

# An Interdisciplinary Approach to Case-Based Teaching: Does It Create Patient-Centered and Culturally Sensitive Providers?

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*Abstract:* This investigation explored whether teaching a case-based seminar influenced dental students' perceptions of the importance of various factors for diagnosis and treatment planning. In addition, the effects of an interdisciplinary approach to case-based teaching were analyzed. During the winter semesters 2004 and 2005, 204 second-year dental students participated in a case-based comprehensive care seminar. The students were randomly assigned either to a section with a behavioral science instructor present or to a section without a behavioral science instructor. At the beginning and end of each semester, the students evaluated the importance of various factors for diagnosis and treatment planning in self-administered questionnaires. This seminar increased students' importance ratings of subjective oral health-related factors (such as dental fear) and diversity-related factors (such as the patient's ethnicity/race) from the beginning to the end of the semester. Students in the section with a behavioral science instructor rated the importance of behavioral and diversity-related factors higher than students in the section without the behavioral science instructor. These findings suggest that interdisciplinary, case-based teaching increased students' appreciation of the complexity of patient care and of a patient-centered, culturally sensitive approach to diagnosis and treatment planning.

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Case-based teaching has a long tradition in medicine,<sup>1,2</sup> nursing,<sup>2</sup> dentistry,<sup>3-5</sup> and dental hygiene<sup>6</sup> programs. Case-based learning has been described in the dental literature as an important method of distilling the basic knowledge learned in texts and lectures and applying it to a patient.<sup>7</sup> Although problem-based learning and case-based learning share common goals and are often described as similar entities, these approaches are actually different techniques that have unique characteristics. In problem-based learning, the problem drives the learning. In some instances, the problem-based approach dominates the educational process from the beginning to the end of a student's professional education. Case-based learning, on the other hand, can take many forms. At its most basic, instructors may use a clinical case to raise awareness about a specific issue, dramatize the importance of a particular health problem or treatment strategy, or introduce a topic.

At the other end of the spectrum, students can document their clinical care of a patient and present it to other students and clinicians in case-based comprehensive care seminars. In this latter situation, the case-based format requires students to recall previously learned material to treat a patient and then present the patient's treatment process.<sup>8</sup> Case-based learning can thus range from being more or less instructor-driven to being a student-directed way of learning. However, the ultimate goal of case-based learning is to educate students in a way that encourages them to consider the complete scope of a patient's situation when planning and providing treatment. The advantages of the case-based method are the promotion of self-directed learning, clinical reasoning, clinical problem-solving, and decision making by providing repeated experiences in class with a collegial infrastructure<sup>5</sup> and by focusing the student on the complexity of clinical care.

This focus on the complexity of oral health care can ultimately serve several of the recommendations of the Institute of Medicine report on the future of dental education.<sup>9,10</sup> This report stressed the importance of educating patient-centered providers who are culturally sensitive and value interdisciplinary considerations.

Analyzing a complex set of information about patients, including considering patients' chief complaints and expressed concerns and their medical and dental histories, as well as objective data such as the radiographs and periodontal charts, allows a provider to come up with a list of problems that need to be addressed and treatment plans that serve the patients' complex needs. In this sense, a case-based approach challenges a student to consider the patient as a person, to be sensitive to the role of cultural factors, and to reflect on a set of factors that are connected with scientific knowledge presented by various disciplines. These themes of providing patient-centered care that is culturally sensitive and has an interdisciplinary focus were also reiterated in the U.S. surgeon general's report on oral health published in 2000.<sup>11,12</sup>

While there is some face validity in the statement that case-based teaching can result in more patient-centered, culturally sensitive providers who value interdisciplinary considerations, an empirical test of this hypothesis has not yet been conducted. The objective of this study, therefore, was to determine if students who participated in a semester-long case-based seminar changed their ratings of the importance of a) patient-centered factors, b) culturally relevant factors, and c) interdisciplinary considerations from the beginning to the end of the semester.

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## Key Features of the Case-Based Comprehensive Treatment Planning Seminar

It is important to acknowledge the fact that even experienced clinicians do not always agree on every treatment plan.<sup>4</sup> However, clinicians develop reasoning processes that allow them to be more efficient and more accurate in diagnosis and treatment planning as they progress from being merely novices to experts.<sup>13</sup> Crespo et al.<sup>13</sup> demonstrated that expert dentists utilized reasoning skills that were qualitatively different from those of beginner and compe-

tent clinicians. These authors also proposed that the steps taken to reach clinical decisions could be explicitly taught. They concluded that the students' clinical experience could be enhanced by exposing them to a wider variety of patients with strategies such as case-based learning and clinical simulations to supplement their direct contact with patients.<sup>13</sup> The benefits of utilizing case-based scenarios to develop students' understanding of the inherent processes of clinical decision making may be particularly useful for novice students as they prepare to meet the needs of patients through collection of diagnostic data and interpretation of such data before the commencement of actual treatment.<sup>14</sup>

Based on these considerations, a comprehensive care treatment planning seminar was developed for second-year dental students during the winter semester. This seminar consisted of twelve, fifty-minute classes taught between January and April. This course was modeled after already existing seminars for third- and fourth-year dental students in which the students presented their own patient cases. However, instead of presenting their own treated patients, the second-year students were provided patient scenarios (simulated cases) at the course website. The students' assignment was to present their analyses of these simulated patients as if they were their own patients in the clinic. In this way, the seminar was designed to complement students' didactic preparation for treatment planning and ease their transition into regular patient care. The patient scenarios were quite detailed and were provided to the students on a secure website. Groups of five students were assigned every week to analyze and present one case to classmates and faculty. In each of the classes, the student presentations were limited to the first fifteen to twenty minutes of class, followed by a class discussion (fifteen to twenty minutes long) and a case summary presentation by the clinical faculty member (ten to fifteen minutes). During this last part of the class, the course director who was familiar with all example cases emphasized some of the important, unique, pertinent features of each case, summarized how the actual treatment of the patient proceeded, and provided long-term follow-up dental care outcomes. In addition to this comprehensive care seminar experience, the second-year students were also invited to join the weekly comprehensive care seminars in which the third- and fourth-year students presented their own patient cases.

Based on prior research concerning the outcomes of case-based teaching, the hypothesis was

that the students' ratings of the importance of various types of information for developing a problem list and for treatment planning would change in a positive direction from the beginning to the end of the semester. Specifically, it was expected that the importance ratings of patient-centered factors (such as the patients' expectations, prior dental experiences, and dental fear) and factors concerning the patients' cultural background (such as their ethnicity/race, socioeconomic status, and social influences) would be higher at the end of the semester compared to the beginning of the semester.

One additional major challenge was to explore how the students could increase their awareness concerning the importance of interdisciplinary considerations for diagnosis and treatment planning. There is some evidence demonstrating that interdisciplinary teaching prepares students for higher order cognitive skills such as problem-solving and critical thinking better than a traditional teaching approach<sup>15,16</sup> and increases their tolerance for ambiguity and enhances their listening skills when compared with discipline-based instruction.<sup>17</sup> Studies of interdisciplinary dental courses taught in the United States<sup>14</sup> and elsewhere<sup>18</sup> also point to the educational benefits of interdisciplinary teaching. In particular, treatment planning may be most effectively taught using an interdisciplinary approach and not merely within the confines of specialty departments.<sup>18</sup> In addition, interdisciplinarity may promote learning by engaging students' prior knowledge and experience, encouraging more effective thinking, developing multiple perspectives, and motivating students toward the goal of learning.<sup>15</sup> Some advantages of interdisciplinary treatment planning seminars might be that the students may benefit from being exposed to different perspectives, which may result in achieving a higher level of integration and application of knowledge during the treatment planning process.<sup>19</sup>

Considering these research findings concerning the role of interdisciplinary teaching in the face of both the recommendations of the Institute of Medicine report on the future of dental education<sup>9</sup> and the call for increased collaborations of oral care providers with other health care fields by the U.S. surgeon general,<sup>11</sup> it seemed worthwhile to investigate the role of interdisciplinary teaching on the development of more patient-centered, culturally sensitive providers who value interdisciplinary considerations. The students were assigned by the school administration to two separate comprehensive care treatment planning seminar class sections based on their laboratory and

clinical assignments. While this procedure did not allow a random assignment of the students to the two sections of the seminar, it was nevertheless possible to conduct a quasi-experiment<sup>20</sup> by teaching the first section in an interdisciplinary way and the second section in the traditional manner. A behavioral science instructor attended all but two classes in the first year the study was conducted and all but one class during the second year this seminar was taught with this intervention. She did not make a presentation after the case and did not comment in a systematic way on each case. Instead, she raised questions that the presenters of the case then addressed. The clinical faculty member collaborated with her on discussing these issues to ensure that the students saw the clinical relevance of the points made. However, the behavioral scientist did not attend any of the classes taught for the students in the second section. It was expected that the participation of a behavioral scientist would increase the students' considerations of patient-centered, culturally sensitive factors and challenge them to focus on interdisciplinary considerations.

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## Methods and Materials

This study was approved by the Institutional Review Board (IRB) for the Health Sciences at the University of Michigan, Ann Arbor, MI.

During the winter semesters 2004 and 2005, 214 second-year dental students participated in a case-based comprehensive care seminar. A total of 204 students (104 in 2004 and 100 in 2005) gave written consent to have their data included in the research. Exactly 50 percent of these students were assigned to the first section of the class (with the behavioral science instructor present), while the remaining students were assigned to the second section by the school administration. Ninety-five of the respondents were female, 101 were male, and eight students did not indicate their gender on the survey.

At the end of the first regularly scheduled class of the winter semesters 2004 and 2005, the course director explained to the students that he wanted to assess the learning outcomes by comparing their responses to a survey both at the beginning and end of the semester. In addition, he informed them that their open-ended responses at the end of each class would also be included in this educational research project—if they gave their written consent. The students then received the written consent form and were

asked to indicate on the form if they agreed or disagreed to have their data included in the research study, sign and date it, and return it to the instructor. The beginning of the semester (pre-course) survey was then distributed and completed by the students. At the end of each case-based seminar, the students submitted short essay responses to describe what they had learned in the class and identify any questions they wanted to have answered. At the end of the last class in each of the two years studied, the instructor distributed the end of the semester survey. The responses for both years were merged using only the students' honor codes for identification. Once the data were merged, all identifying information was removed from the data files.

The surveys administered at the beginning and end of the semester consisted of two separate sets of questions that asked the students to rate the importance of twenty types of patient information (see Table 1 for the wording of these items). First, the students were asked to indicate how important each of these factors was for developing a problem list. Second, the students rated each of the factors again for how important they were for treatment planning. The students rated these factors using a scale rang-

ing from 1=not at all important to 5=very important. To group the twenty items according to their content, a factor analysis (Extraction method: Principal Component Analysis; Rotation method: Varimax Rotation) was conducted to analyze the students' ratings of importance at the beginning of the semester. Factor analysis is a multivariate statistical method used for the analysis of tables, or matrices, of correlation coefficients. It is used to discover the underlying structure in a set of variables by reducing this larger number of variables to more basic variables called factors.<sup>21</sup> As can be seen in Table 1, in this study the twenty items loaded on five factors. Factor 1 was named "Oral Health-Related Matters, Subjective." The items "Dental History, Prior Treatment," "Dental History, Past Experiences," "Oral Health Behavior," "Oral Health Beliefs," "Dental Fear," and "Patient Expectations" loaded on this first factor. Factor 2 was named "Objective Oral Health Indicators." The four items "X-rays," "Clinical Photos," "Periodontal Chart," and "Oral Exam" loaded on this second factor. The three items "Medical History," "Mental Health Status," and "Medications" loaded on a third factor named "General Health Issues." Factor 4 was given the name "Lifestyle Matters."

**Table 1. Factor loadings of the importance ratings of various factors for treatment planning (beginning of semester)**

	Factor 1 Oral Health, Subjective	Factor 2 Oral Health, Objective	Factor 3 General Health	Factor 4 Lifestyle	Factor 5 Diversity
Medical history	.115	.282	<b>.794</b>	.005	.025
Mental health status	.162	-.051	<b>.786</b>	.222	.203
Medications	.326	.212	<b>.686</b>	.213	-.086
Dental history, prior treatment	<b>.641</b>	.285	.249	.123	-.002
Dental history, past experiences	<b>.730</b>	.263	.273	.133	.121
Health behavior	<b>.629</b>	.053	.336	.443	.068
Health beliefs	<b>.617</b>	.053	.370	.440	.174
Dental fear	<b>.645</b>	.172	.280	.121	.293
Patient expectations	<b>.656</b>	-.031	-.104	.040	.386
Smoking	.133	.154	.276	<b>.784</b>	.200
Alcohol consumption	.221	.183	.404	<b>.633</b>	.254
Sugar/caffeine consumption	.137	.313	.067	<b>.819</b>	.077
Values concernng oral health	.466	.062	-.165	<b>.523</b>	.196
Ethnic/racial background	.224	.134	.427	.225	<b>.620</b>
Socioeconomic situation	.251	.104	-.078	.109	<b>.752</b>
Social influences	.092	.108	.117	.182	<b>.818</b>
X-rays	.004	<b>.856</b>	.079	.144	.089
Clinical photos	.186	<b>.599</b>	.212	.110	.226
Periodontal chart	.250	<b>.863</b>	.079	.114	.059
Oral exam	.094	<b>.871</b>	.089	.177	.014

\*Factor loadings of .40 and above are bolded. The answers to the items that loaded .40 and above on a factor were used to create the indices used in these analyses.

The items “Smoking,” “Alcohol Consumption,” “Sugar/Caffeine Consumption,” and “Values Concerning Oral Health” loaded on this factor. Finally, the three items “Ethnic/Racial Background,” “Socioeconomic Situation,” and “Social Influences” loaded on the fifth factor named “Diversity-Related Issues.” For the purpose of the analyses, the responses to the items loading on each of the five factors were averaged for the answers concerning drawing up a problem list and treatment planning for the beginning and the end of the semester, respectively.

Repeated measurement analyses of variance were conducted with the independent variables “Time” (beginning vs. end of semester) and “Interdisciplinarity of section” (yes vs. no) and the dependent variables average scores of the importance ratings in each of the five categories of factors considered.

## Results

The first aim was to explore whether the students would change their importance ratings of various types of information needed for developing a problem list (diagnosis) and treatment planning from the beginning to the end of the semester. Specifically, it was expected that the students’ ratings of patient-centered and culturally relevant information would increase both during their considerations of factors for drawing up a problem list as well as planning a treatment. As can be seen in Table 2, this hypothesis was supported by the data. The average

importance ratings of factors for diagnosing problems increased significantly as predicted for the patient-centered and culturally relevant factors. On a scale from 1=not at all important to 5=very important, the average importance ratings of the six oral health-related subjective factors (“Dental History, Prior Treatment,” “Dental History, Past Experiences,” “Oral Health Behavior,” “Oral Health Beliefs,” “Dental Fear,” and “Patient Expectations”) increased from 4.12 at the beginning of the semester to 4.26 at the end of the semester ( $p=.010$ ). The average importance ratings of the three items concerning cultural factors (“Ethnic/Racial Background,” “Socioeconomic Situation,” and “Social Influences”) also increased from the beginning of the semester to the end of the semester (3.30 vs. 3.59;  $p=.000$ ). In addition, the average importance rating of the four lifestyle-related items (“Smoking,” “Alcohol Consumption,” “Sugar/Caffeine Consumption,” and “Values Concerning Oral Health”) also increased from the beginning to the end of semester, and this change in the mean approached significance. (4.08 vs. 4.17;  $p=.055$ ). “Smoking,” “Alcohol Consumption,” and “Sugar/Caffeine Consumption” are behaviors, and “Values Concerning Oral Health” is a motivational factor. An increase in the importance rating of this lifestyle index therefore supported the general hypothesis that case-based teaching would lead to an increase in the importance of patient-centered considerations.

The second part of Table 2 presents the average importance ratings of the information considered for treatment planning. The results showed that the average importance ratings of the six items of the “Oral Health-Related, Subjective Factors” index increased from 4.19 at the beginning of the semester to 4.30 at the end of the semester ( $p=.037$ ), and the average ratings of the four items of the “Lifestyle” index increased from 4.11 to 4.22 ( $p=.025$ ). However, while the average importance rating of the three items of the “Diversity” index increased from 3.59 to 3.69 over the semester, this increase was not significant ( $p=.109$ ).

The second aim was to test whether the presence of a behavioral science instructor in the case-based seminar would increase the students’ importance ratings of patient-centered and culturally relevant information.

**Table 2. Average importance of factors for diagnosis and treatment planning at the end of the first and last classes of the semester**

	Beginning of Semester	End of Semester	p
<b>Importance of Factors for Diagnosing Problems</b>			
General Health	4.49	4.51	.616
Oral Health, Objective Factors	4.46	4.29	.072
Oral Health, Subjective Factors	4.12	4.26	.010
Lifestyle	4.08	4.17	.055
Diversity	3.30	3.59	.000
<b>Importance of Factors for Treatment Planning</b>			
General Health	4.40	4.45	.332
Oral Health, Objective Factors	4.33	4.37	.574
Oral Health, Subjective Factors	4.19	4.30	.037
Lifestyle	4.11	4.22	.025
Diversity	3.59	3.69	.109

Concerning the importance ratings of information for diagnosing problems, the results showed that the students in the section with a behavioral science instructor rated the importance of lifestyle-related factors and of diversity-related factors higher than the students in the section without a behavioral science instructor (4.20 vs. 4.04,  $p=.044$ ; 3.56 vs. 3.34,  $p=.041$ ) (see Table 3). In addition, the students in the section with the behavioral science instructor also rated the importance of the four items (“X-rays,” “Clinical Photos,” “Periodontal Chart,” and “Oral Exam”) of the “Oral Health, Objective Factors” index as higher than the students in the section without a behavioral science instructor (4.46 vs. 4.29,  $p=.020$ ).

A comparison of the importance ratings of information for treatment planning showed similar results. Again, the students in the section with a behavioral science instructor rated the average importance of the four items related to the patients’ lifestyle and the three items related to the patients’ cultural background as more important than the students in the section without a behavioral science instructor (4.25 vs. 4.07,  $p=.035$ ; 3.77 vs. 3.51,  $p=.035$ ). In addition, the students in the section with the behavioral science instructor rated the importance of the three items concerning general health-related information (“Medical History,” “Mental Health Status,” “Medication”) and the four items concerning objective oral health factors (“X-rays,” “Clinical Photos,” “Periodontal Chart,” and “Oral Exam” of the “Oral Health, Objective Factors”) as more important than the students in the section without a behavioral science instructor (4.51 vs. 4.34,  $p=.036$ ; 4.46 vs. 4.24,  $p=.005$ ).

In addition to analyzing the importance ratings in the surveys presented at the beginning and end of the semester, data were also available from the students’ open-ended responses at the end of each case-based seminar. These open-ended responses were coded by a rater who was blind to whether a student was in the section with the behavioral science instructor or in the section without the behavioral science instructor. The rater was instructed to give one point for each comment/question that related to a psychological, social, cultural, or lifestyle-related subject provided on a long list of relevant issues. Examples of such issues would be dental fear and

health-related behavior such as brushing, flossing, smoking, or alcohol consumption. The results of a *t*-test for independent samples showed that the students in the section with the behavioral science instructor wrote on average 6.52 patient-centered or culture-related remarks during the twelve-week course, while the students in the other section wrote on average 5.07 remarks during the course ( $p=.022$ ). This result demonstrates that the students who were taught in an interdisciplinary fashion wrote more comments about patient-centered and culturally sensitive issues than the students who were taught without the presence of a behavioral science instructor in the classroom. It could be conjectured that students in the “behavioral” section were thinking about these issues more than their peers in the other section.

## Discussion

While it is accepted that case-based learning may not be as useful as extensive clinical experience, it is a worthwhile approach for developing diagnostic skills and clinical judgment.<sup>5,7</sup> Case-based seminars are commonly used in postdoctoral dental education because these programs typically emphasize more individualized instruction, have fewer students, and utilize a less demanding evaluation system than predoctoral programs.<sup>5</sup> However, the results of this study also support the use of case-based teaching in predoctoral dental programs. Due to time limi-

**Table 3. Average importance of factors for diagnosis and treatment planning for students taught with a behavioral scientist vs. without a behavioral scientist**

	Section: With Behav. Science Instructor	Section: No Behav. Science Instructor	p
<b>Importance of Factors for Diagnosing Problems</b>			
General Health	4.54	4.46	.208
Oral Health, Objective Factors	4.46	4.29	.020
Oral Health, Subjective Factors	4.24	4.15	.227
Lifestyle	4.20	4.04	.044
Diversity	3.56	3.34	.041
<b>Importance of Factors for Treatment Planning</b>			
General Health	4.51	4.34	.036
Oral Health, Objective Factors	4.46	4.24	.005
Oral Health, Subjective Factors	4.31	4.18	.156
Lifestyle	4.25	4.07	.035
Diversity	3.77	3.51	.035

tations of undergraduate dental curricula, predoctoral students can be exposed to only a small sampling of the entire spectrum of clinical problems. Case-based learning may serve to counteract some of these educational limitations.<sup>4</sup>

The findings of this research more specifically point to the potential of case-based teaching for educating dental students in such a way that they become more focused on patients in their whole complexity and on the role that cultural background factors may play when diagnosing a patient's problem and planning a patient's treatment. A comparison of the students' importance ratings at the beginning and end of a semester-long case-based seminar showed that the students increased their appreciation of oral health-related subjective factors as well as of lifestyle and diversity-related factors (see Table 2). The students at the end of the semester still valued general health-related issues (such as the patients' medical history, mental health status, and medications) as most important, followed by objective oral health-related factors (such as X-rays, oral exam data, periodontal chart data, and clinical photos) for both diagnosing patients' problems (on a 5-point scale: 4.51; 4.29) and planning treatments (4.45; 4.37). However, the students' ratings of subjective oral health-related factors increased significantly to 4.26 for diagnosis and 4.30 for treatment planning, and these ratings approached those for the objective oral health-related factors. These data provide support for the hypothesis that case-based teaching can shape students' thinking in a way that they become more patient-centered and culturally sensitive.

The results concerning the effect of teaching with a behavioral science instructor present showed the power of interdisciplinary instruction (see Table 3). The students in the section with the behavioral science instructor not only rated the importance of patient-oriented factors such as lifestyle-related information and information about the patients' cultural background as more important than the students in the section without a behavioral science instructor, but they also increased their appreciation of general health-related factors for treatment planning and of objective oral health-related factors for diagnosing a patient's problem and planning a treatment. These findings suggest that students who were taught in an interdisciplinary fashion developed a stronger appreciation of the complexity of factors that affect clinical decision making than students who did not have the benefit of this interdisciplinary instruction.

It should be noted that interdisciplinary teaching may require additional financial resources. In fact, in the study reported here, the behavioral science instructor participated in the seminars voluntarily due to her interest in the material covered. However, the investment of resources in such efforts may be worthwhile if the students gain a stronger appreciation of the complexity of clinical decision making and patient care. Implementing the recommendations of the Institute of Medicine report on the future of dental education<sup>9,10</sup> may be challenging. However, teaching case-based seminars in an interdisciplinary fashion may be one approach to aim dental education in the direction advised in this report. The report of the U.S. surgeon general on oral health<sup>11,12</sup> should be a wake-up call to all dental educators to rethink the discipline-based approach to dental education. The results from our research suggest that interdisciplinary teaching of case-based seminars may shape future providers' values and thinking in a way that will ultimately address the challenges<sup>22</sup> that the dental profession faces.

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