A Case Study Examining Classroom Instructional Practices at a U.S. Dental School

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Abstract: A case study is used to illustrate how an evaluation strategy was used to assess classroom instructional practices following a multiyear institutional curriculum revision process. From January through April of 2003, twelve faculty in medicine and three faculty in dentistry who taught in the first- and second-year basic science courses within the dental curriculum participated in a qualitative study. The purpose was to use a formative evaluation process to assess the impact of the curriculum revision at the level of classroom instruction. The observations revealed that seventeen of the twenty classes observed were teacher-centered, passive, and lacked observable effort to help students understand the relationship of the lecture content to the oral health problems. Findings illustrate the importance of using formative evaluation as a mechanism to assess change efforts and how evidence-based study can be used to support initiatives directed toward assessing active student learning and problem solving. Raising faculty awareness about the importance of acquiring evidence-based educational skills, aligning instruction with course goals and objectives, formatively assessing teaching, and providing learning experiences that will actually be used in practice are essential to ensuring that active learning and critical thinking are demonstrated in the curriculum.

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The goal of incorporating active learning and critical thinking in the dental curriculum is generally well accepted. Yet, little attention has been given to studying the quality of classroom and didactic instruction and the translation of didactic instruction to the clinical learning environment. An observational study that examined the quality of the dental clinical learning environment showed that the teaching of critical thinking skills was infrequent.[1] The purpose of this study was to examine the impact of a multiyear institutional curriculum revision process at a U.S. dental school and to describe whether changes to the written curriculum were actually implemented in classroom instructional practices. In this study, we explored the relationship among an institutional philosophy, the written curriculum and course syllabi, and actual classroom instruction. Although relationships among teaching, curriculum, instruction, learning, and evaluation were occurring simultaneously, this current observational study focused on two components of the microcurriculum, curriculum, and instruction using direct classroom observations.

Analysis Model

The Multidimensional Model of Analyzing Educational Processes was used to guide our analysis (Figure 1). This model illustrates that educational outcomes are mediated by complex interactions across the organization.[2] Examples include interactions among teaching and learning processes and their interactions with those objects used to promote learning and the measurement of outcomes.[3] This perspective can be used as a guide to making inquiry about classroom teaching practices and their relationship to the envisioned curriculum revision. Implicit in the model is the recognition that there are many subsets of interactions that influence and may be influenced by other subsets of variables within and outside an institution, across the macrocurriculum (the total

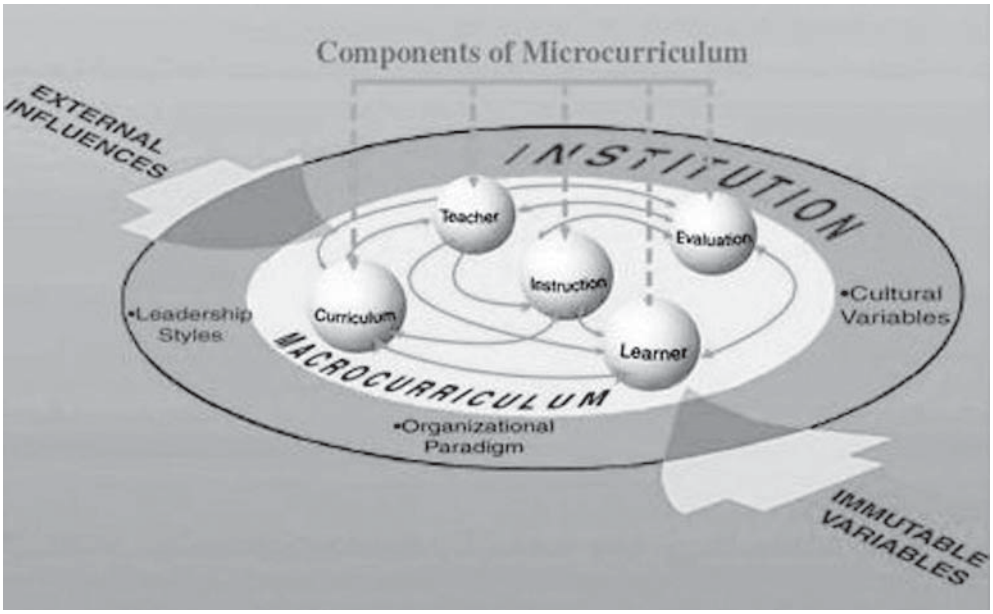

Figure 1. A multidimensional model for analyzing educational processes

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school program), and at the microcurriculum (classroom) level that can impact student learning. While a teacher's beliefs and capacity may be inferred or measured, the actual teaching behaviors can only be understood by observing classroom instruction.

Any subset of interactions within the system is influenced by interpersonal dynamics and by the perceived support or barriers of the organization.[4] Activities, behaviors, and interactions within each level can be observed, measured, or described. For example, an institution might assess the level of student competence as measured by national board scores without considering how mediating influences like the nature of instruction influenced the outcome.[4] Efforts that fall short of this are likely to result in an insufficient understanding of the dynamics of the curriculum or an inability to consider and see how context and values are reflected in how and what is taught in classrooms.[5]

Curriculum can be described as a purposeful or intentional plan that is designed to bring about a change in the learner's behavior or intended learning outcome.[4,6] All curricula, whether they consist of lesson plans, units, courses, modules, or programs, are comprised of the same basic elements: goals or objectives, content, learning experiences or activities, and evaluation. Curricula may vary according to the emphasis placed on one or more of these elements, the purposes to be served, or what decisions are made concerning the basic elements.[7] For example, a curriculum that prioritizes knowledge acquisition, memory, and scientific rationality will be quite different from one that emphasizes constructionism, diversity, and social justice. The curriculum that is taught by individual teachers or within particular subject areas represents one component within the microcurriculum. Other components of the microcurriculum including instruction, teaching, learning, and evaluation are described below.

Instruction refers to how curriculum is enacted during classroom teaching as depicted through methods used to deliver the curriculum and bring about desired outcomes. Instruction is provided through specific types of learning experiences that are auditory, visual, kinesthetic, asynchronous, or synchronous and in which the type of perceiving and processing skills are emphasized. The type of instruction provided can be observed.

Teaching refers to the skills, beliefs, and capacity (knowledge base, competence, and experience) that teachers demonstrate. Teaching can also be characterized by the quality and degree of organization that can be observed during instruction.

Learning refers to the behavior, belief, learning preferences, motivation, and capacity that a student demonstrates during instruction. Students' motivation patterns, ascribing their successes and failures to someone or something, self-efficacy beliefs, and achievement goal orientation influence their level of engagement, their perseverance, and their measured performance. The student's locus of control can also influence his or her perseverance or tenacity in completing a task.[8] Individuals with an internal locus of control tend to believe that outcomes are contingent upon their own behaviors. People with an external locus of control believe that their destiny rests in the hands of powerful others.[8]

Evaluation refers to processes used to judge the value (worth or merit), quality, utility, effectiveness, or significance of an object in relation to some defensible, clearly identifiable, and systematically applied criteria.[9] Evaluation strategies in this study consisted of analyzing documents such as course syllabi, capturing a historical perspective of the curriculum program, time observing classroom behaviors of instructors, and collaboration between the researchers.

The purpose of this case study was to illustrate how an evaluation strategy of two particular components of the model, *curriculum* and *instruction*, were used to assess a component of an institutional curriculum revision process and to determine if the goal of integrating content with oral health care and systemic health care was evident during classroom instruction.

Case Study

The dental school's curriculum committee authored a new educational philosophy that was adopted by the faculty in 1997. This philosophy is as follows: "The College of Dentistry's highest commitment is to academic excellence. The development of the competent graduate in the arts and science of dentistry is the cornerstone of our educational philosophy. It is paramount that the educational environment be humanistic and reflects the values of integrity, honesty, respect, fairness, and cooperation. It is equally important that faculty and staff develop, integrate, and facilitate effective and active learning. These efforts must result in graduates who possess and demonstrate knowledge and skills in the cognitive, psychomotor, and affective domains."

Of relevance to this case study is that the institution chose to focus on active learning as a core component to its educational philosophy. During a faculty retreat on curriculum revision of the doctor of dental medicine (D.M.D.) program in December 1998, the faculty discussed and adopted four proposed goals for curriculum revision. The college planned to: 1) integrate the basic, behavioral, and clinical sciences in order to achieve its educational mission; 2) teach contemporary dentistry as practiced by general dentists today and in the future; 3) develop a system of competency-based education and evaluation; and 4) lay the foundation for professional behavior that demonstrates the importance of lifelong learning.

The curriculum committee was charged to review the current curriculum and to critically assess which components should remain unchanged, be modified, be contemporized, or be deleted from the new curriculum. A biopsychosocial model of health and disease was adopted as the philosophical framework.[10] The biopsychosocial model addresses the dynamic equilibrium that the body attempts to maintain between the internal and external environments**.** As the new coursework was developed, the planning group was asked to ensure that course content provided the requisite knowledge base to make sound clinical judgments in the biology, etiology, epidemiology, and behavioral aspects of health and disease affecting the oral cavity. Each course director was required to create a syllabus that included course goals stating how course content would illustrate that there was a primary emphasis on the head and the neck region of the body and a secondary emphasis on the relationship of oral health to systemic health. A new integrated basic and behavioral sciences curriculum was implemented in the fall of 2000.

The institution used post-course summative measures such as student grades, course evaluations, debriefing sessions with faculty and students, and exit interviews to assess instruction. The college does not have a mandatory faculty peer observation and evaluation process. Therefore, it was difficult to determine if the educational mission, philosophy, and goals of the institutional curriculum revision had been achieved at the level of classroom instruction. The

purpose of this article is to describe how a formative evaluation process of instructional practices was used to assess the impact of the curriculum revision at the level of classroom instruction.

Methods

Permission to conduct this study was granted by the university Institutional Review Board (UFIRB #613-2002). From January through April of 2003, twelve faculty in medicine and three faculty in dentistry who taught in the first- and second-year basic science courses were observed by two of the authors. The goal was to observe teaching in a course a minimum of five times; thus, some instructors were observed more than once to meet this goal. The courses observed were physiology, biochemistry, pathology, and oral medicine. All courses were team taught by a group of faculty. A meeting with course directors was arranged prior to the observations to inform them of the study and after the completion of the study to share the findings. Faculty who were observed signed a letter of informed consent consistent with the requirements of the IRB, which communicated that the results of the observations may be published. The course syllabi were reviewed to assess the relationship of the stated course goals and course content to the methods of classroom instruction.

Goals for each class were stated in the syllabus. A description of the course goals for each class follows:

Physiology: The goal of this course was to provide an in-depth overview of the normal structure and function of body systems, which includes the cardiovascular, pulmonary, renal neurological, endocrine, and gastrointestinal systems. Both systemic health and disease of the body and the relationship of the biology of the whole body to that of the oral-facial complex will be emphasized.

Biochemistry: The goal of this course is to provide advanced knowledge concerning the cellular and molecular biology of the eukaryotic cell, along with selected aspects of biochemistry, in order for a modern dental student to better understand human physiology, nutrition, chemotherapeutics, and biotechnology. The purpose of this course is to provide fundamental information at an advanced level needed by the modern dental clinician both to appreciate the state of modern biology and to better understand the systemic health of his or her patient and the mechanisms of certain key drugs in common usage.

Pathology: The purpose of this course is to provide a general understanding of human pathology with particular emphasis on those conditions that affect dentistry. It is intended that the course provide the student of dentistry the language and understanding of disease processes necessary to communicate effectively with medical colleagues.

Oral Medicine: The goal of this course is to provide an understanding of how medical diseases and the associated medical therapy affect dental care. This course represents the major correlation between basic medicine, clinical care of the medically compromised patient, and modifications required for safe and effective dental treatment.

Unstructured observations were used to document the instructors' teaching behaviors. The purpose of the observations was to describe the activities or behaviors that took place in the setting. First-hand observations allow the inquirer to be open, discovery-oriented, and inductive because the observer has less need to rely on prior conceptualizations of classroom teaching. The observer also has an opportunity to discover things that no one else has really paid attention to and a chance to learn things that people would be unwilling to discuss in an interview.[11]

In qualitative fieldwork, the researcher has been said to be the "primary research instrument" since all data collected through observation and interview has been filtered through the researcher. Thus self-monitoring for bias is essential for objective reporting of data.[12,13] Two issues were considered to describe fully the limitations of the researcher as instrument: the researcher's degree of sophistication in data collection and aspects of personal biography that might contribute to bias.[14] As to questions of experience and sophistication in data collection, the first author has published a number of qualitative studies.

"Trustworthiness" is another word for validity and reliability but more often is used in qualitative work.[15] The rich, thick description that is used in telling the qualitative story is one way to establish validity. The reader can imagine the scene and can transfer the information to other settings.[12] Creswell discusses other verification procedures that were applied to this study: prolonged engagement in the field, triangulation of data, debriefing, negative case analysis, and member checks.[12] Prolonged engagement in the field refers to the time required to gain access and to build a productive, collaborative relationship with the informants.[16] It is unwise to return

to the field until the present set of data has been coded.[17] This limits "overlaying of observation" and allows for each field trip to benefit from the preceding ones. In planning this study, on-site observations were separated by enough time to adequately process the data already collected.

Researchers strengthen triangulation by choosing complementary sources of data, method, and theory that can be used as independent measures.[18] The triangulation process requires using multiple methods and sources for data collection and in analysis by comparing the information from multiple sources. In this study, observations, curriculum syllabi, and comparisons between the stated course goals and content with the methods of instruction were used. Other forms of verification are not as easily planned for, but opportunities to use them did arise during the study. Debriefing by a peer was an external check of the research process.[15] The first author benefited from defending decisions, interpretations, and meanings through a "devil's advocate" type of conversation with the second and third authors. As the data analysis proceeded to the development of themes and tentative findings, the researcher looked for negative case analysis, actively seeking "disconfirmation of what you think is true."[17]

This analysis process required the researcher to look at prior data, new data, and the research of others in an effort to disconfirm the emerging findings. The researcher weighed the proportion of disconfirming to confirming evidence before modifying any conclusions.[17]

Member checks or informant feedback occurred after the study with the course directors to verify the results of the analysis process. Informants were asked if they found the analysis consistent and explanatory. Confirmation or disagreements in response to the member check did contribute to the overall discussion of the data but did not become a part of the data.

In this study, behaviors related to the context of what the teacher said, asked, or directed students to do were recorded using running notes.[19] Each observation lasted an entire class session (minimum of fifty minutes). The observations were transcribed and reviewed by two of the authors. Data were analyzed inductively, guided by the scheme of domain analysis and by the constant comparative method.[20] During data analysis, the observers worked back and forth between the data and their own perspectives and understanding to make sense of the evidence.[21] Evidence and perspective brought to bear on the data need to be elucidated. Alternative interpretations were tried and tested against the data. An evaluator who has studied a program in the field and reflected at length about the patterns and themes that run through the data is in a good position to speculate about meanings of the data and to make conjectures about the significance of the evidence.[11]

Results

Four themes emerged from analysis of the dataset. The themes were categorized as: use of class time, relevance to oral health care, application of learning experiences, and emphasis on critical thinking. In the following section, evidence that supports each of the four thematic categories is presented.

Use of Class Time

In three of the observations, students were actively engaged while they responded to the professor's directions. In one class, the professor asked students to explain aloud what medications should be given for pain to a patient with a complex medical history and to determine if any of the patient's symptoms were caused by medications. In another class, students were also asked to explain how to treat a patient for pain if the patient develops resistance to a particular drug. Students were also asked to identify the harmful side effects of particular drugs and identify what systems would be most vulnerable.

However, the majority of observed class time instruction was characterized by a continuous dissemination of information without pause. Instructional time was not always used for teaching. Some classes ended early; one class began late. Another professor discussed non-instructional matters for 20 percent of the period. Three classes ended twenty-one to twenty-five minutes early. In another class, the professor used the first twenty minutes of the fifty-minute session to explain what was planned in his section of the course. Another class began twelve minutes into the fifty-minute period.

Across seventeen of the twenty classes, content information was presented didactically, delivered at a rapid pace and without pause. One example that typifies the observations is:

> "With the aid of overheads, the professor tells the students detailed metabolic biochemical information rapidly and without

pause. The overheads are difficult to read. There is a great deal of text and no indication of key points. Information presented in a table format is unreadable because the font is too small."

Relevance to Oral Health Care

Connections between the content and oral health were observed during only three of the twenty classes. For example, many professors made no connections between the structure and function of the endocrine organs and oral health, metabolic biochemical information and oral health, DNA structure, replication and repair, and oral health and oxygen transport and oral health care. Two examples follow:

"The professor talks about symptoms, histological evidence, diagnosis, treatment, and prognosis of respiratory diseases. The professor provides examples of patients with varying respiratory airway diseases, explains the patients' symptoms, and shows the histological manifestation of their disease. The professor offers no opportunities for students to relate the information to oral health care."

"The professor poses no questions to students about recombinant RNA and oral health care."

Application of Learning Experiences

Frequently students were not given any questions or asked to apply concepts to relevant problems. Throughout the observations it was also evident that students received insufficient wait time to respond to questions as the following example depicts.

Three illustrations follow:

"The professor does not ask questions while teaching. Additionally the professor provided no clinical examples that would help students link the structure and function of the pyramidal motor system and oral health care."

"The presentation of material focuses on the visual and symptomatic identification of valvular disease. The professor gives students the definition of relevant terms. Throughout the observation, information is disseminated without pause. The professor asks one question in which enough wait time to receive a response from student was not provided. Instruction is didactic. The professor does not pause and check for student comprehension. Students are given no opportunity to apply learning. As the professor talks, students sit and appear passive."

"In a session on the body's acid base equilibrium, the professor presents fact-based information without pause. The professor poses several questions to the students, but does not provide wait time for them to respond."

Media such as PowerPoint presentations are used in dental education and may impact the nature of learning experiences that are provided. Frequently, content was presented using media in a nondynamic way as the following three examples illustrate:

"Most of the information about the carbohydrate metabolism in a distributed system as it appears in the PowerPoint slides is dense, static, and nondynamic. Key points are difficult to identify."

"Media was used in a static way during a presentation on recombinant RNA material."

"The professor presents a lecture on recombinant RNA using a transparency; however, the writing is unreadable."

Emphasis on Critical Thinking

Evidence of emphasizing critical thinking skills was seen in three observations. In one class, the professor asked students whether or not the medical and dental problems were side effects of a medication. In this situation the professor required that students demonstrate higher-order thinking skills such as synthesis, reasoning, and evaluating information from different disciplines simultaneously. In another observation the professor modeled the way that a clinician would process information before examining a patient or making treatment decisions; the professor explained his thinking processes aloud as a model for the students. In one other class, the professor asked students questions that required justification:

"After presenting an overview of a patient-based case study, the professor asked questions that required students to think aloud about whether or not medical and dental problems might be side effects of the medications."

The use of questions or cases that required synthesis, reasoning, or evidence were not observed in the majority of classes. Case-based applications were used infrequently. A representative example follows:

"A didactic presentation on DNA structure, replication, and repair is observed. During the presentation the professor writes figures and text on a transparency on the lectern. The professor does not provide objectives, a summary, or a case-based application during today's presentation."

Faculty infrequently asked questions, and when questions were asked, they did not provide students with sufficient time to respond. Some instructors asked questions that required only a restatement of factual information. Three representative examples follow:

"Four times during the presentation the professor asks students to respond to questions that require fact-based response."

"During a didactic presentation on DNA structure, replication, and repair, the professor paused and asked students if they 'are all right'; however, the professor does not ask any questions."

"The professor asks only one question during class; however, without providing any wait time, the professor also answers the question."

Discussion

Classroom observations revealed that instruction was predominantly teacher-directed. The professor served as the subject expert. Teaching consisted of didactic methods, dissemination of facts and content, teacher talk, and little to no opportunity for students to demonstrate comprehension. Opportunities for students to think aloud, explain their conceptions, or alter misconceptions were infrequent. There was little emphasis on the application of basic science information to oral health. Learning experiences that fostered the ability to make associations among the content, treatment planning, and patient care were seen in only three observations. Although course goals were revised to meet the institutional expectations of the curriculum revision process, the predominant nature of instruction in these observed classes had not changed in ways that were necessary to achieve the college's curriculum revisions goals to integrate basic science content with oral health and patient care. Also, most of the observed instruction fell short of the aim of the school's educational philosophy of providing active and authentic learning experiences that require the learner to use the skills valued in the real world after graduation.[22]

Qualitative methods of inquiry were used in this study because they afford a level of insight that is not discernible through the strict use of quantitative methods.[1] However, it is important to point out the limitations of this study. The use of a purposeful sample may raise concerns about the validity of data and the representation of the larger population from which the sample was taken. Also, the observations and interpretations reported in this study represent only a portion of the instruction provided during the time of this study. Therefore, the findings should not be generalized to the overall curriculum, and we cannot make any assumptions about the quality of instruction that was not observed. Because this study was conducted at only one dental school, replication of the study methods at additional dental schools should be conducted to determine if these findings are generalizable.[1]

Whether dental education utilizes classroom instruction or problem-based learning (PBL), it is important to ensure that all teaching activities contribute to developing students' capacity for critical thinking skills. Evidence of active learning, whereby students were expected to reason aloud, respond to questions, and apply what they were learning to oral health, was seen during three of the twenty observations. Assessment of student comprehension was not observed. Professors infrequently asked questions about the material during instruction. Students often sat quietly throughout the class and took notes. As demonstrated by the observations, classroom instruction emphasized content delivery—the acquisition of factual and discrete information—in seventeen of the twenty observations.

Starting and ending class on time conveys an important message to students about professional-

ism and the professors' attitudes about the course. Rather than ending class early, professors could have used this time to help students actively apply the newly learned information by presenting problem-solving activities. Non-instructional information such as announcements or matters that do not pertain directly to the content or learning activity could be presented on the Web or through a handout. If class is going to end early, then students should be informed at the beginning of class that this will happen.

Rather than simply delivering content-based information without pause, professors should consider ways to promote students' ability to accommodate this information. For example, faculty could provide questions prior to the presentation that focus students' attention on particular aspects of the content; explain to students what they will be expected to know, do, or show at the end of the period; or check student comprehension during the class session by using an instructional strategy known as "the one-minute paper."[23] During a presentation, the instructor pauses and requests students to summarize in writing the main points presented so far, respond to a question, or apply a concept that they are learning. When the minute or other assigned time is up, the instructor may either collect the papers or break the class into pairs or subgroups to review and discuss one another's papers.

Each class session should provide an opportunity for students to learn actively. One instructor used class time to promote active and deep learning. In three classes, this professor questioned students frequently throughout the session and asked students to state reasons for their responses. Expectations for student outcomes were made explicit. The professor used frameworks that fostered student mastery in the acquisition of new knowledge. For example, the professor asked students questions that elicited their comprehension and an explanation to provide support for their reasoning.

One professor gave students an overview of a patient-based case study. To ensure that students understand the link between content-driven information and oral health, professors must provide explicit connections between material and oral health care. Taking time to portray the continuum of interactions between acid base equilibrium and oral health, for example, would be a more salient contribution. Using a patient-case scenario is one way to illustrate the relevance of material to oral health care. Web-based or real-time patient based-examples to illustrate relationships between content and patient care could be used to mitigate the emphasis on breadth of content delivery.

Students received no problem-solving learning experiences that could foster comprehension or develop fluency (the ability to express what they have been learning effortlessly and clearly) in relationship to oral health and patient care. Typically, professors did not ask students questions during class. When students were asked questions, either they weren't given sufficient time to respond, or the professor asked and answered his or her own question. The concept of providing wait time is an effective instructional practice. If students seem unable to respond to questions, instructors should provide cues that may elicit appropriate responses.

Professors can use several strategies to promote the development of critical thinking skills. They could explain aloud how a clinician would use this information during patient care; prepare a set of questions prior to the presentation that can be used to elicit student reasoning aloud; use examples drawn from patient-based scenarios; and explain aloud the relevance of the material to patient care. Professors can also ask students to speculate how a clinician would use content-based information to make decisions about treatment planning. Providing an exercise that requires application of the material before and/or following class may also help student comprehension. Additionally, this could create time for alternative methods of instruction during class time

These findings raise some important questions. Were the faculty aware of their own instructional practices? Did the professors believe that they were using best practices and strategies that supported learning? Were their instructional practices influenced by the expectation that all students would be prepared to pass the National Dental Board Examination?

Faculty can facilitate learning by making students explicitly aware of expected accomplishments as a result of their instruction, helping them see the relevance and connectivity of learning experiences to their work as a practitioner, and building their expertise and confidence. This must be a primary goal of classroom teaching. Careful planning prior to instruction is needed to ensure that students experience a deep rather than superficial approach to learning. Instructors need to consider teaching less fact-based information and teach in ways that cultivate learning how to learn. Deep learning occurs when students are given opportunities to learn the

conditions in which the information they are learning can be used.[24] In contrast to surface learning, deep learning requires an active search for understanding. Surface learning merely requires students to reproduce what they have learned.[24] For deep learning to occur, students must first develop mastery over the information, and then they need to understand when, where, and why to use the new information. Use of contrasting situations whereby students notice information that escaped their attention and learning what facts are relevant and irrelevant to particular biochemical principles is especially important to perceptual as well as conceptual learning.[23] Using context-rich clinical examples and patient scenarios that cause students to extrapolate what they are learning to patient care is one way to foster deep learning.

The findings in this study may also be significant in helping dental and medical educators recognize the ways that an emphasis on content affects learning and transfer. Teaching that "emphasizes [acquisition of the] breadth of knowledge may prevent [students from being able to effectively organize] knowledge because there is not enough time to learn anything in depth."[25] The kind and amount of learning are likely to influence the development of expertise.[23,25] Balancing the delivery of general principles, using examples that promote active learning and problem-solving, and providing learning experiences that correspond to students' preferred and least preferred learning types are more likely to promote the development of expertise than a singular emphasis on information delivery. The findings support the concerns raised by Bertolami who suggested that there is disjunction between what dental schools teach and how they teach it.[26] An expectation among dental school faculty that learning primarily involves rote memorization and teaching that involves telling cannot provide students with an intellectual challenge.[24]

We cannot account for how teacher or student beliefs and learning experiences or other factors may have impacted the instructional practices that we observed. However, the findings in this study do point out that although changes can be made to the written curriculum, instructional changes may not always follow. Writing changes into a statement of philosophy or articulating a revised institutional vision does not always result in changes to instructional practice. Formative evaluation, communication about the need for change in instructional practice, and professional development must occur simultaneously to ensure that envisioned changes do occur.

Assessing actual teaching practice offers significant opportunities to address the imperative for changes in approaches to instruction in the dental curriculum. This process is important for helping individuals reflect about how they think they teach, fostering self-awareness, and ultimately leading to changes in instructional practices that support student learning. Also, it is important to bear in mind that just because you are an expert of some kind or other doesn't mean you know how to teach it.[22] Perhaps additional studies grounded in the science of learning can contribute to this evidence base in teaching and learning.

Dental faculties are experiencing a new generation of student learners. Instructors are expected to meet the needs of a diverse student body that no longer accepts all faculty methods without question. This college is not very different from other dental schools in that it endorses good basic instructional practices. The findings call attention to the need to raise faculty awareness about acquiring evidence-based educational skills; aligning instruction with course goals and objectives; formatively assessing teaching; and providing learning experiences that promote active learning and critical thinking. Using peer observation may be a first step toward initiating an institutionally supported practice of examining instructional practices formatively. In a field in which research has been dominated by empirical and summative methods, helping faculty appreciate the need for this type of study is essential for conversation to begin. Thus efforts should be directed at raising awareness about the need to assess teaching practices formatively and the importance of discussing the findings.

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REFERENCES

1. Behar-Horenstein LS, Dolan TA, Courts FJ, Mitchell GS. Cultivating critical thinking skills in the clinical learning environment. J Dent Educ 2000;64(8):610-5.

2. Behar-Horenstein LS, Mitchell GS, Dolan TA. A multidimensional model for analyzing educational processes. Int J Leadership Educ 2004;7:165-80.
3. Gendrop SC, Eisenhauer LA. A transactional perspective on critical thinking. Sch Inq Nurs Pract: Internat J 1996;10:334-41.
4. Johnson M. Definitions and models in curriculum theory. Educ Theory 1967;17:127-40.
5. Ornstein AC, Hunkins FP. Curriculum: foundations, principals and theory. 3rd ed. Boston: Allyn & Bacon, 2002.
6. Fox W, Gay G. Integrating multicultural and curriculum principles in teacher education. Peabody J Educ 1995; 70(3):64-82.
7. Taba H. Curriculum development: theory and practice. New York: Harcourt, Brace & World, 1962.
8. Rotter JB. Generalized expectations for internal versus external control of reinforcement. Psycholog Monographs 1966;80:609.
9. Fitzpatrick JL, Sanders JR, Worthen BR. Program evaluation: alternative approaches and practical guidelines. New York: Longman, 2003.
10. Engel G. The need for a new medical model: a challenge for biomedicine. Science 1996;4286: 129-36.
11. Patton MQ. Qualitative research and evaluation research. Thousand Oaks, CA: Sage, 2002.
12. Creswell JW. Qualitative inquiry and research design: choosing among five traditions. Thousand Oaks, CA: Sage Publications, 1997.
13. Mason J. Qualitative researching. London: Sage Publications, 1996.
14. Locke LF, Spirduso WW, Silverman SJ. Proposals that work. London: Sage Publications, 1993.
15. Lincoln YS, Guba EE. Research, evaluation, and policy analysis: heuristics for disciplined inquiry. ERIC Document Reproduction Service No ED 252 966. Kansas, 1985.
16. Kirk J, Miller ML. Reliability and validity in qualitative research. Newbury Park, CA: Sage Publications, 1986.
17. Miles MB, Huberman AM. Qualitative data analysis. London: Sage Publications, 1994.
18. Dinzen NK. Sociological methodologies: a source book. New York: McGraw Hill, 1978.
19. Bogdan RC, Bilken SK. Foundations of qualitative research in education: an introduction to theory and methods. Needham Heights, MA: Allyn and Bacon, 1988.
20. Spradley JP. Participant observation. New York: Holt, 1980.
21. Glaser BG, Strauss AL. The discovery of grounded theory: strategies for qualitative research. Chicago: Aldine, 1967.
22. Barrows H. Response to the problem with problem-based medical education: promises not kept by R.H. Glenk. Biochem Molecular Biol Educ 2003;31(4):255-6.
23. McKeachie W. Teaching tips: strategies, research, and theory for college and university teachers. Boston: Houghton Mifflin, 2002.
24. Spencer JA, Jordan RK. Learner centred approaches in medical education. Br Med J 1999;318:1280-3.
25. Bransford JD, Brown AL, Cocking RR, eds. How people learn: brain, mind, experience, and school. Washington, DC: National Academies Press, 2000:49.
26. Bertolami CN. Rationalizing the dental curriculum in light of current disease prevalence and patient demands for treatment: form vs. content. J Dent Educ 2001;65:725-35.