses preventive, diagnostic, and treatment services.