Implementation of Portfolios as a Programmatic Global Assessment Measure in Dental Education

Cynthia C. Gadbury-Amyot, Pamela R. Overman

Abstract: Studies of assessment have shown that three elements—multiple assessments, over time, with multiple evaluators—provide the best strategy for global assessment of student competence in a valid and reliable manner, while experts on competency-based education (CBE) have defined the use of portfolios for assessment as a best practice for CBE. The aim of this article is to describe the five-year experience of one U.S. dental school's implementation of portfolio assessment of student competence as a programmatic global assessment strategy and to share the lessons learned. From approval by the Curriculum Committee to the first graduating class's portfolios, the steps and lessons learned along the way are described, in hopes of providing guidance to other schools interested in adopting portfolios for global assessment. This assessment strategy required the collaboration of a broad range of administrators, faculty, and students, as well as a high degree of faculty and student development. Calibration of the summative evaluators resulted in an interrater reliability estimate of 0.81. An important lesson learned was that development of reflective writing was underestimated, resulting in initial failure of 12 (11%) of the portfolios for the Class of 2017. Dental schools interested in adoption of portfolios should expect to invest time in the preparation of faculty and students. However, the result of this investment will be an assessment measure considered a best practice in both the assessment and competency literature.

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A progression of change in dental education has supported adoption of portfolios as a programmatic or global assessment strategy, crossing all four years of the dental curriculum. In 1998, predoctoral dental education moved to a competency-based education (CBE) model as mandated by the Commission on Dental Accreditation (CODA). Although a review of the literature on best practices for assessment in CBE defined portfolios as being at the highest level of assessment (Figure 1),[1] a study of North American dental schools published in 2008 found very few engaging in assessment strategies called for in CBE programs, including portfolio assessment.[2] In 2016, revisions of CODA standards for predoctoral dental education showed a major shift toward CBE, including such areas as critical thinking and self-assessment.[3] About the same time, California implemented the use of portfolios as one pathway for licensure.[4] Combined, these changes have prompted action in dental education programs to consider assessment strategies that align with these developments.

In January 2013, the University of Missouri-Kansas City School of Dentistry (UMKC-SOD) Curriculum Committee approved development of a plan to implement portfolios in the predoctoral dental program. Justification for this action provided in the committee minutes included the following: over two decades of CBE as a dominant curricular philosophy in the health sciences and 15 years in predoctoral dental education; the need for assessing both formative and summative learning; change in National Board Dental Examination (NBDE) reporting from a score to pass/fail, resulting in an unintended consequence of advanced dental education programs' no longer using NBDE scores for admission requirements; and the need for documenting critical thinking and problem-solving in fulfillment of anticipated revisions in CODA standards.

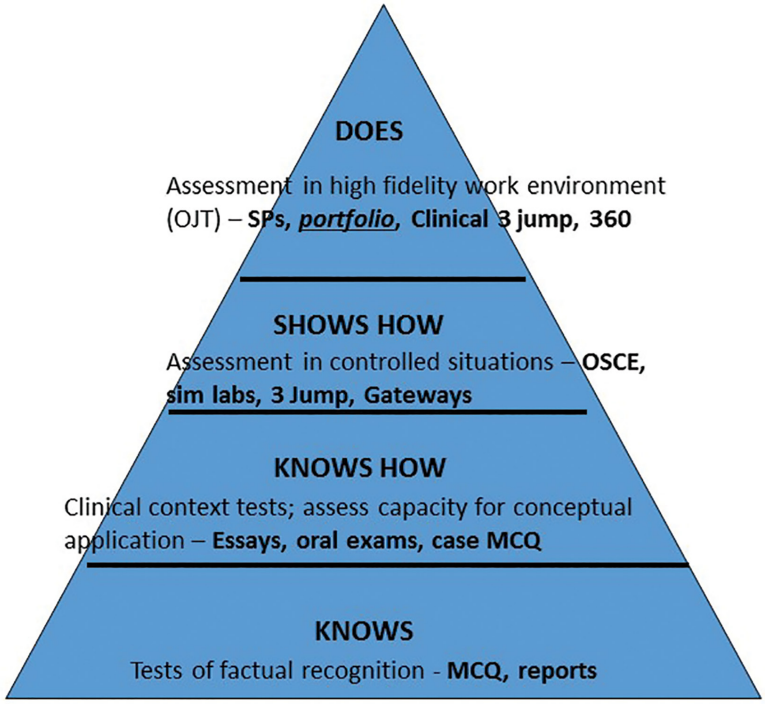

Figure 1. Miller's pyramid of professional competence

Source: Adapted with permission from Miller GE. The assessment of clinical skills/competence/performance. Acad Med 1990;65(9 Suppl):S63-7.

Based on deliberations of the Curriculum Committee, school leadership decided that six of the ten dental education program competencies would be included in the portfolios. The committee deemed that assessment strategies for the other four competencies, which mainly related to clinical skills, were adequate. The six program competencies (PCs) identified for inclusion in a portfolio were the following: PC 2) ethics and professionalism; PC 3) interpersonal communication skills; PC 4) critical thinking and problem-solving skills; PC 5) models of oral health management and care delivery; PC 6) oral health promotion, education, and interaction; and PC 10) self-assessment. The principal investigator (PI) led this effort in the predoctoral program at UMKC-SOD based on her experience with this assessment measure.[5-7] The aim of this article is to describe the five-year experience of the school's implementation of portfolio assessment of student competence as a programmatic global assessment strategy and to share the lessons learned.

Design and Implementation of Portfolios

As the portfolio co-leaders (PI [CGA] and Co-PI [PO]), we decided from the start that, to achieve the Curriculum Committee's charge of incorporating both formative and summative evaluation into the portfolio project, it would be necessary to build the portfolio across predoctoral courses over the span of the four-year curriculum. The portfolio was not to be a stand-alone project but instead to highlight the existing curriculum, with assessment carried out by faculty with content expertise as students progressed through the curriculum. In this manner, assignments and projects completed throughout the curriculum would serve as evidence of students' gaining the knowledge, skills, and values/attitudes for meeting program competencies. Incorporation of the portfolio across the curriculum served to provide formative assessment. It also ensured student accountability for portfolio assignments since the assignments and projects were incorporated into

existing courses and required completion in order to complete the individual courses. Research on assessment has demonstrated that a process of multiple assessments, conducted over time, and evaluated by multiple evaluators is the best strategy for achieving a valid and reliable assessment strategy.[8-10]

The first step in the implementation process involved an extensive review of the predoctoral curriculum map. Courses with assignments/projects best illustrating development of students' knowledge, skills, and values/attitudes for meeting the six program competencies to be included in the portfolio were identified. Next, the course directors were approached to determine if they would agree to be part of the portfolio programmatic assessment measure. The courses represented content from all four years of the curriculum. An example of evidence required for inclusion in the portfolios to document Competency 4 is shown in Table 1.

Faculty Preparation

All faculty members approached about being part of the portfolio assessment measure accepted the challenge, so the next step was a meeting with them, hereafter referred to as the "portfolio faculty." At an initial meeting of the portfolio faculty, programmatic global assessment was discussed along with best practices in the assessment and competency education literature to provide background and rationale for adopting this assessment strategy.[11] Assignments and projects chosen for inclusion in the portfolios were reviewed with the portfolio faculty along with the program competencies linked to the courses and assignments/projects. Following this initial meeting, individual meetings were scheduled with the portfolio co-leaders to discuss evaluation strategies.

The individual meetings revealed a variety of assessment strategies were being used by the portfolio faculty, ranging from grading rubrics to simply giving students a "pass" if the assignment was handed in. The portfolio co-leaders worked individually, and as a group, with the portfolio faculty in the development of grading rubrics. Brennan's textbook on educational measurement supports the use of grading rubrics, particularly in the framework of competency-based education and performance assessment.[8] Faculty members turned to a variety of methods for implementation of the grading rubrics. Some chose to use a Word document that is filled out by the faculty member and returned to the student via email, while others used grading rubric software available through the learning management system. All portfolio faculty members were asked to include a reflective component in their assignment/project, requiring students to reflect on the assignment/project as it related to the associated program competency(ies) in the curriculum map. Table 2 shows an example of a grading rubric developed for the first-year Clinical Decision Making course. The criteria (dimensions) on the grading rubric evaluate the student's work on the Critically Appraised Topic (CAT) summary with the last dimension evaluating the reflective process called for in CBE and by CODA. By reflecting on the assignment/project and relating that to their program competencies, students begin to make meaning out of their educational experience, connecting program competencies to curricular requirements.

To assist with the potential issue of plagiarism, all assignments and projects slated for inclusion in the portfolios were required to be run through Turnitin, an Internet-based plagiarism technology designed to work within the learning management system. Submission to Turnitin produces an originality report with a similarity index that identifies all the top and underlying sources that match text in the assignment and displays those matches as a percentage. Examination of the originality report allowed faculty members to objectively evaluate the identified sources and ensure that there was no plagiarism in the assignment.

Table 1. Evidence required in the portfolio for meeting program competency #4, by year

Competency #4	Year	Evidence Required
Apply critical thinking and problem-solving skills to provide evidence-based patient-centered care.	D1	CAT (Critically Appraised Topic) summary (and grading rubric) *D6328 Clinical Decision Making*
	D3	Clinical Scenario Assignment *D6502 Grand Rounds I*
	D3	Poster Presentation (and grading rubric) *D6602 Grand Rounds II*
	D4	Innovation Clinic CAT *D6603/6604 Grand Rounds IV*

Table 2. Grading rubric for first-year Critically Appraised Topic (CAT) summary assignment

Team Name: _____

Students in Team: _____

Critically Appraised Topic (CAT) Grading Rubric

The CAT is a structured one- to two-page summary and critique of the best available evidence on a focused question.

Dimension	Definition of Dimension	Comments	Score
Clinical question (PICO)	Concise, relevant clinical question. PICO is developed that can drive an efficient search.		/5
Search strategy for evidence	Appropriate databases, keywords, and limits are combined logically to identify best evidence. Include all searches for evidence listed below.		/5
Best evidence selected (minimum of 2 articles; no more than 5)	Using critical appraisal skills, team identifies 2-5 articles to best answer the clinical question. Correct Vancouver citation followed by study type and level.		/5
Key results synthesized	A concise, accurate amalgamation and summary of the selected evidence. (One summary of all evidence.)		/5
Clinical bottom line	Develops a one- to two-sentence summary of the findings targeted at a clinician.		/5
Comments on quality of evidence	Evaluates the quality of evidence available at this point in time to answer the question/s.		/10
Reflection on acquired skills	Reflect on how this activity helped in development of your knowledge, skills, and attitudes necessary for meeting Competency#4 (apply critical thinking and problem-solving skills to provide evidence-based patient-centered care).		/5

Possible points: 40 points (30% of your final grade)

Team score: _____

The next step in the process of implementing portfolio assessment involved the selection of an ePortfolio tool. Using Helen Barrett's schema for exploring ePortfolio tools (electronicportfolios.com/categories.html), we chose Foliotek as the ePortfolio solution for the predoctoral portfolio. Foliotek is a hosted system (no server required by the participating institution), includes a data management system that allows collection of evaluation data about portfolios, and can produce reports aggregating both quantitative and qualitative data. All other programs using portfolios at the UMKC-SOD had previously adopted Foliotek, so this decision provided consistency across the school.

Formative assessment is achieved throughout the four years of dental school, with assignments and projects graded by the course directors who are considered the content experts in their individual courses. The next step in the process involved development of a summative assessment strategy. Summative assessment of the portfolios was accomplished in the fourth year of the curriculum. Up to this point, all evidence in the portfolio had been assignments or projects imbedded within courses throughout the four years and evaluated by course directors.

In the final semester of the predoctoral program, students were required to develop a portfolio introduction and global portfolio reflection. These two portfolio entries were assessed by the summative evaluators, who were nine clinical dental faculty members. The portfolio co-leaders organized an orientation and calibration session for the summative evaluators. A comprehensive review of the summative grading rubric and accompanying criteria was carried out. Using the summative evaluation grading rubric, the summative evaluators engaged in calibration exercises using a variety of portfolio examples (some deemed as well done and some deemed as not well done by the portfolio co-leaders using the summative evaluation rubric). The summative evaluators individually evaluated sample introductions and global reflections, followed by sharing and discussing how they came up with their individual ratings. A robust discussion followed until the evaluators came

to a reasonable consensus. This level of calibration has been identified as critical in performance assessment measures such as portfolios.[12] The summative evaluation of the portfolios was conducted electronically within Foliotek using the grading rubric. The three areas used to evaluate the portfolio introduction and global reflection were professional communication, growth and professional development, and self-evaluation. Table 3 provides an example of the criteria used to evaluate professional communication and the grading scale.

Student Preparation

Parallel to the steps taken regarding the faculty and program aspects of implementing programmatic portfolios were steps involved with process and procedure on the student side. The Curriculum Committee decided that a phase-in approach would work best at the UMKC-SOD. Therefore, the first step in working with students involved informing the Class of 2017 during their orientation in the fall of 2013 that their class would be developing portfolios as a new assessment strategy in the predoctoral program and that more information would be forthcoming. A second step—a strategy that proved to be extremely helpful—was the selection of a "tech expert" from each class. This individual served as a liaison between faculty and students and helped troubleshoot technology issues.

In the third step, the PI met with the first-year students in their first semester to discuss the portfolios and the rationale behind this assessment measure, to provide an introduction to the ePortfolio in Foliotek, and to discuss the first assignment for the portfolio. The portfolio faculty and co-leaders decided that the first entry in the portfolios should be the students' personal statements developed when they applied to dental school. The hope was that, as students reached their fourth year and prepared to write their global reflection, reflecting on where they started through re-reading and reflection on their personal statement would provide a global perspective on their growth and development that had taken place over the four-year curriculum.

The fourth step took place in the courses led by the portfolio faculty. The portfolio faculty members were responsible for providing instruction in their classes about assignments and projects chosen for inclusion in the portfolio. They worked in collaboration with the portfolio co-leaders to ensure that students were populating their portfolios with the required evidence starting in year one and culminating in year four.

The fifth step involved a Global Reflection Workshop held in January of the students' last year. They were given an image (Figure 2) to illustrate how traditionally students have had minimal involvement in assessment. The PI discussed how global portfolios challenge students to employ critical thinking and problem-solving skills as they construct meaning out of their educational experiences and convey that meaning to others through their portfolios. The workshop included instructions for completion of a portfolio introduction and global reflection. The summative evaluation grading rubric was reviewed with the students, along with discussion of each of the criteria.

Table 3. Summative evaluation grading rubric: criteria used to evaluate professional communication

Professional Communication

Based on the portfolio introduction and global reflection, does the student portray a professional level of communication by incorporating the following components?

Criteria (components)	Not Enough (3 points)	Some (2 points)	Mostly (1 point)
• Introduction and global reflection present clear and succinct statements.			
• The relationships between the evidence and program competencies are clearly linked for the reader.			
• Portfolio contents are referred to as documentation to support points made by the student.			
• There are few errors in grammar or mechanics to distract from the overall presentation of information.			

If a score of less than 3 is earned, PLEASE MAKE SURE TO PROVIDE FEEDBACK TO THE STUDENT ON HOW HE/SHE CAN IMPROVE.

Comments: _____

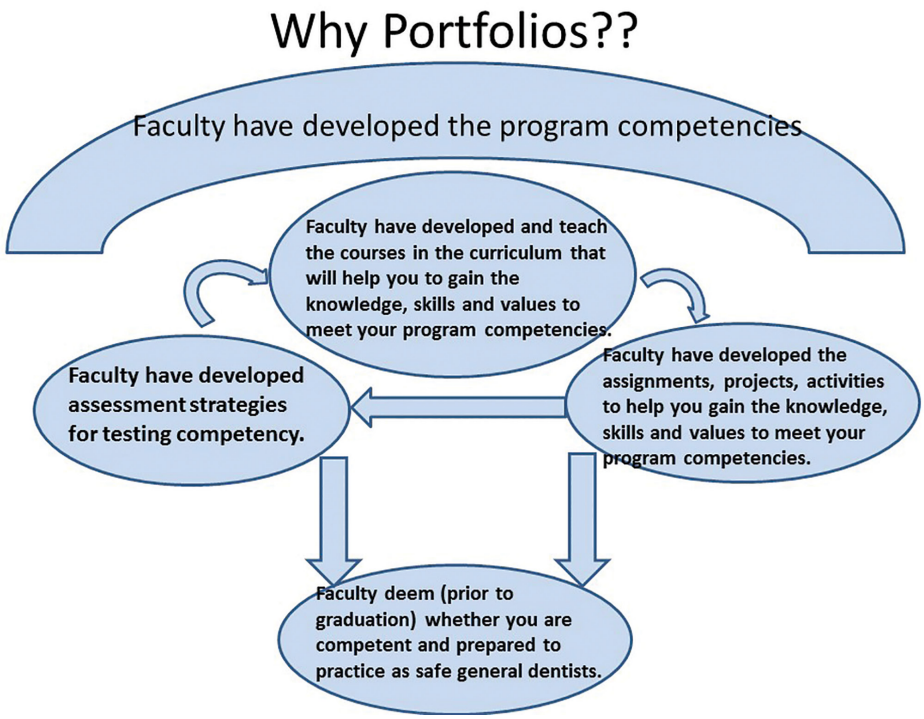

Figure 2. Absence of student involvement in usual competency assessment: showing need for students' self-assessment using methods like ePortfolios

Initial Outcomes

The Class of 2017 was the first to complete the four years of portfolio assessment, so their experience and the faculty's experience with them formed the first outcome measures from implementing the program. Unfortunately, that class had 12 students (11%; 12/106) who initially failed the summative portfolio evaluation. Because portfolios had become a requirement for graduation, students who failed were required to revise and resubmit their portfolios for evaluation. The identity of the summative portfolio evaluators was not revealed to students, but some faculty members identified themselves to the students and worked with them on strategies for revision. In instances in which the evaluator chose to remain anonymous, the PI worked with the students on the revision of their portfolios. Seven portfolios passed with one revision (64%), four (36%) passed with a second revision, and one required four revisions before passing.

Using SPSS, we conducted coefficient alpha reliability estimates for the evaluations of that class's portfolios. The resulting interrater reliability estimates for the nine summative evaluators was 0.81. Cohen classifies correlation coefficients of 0.50 as representative of a strong or large correlation.[13] According to van der Vleuten and Schuwirth, a reliability estimate of 0.80 is regarded as the minimal acceptable value; however, the purpose of the assessment must be factored into the decision.[9] Because in this instance portfolios served as one form of assessment in the predoctoral program, a strong argument can be made that the 0.81 reliability achieved by the summative evaluators is adequate.

Lessons Learned

While we anticipated that faculty and student development would be required to implement a global assessment strategy, we underestimated the extent of development required. From the development of grading rubrics to use of educational technology, the learning curve was steep for the portfolio faculty. While many had used Blackboard previously for their courses, new technologies such as Turnitin and the development and use of electronic grading rubrics required development. Assessment

beyond traditional multiple-choice exams was new to the majority of the portfolio faculty. However, the feedback provided to students through comments from faculty on the grading rubric has continued to improve each year.

There were also lessons regarding student development. The PI has been extensively involved in teaching and learning using technology since 1998. Although many assume that today's students are advanced users of technology, that has not been her experience when it comes to technology for teaching and learning. For example, assignments created in Word must be converted to PDFs for inclusion in the portfolio, and this proved to be a challenge for many students. The management of files, from naming them to loading them into an ePortfolio format, also proved to be challenging. The addition of a class tech expert proved extremely helpful in facilitating the development of digital literacy skills. Solutions to the vast majority of these issues were facilitated through the class tech expert. This lack of technology skills of many of the students is corroborated in a report by the National Center for Education Statistics (NCES) that placed U.S. students last in technology skills compared to other countries around the world.[14] The NCES study examined basic technology tasks such as using email, using a drop-down menu, and naming a file on a computer—all skills needed in the portfolio assessment.

It was critical that the material included in the ePortfolio be tied to individual courses in order to ensure that it was completed. Without that, the ePortfolio may not have captured the attention of the majority of students. Making the assignments required in courses alleviated this issue. As with any other course assignment, until it was completed, students would not pass the course.

An area requiring attention stemmed from the fact that the level of students' reflection demonstrated in the global reflection was disappointing. Debrief meetings with the portfolio faculty and summative evaluators included an examination of portfolio reflections based on Bain et al.'s 5 Rs of reflection (reporting, responding, relating, reasoning, reconstructing).[15] The first three levels—reporting, responding, and relating—focus on what happened and what lessons can be learned and applied in other situations. At these levels, Bain et al. contend there is no in-depth analysis of how or why the experience unfolded as it did. Instead, the reflector used existing frameworks of thinking and beliefs to review the event. Higher levels of reflection, on the other hand, involve in-depth analysis and can involve challenging existing frameworks of thinking. At this level, alternative ways of interpreting the events/experiences are perceived. The PI is currently working with a couple of the portfolio faculty members to evaluate the Class of 2017's global reflections using Bain et al.'s 5 Rs. These results informed the Class of 2018 Reflection Workshop and assisted with preparing students to develop a global reflection that goes beyond the lower levels of reflection. Strategies for accomplishing this have been outlined in another publication by the PI.[6]

The process of reflection is central to critical thinking and problem-solving. The work of individuals like Dewey, Schon, and Boud have demonstrated the importance of reflection for learning.[16-18] Ausubel's work emphasizes the importance of linking new knowledge with existing knowledge and learning experiences for meaningful learning to take place.[19] Through the assessment of reflection in the portfolio, it is our hope that the program will meet accreditation requirements, while at the same time preparing future-ready practitioners able to critically think and problem-solve as the practice of dentistry evolves over time.

Conclusion

Implementing programmatic/global assessment at UMKC-SOD involved a high degree of faculty and student development. As PI and Co-PI of the project, we found that our knowledge of education and assessment proved to be extremely valuable in guiding the development and implementation of portfolios across the curriculum. Faculty members, as content experts in their disciplines, were essential to the process of incorporating assignments and projects from their courses into the portfolios as evidence of student attainment of knowledge, skills, and values to meet program competencies. Reflective writing and self-assessment turned out to be much more challenging than initially anticipated. Because students were required to reflect on each of their assignments or projects included in the portfolio, we expected that this process would translate into quality global reflections at the end of the students' educational journey. That did not prove to be the case, and efforts are under way for strengthening instruction during the Reflection Workshop. Debrief meetings were held with the portfolio faculty and summative evaluators in which literature and actual student introductions and global reflections were used to engage these faculty members in discussions about what constitutes

strong versus weak reflective writing. Overall, the experience reinforced the notion that change is hard. Change, whether in teaching, learning, or assessment, involves risk and uncertainty for faculty and students. Our experience demonstrated that implementing global assessment in the form of portfolios can only be accomplished through the collaborative efforts of administration, faculty, and students.

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