

Dental Student Assessment Toolbox

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This article is one in a series of invited contributions by members of the 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: assessment, competence, dental education, dental students

Preface from the Chair of the ADEA CCI:

In 2005, the American Dental Education Association established the Commission on Change and Innovation in Dental Education (ADEA CCI) to build a consensus within the dental education community about innovative changes that are necessary in the education of general dentists to ensure that dental school graduates enter the profession fully competent to meet the oral health needs of the public.^{1,2} As a part of its work, the ADEA CCI established several task forces, including the Task Force on Student Outcomes Assessment. The specific goal of this task force is to improve assessment practices in dental education. To this end, the task force, led by Dr. Gene A. Kramer, director of testing services at the American Dental Association, has created a "toolbox" designed to provide dental educators with a variety of techniques and methods for assessing the acquisition by students of competencies associated with the successful practice of dentistry. The assessment tools described range from familiar and frequently used assessment techniques such as multiple-choice and short answer essay items to newer and less familiar methods such as objective structured clinical examinations (OSCEs), portfolios, and triple jump exercises.

In the survey on competency assessment strategies used by dental schools that was reported in the December 2008 issue of the *Journal of Dental Education*,³ it was found that the multiple-choice format is used most often by dental educators in assessing most student competencies, despite evidence to suggest that some competencies might be better assessed with other tools. The task force hopes that, by describing a range of tools and their possible applications, educators will explore ways to expand how they assess the knowledge, skills, and abilities of their students as they relate to the competencies necessary to function as beginning general dentists.

This Dental Student Assessment Toolbox is a first step in introducing alternative assessment tools and strategies into pre-doctoral dental education. The content of the toolbox will be honed and expanded in coming years to continue to meet the evolving needs of the dental educational community.

Stephen K. Young, D.D.S.
Chair, ADEA Commission on Change and Innovation in Dental Education
Chair, ADEA CCI Task Force on Student Outcomes Assessment

Assessment is an essential component of the educational experience. Assessment of students' progress in the dental curriculum ensures that they are acquiring the necessary knowledge, procedural/technical skills, problem-solving capacities, and critical thinking abilities. There are a variety of purposes to conducting assessment in the educational environment. The outcomes of assessment can be used to diagnose student strengths and weaknesses, to identify potential programmatic or curricular challenges, and to monitor students' progression toward, and ultimate attainment of, designated competencies that comprise the capacities of entry-level practitioners.

Assessment, however, is not a unitary concept when it comes to methodology. There are any number of methods that can be used, depending on the competencies being assessed. Using only one or two methods to assess students' attainment of the wide variety of knowledge, skills, and abilities supporting dental competencies would not be efficient or effective. Assessment methods range from simple written formats with relatively low levels of fidelity to actual demonstrations of capacity to perform skills in high fidelity situations that approximate the circumstances of general dental practice in the community. This Dental Student Assessment Toolbox was created to assist dental educators with the critical yet challenging task of determining the optimal methods for assessing students' progression toward and ultimate attainment of the competencies designated as necessary for the entry-level practice of general dentistry.

Glossary

This section provides a glossary of terms and concepts that are used in the description of the assessment methods in the toolbox.

Assessment and Assessment Tools: In the broad sense, assessment involves the gathering of information to determine the knowledge, skills, abilities, and performance levels of students or candidates for graduation, licensure, or certification. Assessment tools comprise a wide range of instruments and methodologies designed to gather this information for feedback, diagnostic purposes, and identifying successful attainment of competence.

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.

Fidelity: Fidelity refers to the similarity of the assessment tool to the actual competency or student performance being assessed. A high fidelity tool is one that is very similar to the actual performance.

Formative Assessment: Formative assessment involves the accumulation of evaluative information for diagnostic purposes and, in the educational context, for assessing and guiding students' development. For dental students, the findings of formative assessments are used to diagnose strengths and weaknesses for the purposes of identifying strategies to enhance student performance. For programs, the findings of formative assessments can suggest opportunities to improve the focus of the curriculum and instructional methods.

Measurement: Measurement refers to the representation of performance using the outcomes of the application of mathematical formulas to numerical data. For many years in the past, classical measurement theory was the primary system used to describe these characteristics or properties. During the last several decades, item response theory (IRT) has been the system of choice for large-scale testing. Because IRT requires large numbers of individuals, however, classical theory remains the mainstay in the academic environment.

Reliability: Reliability relates to consistency in measurement, i.e., scores derived from a reliable assessment tool are similar across assessment events. Reliability is typically reported as a value ranging from 0.0 to 1.0. Reliabilities above 0.90 are considered to be excellent. Reliabilities below 0.70 are considered suspect, and results from such an assessment tool should be interpreted with caution.

Summative Assessment: Summative assessment involves the accumulation of information. For the student, the findings of the assessments determine whether the student has accomplished programmatic goals. This form of assessment often represents the level of accomplishment, achievement, or "grade." For the program, findings determine the overall quality of the curriculum for the purposes of making decisions concerning the future of the program.

Validity: Validity refers to the accumulation of evidence gathered from a variety of sources and supporting the proposition that the assessment is, in fact, evaluating the competency of interest, or the knowledge and abilities that support the acquisition of competence. Evidence can take the form of expert opinion derived from a practice analysis, survey, or standard setting event.

Table and Descriptions of Assessment Methods

A summary table in a two-dimensional matrix is presented in the appendix. Along the vertical dimension of the table are the Competencies for the New General Dentist endorsed by the ADEA House of Delegates in April 2008;⁴ sixteen assessment methodologies are presented across the horizontal dimension. Each of the sixteen assessment methods in the summary table is described in the following sections. Each intersecting cell shows

the appropriate methodology for use in evaluating each competency. A “1” in the cell indicates a preferred technique, a “2” indicates an acceptable methodology, and a “3” indicates an assessment that is potentially applicable in certain circumstances. It is important to note that these indicators are suggestions. Depending on the particular competency, an alternative methodology or combination of techniques might be appropriate. Key sources that were consulted to create the summary table are cited in the general reference section of this article. The recommendations for assessment strategies that appear in the summary table are based on reviews of the performance and competency assessment literature described in the task force’s prior article, published in the December 2008 JDE.³

The separate sections that follow describe the sixteen assessment methods that appear in the summary table. For each method, the characteristics, use, strengths, limitations, and key references are provided. As shown in Figure 1, the assessment methods are organized into six categories based on

Category	Format		
1. Written Assessment Selected and constructed response items	Multiple-Choice Items <ul style="list-style-type: none"> Independent questions Testlets (case-based) 	Short Answer	Structured Essay
2. Faculty Assessment by Observation	Global Ratings	Structured Observation with checklists and rating scales	Standardized Oral Exam
3. Multisource Assessment	Student Self-Assessment Peer Assessment	Patient Survey	Standardized Patients
4. Simulation	Virtual Reality Computer-based clinical scenarios	Models	
5. Multi-Competency, Comprehensive Assessment	Objective Structured Clinical Exam (OSCE)	Triple Jump Exercise (TJE)	
6. Work Samples	Portfolio	Record Review Chart-stimulated review	

Figure 1. Methods for assessing dental students’ attainment of competence

the nature of the assessment format and/or the type of response requested from students: 1) *selected and constructed response items (written assessment)*, in which students select a best response from a series of options or construct a response in their own words; 2) *faculty assessment by observing student performance*, in which students are observed while they perform tasks associated with professional competence by their instructors and are evaluated using checklists and rating scales to guide the appraisal process; 3) *multi-source assessment*, which refers to a group of assessment tools often used in conjunction with other methods to provide a well-rounded perspective on students' progression toward competence; 4) *simulation*, including computer-based applications and realistic models; 5) *multi-competency, comprehensive assessments*, including the objective structured clinical examination (OSCE) and triple jump exercise (TJE); and 6) *work samples*, including portfolios and record review.

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Written Assessments: Selected and Constructed Response Items

Multiple-Choice Items

Description and Characteristics

The multiple-choice item consists of two components, i.e., a stem and a series of alternatives. The stem can be an incomplete statement or a question. The dental student examinee is to select the alternative that either correctly completes the statement or provides the most appropriate response to the question.

There are two variations of importance when describing multiple-choice items. The stem is essentially a stimulus for the response. In stand-alone or independent items, the stem is the only stimulus material (Figure 2). In testlet-based or case-based multiple-choice items, additional material is provided as a stimulus (Figure 3). In the case of dental education, the additional stimulus material might consist of a dental chart or history along with a brief clinical scenario, as in a testlet. Case-based items might include radiographs, clinical photographs, and dental charting.

Uses

Notwithstanding the significant number of existing variations for this assessment method, multiple-choice items are the most frequent choice for assessing comprehension or application of theoretical knowledge. If properly constructed, they also can be used to assess problem-solving ability. Multiple-choice items also are an effective method for gathering formative and summative performance information.

Strengths and Limitations

This method is widely used because multiple-choice items can be readily developed and scored objectively and can sample widely from an extensive volume of knowledge. This item type has a relatively

low level of fidelity to actual practice, however, and it is also susceptible to various measurement disturbances, such as guessing. Additional stimulus material provided in testlet or case-based items enhances the fidelity of the item type and allows for sampling more clinically relevant material from the curriculum.

Short Answer Questions

Description and Characteristics

Stimulus material is provided in a short statement or question that poses a problem requiring the dental students to respond with the solution to the problem in their own words (Figure 4).

Uses

This item type is most often used in formative assessment designed to gather information on a student's knowledge of basic information. It can also be used to assess a variety of other abilities, e.g., 1) list a differential diagnosis, 2) list steps in a procedure in order and/or priority, 3) develop a treatment plan, and 4) list etiology of disease and conditions.

Strengths and Limitations

By requiring the student to generate a response in the form of a sentence or two, this item type taps different cognitive processes than the multiple-choice item, i.e., it can be used to tap the dental student's ability to generate an original response. This item type eliminates guessing as an assessment factor; however, evaluation of the response is less objective and is subject to measurement disturbances such as the influence on the rater of spelling, handwriting, and grammatical errors. To help avoid these influences, a key is developed that focuses on the salient information to be provided in the response.

A new young adult patient presents for a routine dental examination. In reviewing the periapical radiographs, you note that the lower right second premolar appears to be congenitally missing. Which primary tooth is most likely retained in its place?

A. Canine
 B. First premolar
 C. Second premolar
 D. First molar
 E. Second molar

Figure 2. Example of an independent multiple-choice item

Age	65 years		SCENARIO The patient presents for replacement of a filling in tooth #19. He reports that he lost the filling over a year ago, but he delayed seeking care because the tooth has not been sensitive. Upon examination, tooth #19 has a missing occlusal restoration and a fractured ML cusp.
Gender	<input checked="" type="checkbox"/> Male	<input type="checkbox"/> Female	
Height	5' 9"		
Weight	240 lbs.		
B/P	170/100		
Chief Complaint	"Lost filling in back tooth"		
Medical History	Last saw his physician 2 years ago; father died of heart attack at age 52		
Current Medications	Diuretic for high blood pressure; statin for high cholesterol; low dose aspirin		
Social History	Married, grown children; retired construction foreman		

Which would be the most likely consequence of the patient's delay in having the lost restoration replaced?

A. Supra-eruption of tooth #14
 B. Chewing inefficiency
 C. Loss of canine disclusion
 D. Mesial drift of tooth #18

Figure 3. Example of a testlet-based multiple-choice item

Q: What is the legal principle underlying the doctrine of informed consent?

A: *That a patient can only consent if adequately informed.*

Q: What are the basic elements of informed consent?

A: *A description of treatment recommendations, the benefits and risks of treatment and nontreatment, and alternative treatments.*

Figure 4. Examples of short answer questions and students' responses

Patient Scenario

An 81-year-old female presents to your office. She is 5' 4", 142 pounds, with a blood pressure reading of 122/84. She has diabetes mellitus type II and rheumatic disease with a resultant murmur; she is allergic to penicillin, photosensitive to tetracyclines, and has an atrial fibrillation. She is currently taking insulin, warfarin, and vitamin A.

The patient had rheumatic fever as a child and was diagnosed with diabetes at age 52. Lately, her appetite has been poor, and her caregiver reports frequent disorientation.

The patient had routine dental care before retirement at age 62. She has had sporadic care since then and is very frightened. She requests sedation for any "painful" treatment. Patient smoked a pack of cigarettes per day for over 50 years and quit smoking five years ago.

She is widowed with two sons who don't live in the area and is active in church and senior center activities. She resides in an assisted living facility.

She reports a chief complaint as "My back teeth hurt, and sometimes my gums bleed when I brush. My teeth seem loose and food gets caught between them."

The mandible will be treated with an interim removable partial denture, and Teeth #17, #21, #22, #27, #28, and #32 will be maintained.

Questions

- What treatment plan would most enhance the facial retention on the anterior abutments?
- Before performing any extractions on the patient, what actions should be considered? If planning intravenous conscious sedation for this patient, what is of concern to the dentist and how should it be handled?
- What is the most likely medical emergency to arise in this patient?

Figure 5. Example of a structured essay assignment based on a patient scenario

Structured Essay

Description and Characteristics

This item type is similar to the short answer item except that the response presented by the dental student is far more involved. Stimulus material is provided that poses a question or problem. The stimulus material might involve a clinical scenario. The material requires the dental student to provide a logical and detailed response to the question or problem posed (Figure 5).

Uses

The structured essay is used to evaluate the student's ability to clearly identify the salient elements of the problem and logically present a solution or resolution. This type of item addresses a full range of competencies that do not involve clinical demonstrations.

Strengths and Limitations

One of the strengths of this type of item is that it can address most competencies. In the case of competencies associated with patient care, the stimulus material provided involves some sort of clinical scenario. The evaluation of the response can be subjective, however, unless the rater is calibrated, i.e., raters have developed a clear and precise key, or set of criteria, to apply to the response.

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Assessment by Observation

Global Ratings

Description and Characteristics

Dental students are rated on their performance using a series of general or global rating scales following some interaction with colleagues or dental patients most often in a clinical setting (Figure 6). This form of assessment requires a clear set of performance indicators or rubrics that are judged to be important relative to the competency or competencies being evaluated. The student is rated on each indicator. The student is typically rated on a scale ranging from 1 to 5, with a 1 indicating that the competency of interest has not been successfully achieved and a 5 indicating most or all aspects of the competency have been achieved successfully. Global ratings are not restricted to a five-point scale, although more than five points tend to be confusing to the rater. For measurement purposes, it is assumed that the scale is comprised of uniformly increasing levels of success.

Uses

This is an effective form of assessment for evaluating the student on competencies related to

critical thinking, communication and interpersonal skills, and professionalism, although the method is not confined to these competencies.

Strengths and Limitations

The strength of this form of assessment lies in its suitability at evaluating general behaviors in a variety of settings. The indicators of the successful acquisition of the competency must be agreed upon by raters as important or critical to the competency. The limitation of the form is the potential for subjectivity in ratings, unless only one rater is used or multiple raters are calibrated to ensure consistency.

Structured Observation with Checklists or Rating Scales

Description and Characteristics

In this type of assessment, students are exposed to a highly structured situation, most often in a clinical setting, with pre-established performance demands. Typically, students are expected to perform

It is characteristic of _____ to:					
	student name				
		Agree		Disagree	
1. identify existing clinical problem and etiology successfully	5	4	3	2	1 DK
2. have sufficient information prior to beginning a procedure	5	4	3	2	1 DK
3. effectively generate ideas regarding the origin of the problem	5	4	3	2	1 DK
4. reflect on the new knowledge needed to solve a problem	5	4	3	2	1 DK
5. develop hypotheses rather than jump to conclusions	5	4	3	2	1 DK

Source: excerpted with permission from Clinical problem-solving inventory. Chicago: American Dental Association, 2003.

Figure 6. Example of a global rating scale

a specific skill, and the rating scale includes important components/attributes of that skill rather than a general set of performance parameters as are included on the previous global rating scale. The student's performance is observed by a rater or multiple raters, who use a checklist to indicate that some aspect of performance has been demonstrated or a set of rating scales to indicate the level of performance relative to the competency or competencies of interest. In the case of a checklist, the agreed upon entries address the critical aspects of the performance. As with global ratings, the student typically is rated on a scale consisting of three, four, or five points, ranging, for example, from 1 to 3, with a 1 indicating that the competency or some component of the competency has not been successfully achieved and a 3 indicating that most or all aspects of the competency have been achieved successfully (Figure 7).

Uses

As with global ratings, this is an effective form of assessment for evaluating the student on competencies related to critical thinking and communication and interpersonal skills, although the method is not confined to these competencies. The difference between global ratings and structured observations lies in the situation to which the student is exposed. With structured observation, the student is exposed to a situation that is designed to elicit specific

knowledge or behaviors. It is used extensively for assessing psychomotor skills and performance of clinical procedures.

Strengths and Limitations

This assessment form is ideal for evaluating specific areas of performance, and it represents a method for evaluating competencies related to the more clinically relevant competencies. As with global ratings, however, it is susceptible to subjectivity on the part of raters.

Standardized Oral Examination

Description and Characteristics

A set of stimulus questions are developed that address critical areas of knowledge or sets of abilities related to a competency or set of competencies. All students being evaluated are exposed to the same set of questions. Students are expected to respond verbally in their own words, which allows an assessment of the student's depth of comprehension and capacity to apply knowledge and insights to different situations. Responses to the questions are assessed using a standardized rating scale or scoring system.

Rating: 1-Unacceptable, 2-Marginal, 3-Acceptable			
1. General health status reviewed and questionnaire document completed.	1	2	3
2. Chief complaint identified and documented.	1	2	3
3. Discusses diagnosis and treatment plan with patient at the appropriate level and obtains informed consent.	1	2	3

Figure 7. Example of a structured rating scale for a specific skill

Uses

This form of assessment is well suited to the evaluation of critical thinking competencies and competencies in the area of professionalism, although it can be used with other competencies exclusive of clinical demonstrations.

Strengths and Limitations

The strength of this form of assessment lies in the opportunity on the part of the rater to examine the underlying logic of the student's response, assuming that probing for further information is allowed by the design of the examination. As with other faculty assessment methods, however, structured oral examinations are susceptible to subjectivity on the part of raters.

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Multisource Assessment

This section describes several assessment tools that are often used in conjunction with other methods to provide a well-rounded perspective on students' progression toward competence.

Student Self-Assessment

Description and Characteristics

Dental students evaluate their own performance against a set of criteria related to important competencies or the knowledge, abilities, and skills underlying a competency. This approach might involve a form with rating scales associated with specific criteria. Students might also provide narratives evaluating their performance and reflecting on lessons learned and strategies for enhancement or modification of performance in the future.

Uses

This form of assessment can be applied to any competency or underlying knowledge or ability; however, it is best reserved for assessment of competencies that do not involve demonstrations of highly precise technical skills that are best evaluated by experienced clinicians. Student self-assessment can also be an important component of formative assessment. Student self-assessment has been found to be very useful in the preclinical environment.

Strengths and Limitations

Dental students are best able to assess their own performance if provided with a clearly defined set of criteria against which to make judgments and a set of standards of acceptable levels of knowledge and performance. This form is limited by students' own ability to view their knowledge or performance realistically. This approach is most effective when used in combination with or comparison to assessment by competent, experienced instructors/evaluators.

Peer Assessment

Description and Characteristics

Dental students assess each other's performance and, in some instances, knowledge. Checklists or rating scales are best incorporated into this form of assessment.

Uses

This form of assessment is well suited to evaluating the communication and interpersonal skills and health promotion competencies, although peer assessment can be useful with other competencies as well. This assumes the criteria have been clearly articulated and are relevant to essential knowledge and abilities. Peer assessment is also useful in problem-based learning and in other curricular activities in which students' contributions to group learning are important.

Strengths and Limitations

This approach to the assessment of students is limited, however, by the level of knowledge and ability of the peer group.

Patient Survey

Description and Characteristics

Patient surveys typically involve a series of rating scales or checklists designed to assess the patient's satisfaction with the performance of the student in the clinical setting. The standard survey solicits the patient's satisfaction using categories such as poor, good, and excellent, with categories in between where appropriate. Also, categories might be agree, neutral, or disagree with value judgments included on the survey.

Uses

This form of assessment is ideally suited to evaluating those competencies related to communication and interpersonal skills, as well as patient care. However, patient evaluations are not confined to assessing students' behavior. Perspectives and ratings provided by patients can be expanded to assess the quality of clinic services.

Strengths and Limitations

This form of assessment involves gathering information from patients on those aspects of care that are important to them. It should be possible to complete the assessment in a reasonable amount of time, typically ten to fifteen minutes. This involves interviewing patients and focus groups to determine the critical aspects of care that will be assessed. These aspects, in turn, are translated into a survey form. The survey can be an effective method of gathering information because it is based on the concerns of patients. Limitations include issues related to the patient's ability to understand the language on the survey, costs involved in obtaining survey information, and the challenges of obtaining a sufficient number of completed surveys to achieve reliable findings.

Standardized Patients

Description and Characteristics

Standardized patients (SPs) are trained individuals who present in a clinical situation with standardized symptoms similar to those that might be encountered with actual patients. These patients present with a full variety of symptoms that allow the dental student to develop a range of treatment plans.

Uses

Standardized patients provide essential feedback on dental student performance, often using a checklist or series of rating scales. Faculty raters also provide feedback in the form of evaluative comments. This is an effective approach to evaluating competencies related to communication and interpersonal skills and patient care.

Strengths and Limitations

This form of assessment provides the students with valuable information on their ability to think critically, their interpersonal skills in working with patients, and their ability to diagnose and develop a treatment plan. It can be subjective, however, unless patients are highly trained and calibrated.

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Simulation

Virtual Reality (Computer-Based Clinical Scenarios)

Description and Characteristics

Computer-based clinical scenarios are designed to evaluate students' knowledge and abilities related to diagnosis and treatment planning. These scenarios can be highly sophisticated, involving and often using audio and video simulations.

Uses

Computer-based scenarios are well suited to assessing competencies associated with diagnosis and treatment planning. These scenarios tend to have high fidelity and make excellent teaching and assessment tools.

Strengths and Limitations

The strength of virtual scenarios lies in their high fidelity. Determining performance levels is difficult, however, and requires considerable research in determining salient decision points in evaluating appropriate diagnoses and treatment plans. This research involves exploring novice and expert performance with focus groups of students and expert practitioners to determine levels of acceptable performance.

Computer-based scenarios that depict actual patient care situations are time-consuming and often expensive to produce, factors reflecting common logistical limitations.

Models

Description and Characteristics

Models consist of mannequins showing various dentally related clinical challenges for the dental student to evaluate.

Uses

This form of assessment taps knowledge and problem-solving skills underlying competencies often related to diagnosis and treatment planning. Because models are standard for all students and evaluation criteria can be readily defined, evaluation can be relatively objective.

Strengths and Limitations

This form of assessment is effective largely because symptoms are easily standardized and consistent across students. Assessing performance is relatively straightforward. It is only limited if criteria are not well defined or those serving as raters are not well calibrated.

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Multi-Competency, Comprehensive Assessments

Objective Structured Clinical Examination (OSCE)

Description and Characteristics

In dental school applications, OSCEs consist of a set of work stations that involve standardized procedures for the dental student to perform. Multiple tools are used to assess students' performance on the designated tasks at these stations, which can number from ten to thirty. The time allotment at each station varies, but is usually from five to fifteen minutes.

Uses

This form of assessment provides a standardized opportunity for students to demonstrate their ability to conduct an oral examination, take comprehensive notes, and interpret the clinical situation. This is an excellent format for evaluating a full range of competencies, especially those related to diagnosis and treatment.

Strengths and Limitations

The strengths of this form of assessment are that it provides an opportunity for students to demonstrate specific clinical skills and it has high fidelity. It is also effective at evaluating competencies related to treatment. However, gathering reliable performance information can be problematic since there are a limited number of stations. It is logistically difficult and time-consuming to develop and conduct this form of assessment.

Triple Jump Exercise (TJE)

Description and Characteristics

There are two types of TJEs used in different components of the curriculum, but they involve

similar techniques. A clinical TJE consists of three phases ("jumps") in which students 1) interview and examine patients while observed by faculty or, less often, are videotaped for retrospective review; 2) write an assessment of the findings from the patient assessment using the "SOAP" format (subjective data, objective data, assessment, plans), with emphasis on providing evidence from the literature to support diagnostic and therapeutic decisions and submit this document to the faculty member who observed jump one; and 3) participate in an oral examination conducted by the observing faculty member in which students are questioned about the pathophysiology, diagnosis, and treatment of the patient's problems and asked to discuss research evidence pertinent to treatment 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' skills in searching the literature to answer health-related questions that they have developed. In a preclinical TJE, the first jump involves reading a scenario depicting a patient with an oral health problem, identifying key issues, and writing a researchable question in the PICO format (patient with problem, intervention, comparison, and outcome). During the second jump, students investigate literature to find evidence pertinent to their question, and then, in jump three, report their findings, answer the research question, and critically appraise the quality of available evidence. As with clinical TJEs, preclinical students receive evaluations for each jump and a cumulative score for the whole exercise.

Uses

The triple jump exercise is used to evaluate students' capacity to access, analyze, and apply biomedical knowledge to health care problems. When coupled with multiple-choice testing in the case-based testlet format (i.e., several multiple-choice questions linked to a patient scenario), TJEs provide a mechanism for assessment of students' capacity to function at the application level of the cognitive taxonomy. Both types of TJEs emphasize accessing pertinent informa-

tion, applying this information to health problems, and appraising the quality of knowledge available to answer clinical questions.

Strengths and Limitations

The strength of this form of assessment is that it provides an opportunity for faculty to appraise the student's performance across a spectrum of skills ranging from patient assessment (conducting an interview or performing an examination) to diagnosis and treatment planning and ultimately the ability to explain the rationale for selected therapy and demonstrate understanding of the research evidence pertinent to the patient's oral health problems and therapeutic options. However, the TJE for either preclinical or clinical students is time-consuming to develop and logistically difficult to implement, requiring considerable numbers of faculty mem-

bers who need to be trained in the technique and calibrated to provide uniform assessments of each of the jumps.

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Work Samples

Portfolios

Description and Characteristics

Portfolios require that students gather a collection of documents demonstrating the acquisition of relevant knowledge and ability across all competencies. This form addresses both formative and summative assessment. These documents can include self-assessments, patient survey findings, and sample patient cases, including diagnosis and treatment plans. The portfolio is an opportunity for the student to show any learning product that meets certain prespecified criteria.

Uses

This is a student-centered tool, which is an effective method for evaluating a variety of competencies such as critical thinking, professionalism, and health promotion.

Strengths and Limitations

The strength of this assessment tool is that it allows for the evaluation of competencies that are not readily evaluated using other tools. However, the variability among portfolios makes consistent evaluation difficult for raters. Also, supporting students in their development of their portfolios can be time-consuming, as can evaluating the documents themselves. It has been found that, because of these limitations, portfolios can be problematic to both students and faculty raters.

Record Review (Chart-Stimulated Review)

Description and Characteristics

This methodology involves a review of the patient care records (i.e., patients' charts) developed

by the student. The review consists of an evaluation of diagnostic information and an examination of findings related to treatment planning in light of standards of dental practice. Chart-stimulated review is commonly used as an assessment technique in medical education for residents and students on clerkships. The method assesses the learner's capacity to explain rationales for treatment decisions, show comprehension of key concepts, and compare and contrast alternative treatment approaches; it also is used to stimulate students' self-assessment and reflection.

Uses

Record review is effective for evaluating competencies that are not readily assessed by other tools including competencies in the domains of critical thinking, professionalism, and health promotion in the ADEA Competencies for the New General Dentist.

Strengths and Limitations

Similar to portfolios, a wide range of competencies can be evaluated with chart reviews. The variability among records can lead to subjective judgments regarding their quality, however.

SOURCES

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General References on Assessment

Standards

The most authoritative source of information related to assessment standards has been developed and described in a document published by the American Educational Research Association, American Psychological Association, and National Council on Measurement in Education. This document is:

American Educational Research Association, American Psychological Association, National Council on Measurement in Education. Standards for educational and psychological testing. Washington, DC: American Educational Research Association, American Psychological Association, National Council on Measurement in Education, 1999.

The standards are currently under review, and a revised set of standards will be published in the near future.

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- The assessment toolkit developed by the Accreditation Council for Graduate Medical Education can be accessed at www.acgme.org/Outcome/assess/Toolbox.pdf.

Organizations Involving Assessment

- American Dental Education Association, Washington, DC. At: www.adea.org.
- American Educational Research Association, Washington, DC. At: www.aera.net.
- American Psychological Association, Washington, DC. At: www.apa.org.
- Association for Psychological Science, Washington, DC. At: www.psychologicalscience.org.
- National Council on Measurement in Education, Washington, DC. At: www.ncme.org.

APPENDIX

Summary Table of Assessment Techniques to Measure Dental Students' Attainment of the 2008 ADEA Competencies for the New General Dentist

Along the vertical dimension of the table are the Competencies for the New General Dentist endorsed by the ADEA House of Delegates in April 2008; sixteen assessment methodologies are presented across the horizontal dimension. Each intersecting cell shows the appropriate methodology for use in evaluating each competency. A “1” in the cell indicates a preferred technique, a “2” indicates an acceptable methodology, and a “3” indicates an assessment that is potentially applicable in certain circumstances. It is important to note that these indicators are suggestions. Depending on the particular competency, an alternative methodology or combination of techniques might be appropriate.

Dental Student Assessment Toolbox (continued)

Toolbox of assessment techniques to measure dental students' attainment of the 2008 ADEA Competencies for the New General Dentist (1: Preferred; 2: Acceptable; 3: Potentially Applicable)

Competencies for the New General Dentist	Written Assessment			Faculty Observation		
	Multiple-Choice	Short Answer	Structured Essay	Global Ratings	Structured Observation	Standardized Oral Exam
<i>Critical Thinking</i>						
Graduates must be competent to:						
1.1 Evaluate and integrate emerging trends in health care as appropriate.	3	2	1			
1.2 Utilize critical thinking and problem-solving skills.			1		2	
1.3 Evaluate and integrate best research outcomes with clinical expertise and patient values for evidence-based practice.			2		1	
<i>Professionalism</i>						
Graduates must be competent to:						
2.1 Apply ethical and legal standards in the provision of dental care.			1			3
2.2 Practice within one's scope of competence and consult with or refer to professional colleagues when indicated.					1	
<i>Communication and Interpersonal Skills</i>						
Graduates must be competent to:						
3.1 Apply appropriate interpersonal and communication skills.					1	
3.2 Apply psychosocial and behavioral principles in patient-centered health care.					3	
3.3 Communicate effectively with individuals from diverse populations.					1	
<i>Health Promotion</i>						
Graduates must be competent to:						
4.1 Provide prevention, intervention, and educational strategies.	3					2
4.2 Participate with dental team members and other health care professionals in the management and health promotion for all patients.			3			
4.3 Recognize and appreciate the need to contribute to the improvement of oral health beyond those served in traditional practice settings.			3			
<i>Practice Management and Informatics</i>						
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.		2	1			
5.3 Apply principles of risk management, including informed consent and appropriate record keeping in patient care.						2
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.	2	3				

Dental Student Assessment Toolbox *(continued)*

Multisource Assessment				Simulation		MCA		Work Samples	
Self Assessment	Peer Assessment	Patient Survey	Standardized Patients	Virtual Reality	Models	OSCE	TJE	Portfolio	Record Review
				3				3	
						2			2
									3
	3	2							
		2	1						
		2	3						
								1	
							2	1	2
2							2	1	
				3				1	2
						3			
		3							1
2		1						3	
1								2	3
									1

(Continued)

Dental Student Assessment Toolbox (continued)

Toolbox of assessment techniques to measure dental students' attainment of the 2008 ADEA Competencies for the New General Dentist (continued)

	Written Assessment			Faculty Observation		
	Multiple-Choice	Short Answer	Structured Essay	Global Ratings	Structured Observation	Standardized Oral Exam
5.7 Develop a catastrophe preparedness plan for the dental practice.			1			3
<i>Patient Care: Assessment, Diagnosis, and Treatment Planning</i>						
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.				2	1	
6.2 Prevent, identify, and manage trauma, oral diseases, and other disorders.				2	3	
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.	3	2				
6.4 Select, obtain, and interpret diagnostic images for the individual patient.	3				1	
6.5 Recognize the manifestations of systemic disease and how the disease and its management may affect the delivery of dental care.	1					
6.6 Formulate a comprehensive diagnosis, treatment, and/or referral plan for the management of patients.			1			
<i>Patient Care: Establishment and Maintenance of Oral Health</i>						
Graduates must be competent to:						
6.7 Utilize universal infection control guidelines for all clinical procedures.	2				1	
6.8 Prevent, diagnose, and manage pain and anxiety in the dental patient.	2				1	
6.9 Prevent, diagnose, and manage temporomandibular disorders.	2				1	
6.10 Prevent, diagnose, and manage periodontal diseases.	2				1	
6.11 Develop and implement strategies for the clinical assessment and management of caries.			3			
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.	2				1	
6.13 Diagnose and manage developmental or acquired occlusal abnormalities.	2				1	
6.14 Manage the replacement of teeth for the partially or completely edentulous patient.	3					
6.15 Diagnose, identify, and manage pulpal and periradicular diseases.	2				1	
6.16 Diagnose and manage oral surgical treatment needs.	2				1	
6.17 Prevent, recognize, and manage medical and dental emergencies.					1	
6.18 Recognize and manage patient abuse and/or neglect.	1					
6.19 Recognize and manage substance abuse.	1					
6.20 Evaluate outcomes of comprehensive dental care.				1		2
6.21 Diagnose, identify, and manage oral mucosal and osseous diseases.	1					

Dental Student Assessment Toolbox (continued)

Multisource Assessment				Simulation		MCA		Work Samples	
Self Assessment	Peer Assessment	Patient Survey	Standardized Patients	Virtual Reality	Models	OSCE	TJE	Portfolio	Record Review
								2	
			3						
				1		2			
							2	2	1
				2			2		
				2		3			
				3			2		2
						3			
			2	3					
				3					
				3					
				2				1	
					2	3			
								3	
					2	1			
				3			3		
				3					
			2			3			
				2					3
				2					3
								3	1
				2		3			