

Effects of a Case-Based Discussion on Educational Outcomes in Dental Students

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THESIS

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DEDICATION

This thesis is dedicated to my amazing mother. As an educator herself, she inspires me to never stop learning. Thank you for shaping me into the person I am today.

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LIST OF ABBREVIATIONS

ADEA: American Dental Education Association

ADEA CCI: American Dental Education Association Commission on Change and Innovation

BEME: Best Evidence Medical Education

CBL: Case-based learning

HSDM: Harvard School of Dental Medicine

IOM: Institute of Medicine

NBDE: National Board Dental Examinations

PBL: Problem-based learning

TBL: Team-based learning

UIC COD: University of Illinois at Chicago College of Dentistry

USC: University of Southern California

SUMMARY

Dental schools throughout the country have recently begun to shift their curricula to include active approaches to learning, such as case-based discussions, in an effort to help students develop critical-thinking and problem-solving skills. The aim of this study was to determine the effects of a case-based discussion on knowledge, preferences, and self-confidence in second-year dental students in a pediatric dentistry course. Using a crossover design, students participated in a case-based discussion either before or after lectures on stainless steel crowns and pulp therapy. For a control unit on space maintenance, no case-based discussion was held. Students took quizzes a week after the lectures and surveys on their experiences.

This study found that students performed better on a quiz when participating in a case-based discussion after the lecture (mean score after=6.1 vs. before=5.5, $F=8.68$, 1df, $p=0.005$). Improvements in quiz scores were not associated with a case discussion. Students preferred having the case after the lecture (70% vs. 30%, $X^2 = 7.68$, 1df, $p= 0.01$) and felt more confident when the case was held after the lecture (12.7 vs. 11.6, $F=5.6$, 1,86 df, $P=0.02$).

The findings from this novel study regarding the timing of case-based discussions with lectures are consistent with students scoring higher on quizzes when a case discussion was held after, instead of before, a lecture. However, we found no evidence that a case-based discussion compared to a lecture alone was related to higher quiz scores. These findings may not be consistent across content and lesson structures, and further research is needed to understand how all the elements of a learning situation are integrated to produce maximum learning. The study also revealed that students felt more confident about, and preferred sessions when a case discussion occurred after the lecture

I. INTRODUCTION

A. Background

Throughout the past several decades, educators in the U.S. have become focused on improving dental schools' curricula. For almost a century, dental education was largely lecture-based, and learning took place in a passive environment. A 1995 report by the Institute of Medicine (IOM), *Dental Education at the Crossroads: Challenges and Change*, stated that dental education should "shift more curriculum hours from lectures to guided seminars and other active learning strategies that develop critical thinking and problem-solving skills."¹ In order to address the problems outlined by this report, the American Dental Education Association created a Commission on Change and Innovation in Dental Education (ADEA CCI). One publication from the ADEA CCI outlined educational strategies to address a means to shift from a passive to an active learning environment. Among other strategies, the ADEA CCI suggested: "analyzing problems, or reviewing cases that provide opportunities to apply the information being communicated."² Educators at dental schools throughout the country, including at the University of Illinois of Chicago College of Dentistry (UIC COD), have been shifting their curricula to align with these recommendations.

The traditional pedagogical approach to education in the health professions is a professor delivering a lecture to a large group of students for several hours at a time. However, this method of learning may not foster the critical thinking skills essential to creating a competent and forward-thinking dentist. Moreover, the average student's attention span is much less than the average dental school lecture length. Students frequently have lapses in attention during a passive didactic session.³ With an active approach to learning, students may become more engaged and glean a greater understanding of the information compared to those in a passive lecture environment.⁴

Students have become accustomed to learning within this traditional, lecture-based format. Thus, rather than take lectures away completely, this study explores the possible benefits of adding a case-based discussion to supplement the traditional lecture. Case-based discussions may be added either before or after a lecture. To date, no published studies have investigated the timing of case-based discussions in relation to lectures. One possibility is that a case-based discussion may serve as an introduction to material to be presented in a lecture, to stimulate thinking about the topic and prime students to be more engaged during the lecture. However, holding a discussion after a lecture could also potentially serve to reinforce concepts from the didactic session and better allow students to process information.

B. Specific Aims

This study assessed the impact of case-based discussions either before or after a lecture on a given topic in pediatric dentistry, using a randomized, crossover design. Knowledge on a subject area was assessed with a quiz, and self-confidence and student preferences were assessed with participant surveys.

C. Hypotheses

This study investigated the hypothesis that a case-based discussion, along with a lecture, improved second year dental students' performance on a quiz on specific topics in pediatric dentistry.

The study also explored whether conducting the case before the lecture, as an introduction to unfamiliar material, or after a didactic session, as a reinforcement of new material, was more effective for learning.

Furthermore, this study surveyed dental students' attitudes and confidence levels about each topic, after being exposed to the following conditions:

- 1) a case-based discussion before a lecture
- 2) a case-based discussion after a lecture
- 3) lecture only (no case-based discussion).

2. LITERATURE REVIEW

A. History of Dental Education

According to a summary of the history of dental education in the Crossroads report, the earliest roots of dental education lie in ancient times.¹ The first known dental text dates back to 5,000 years ago – a Sumerian clay tablet describing decayed teeth infected by “dental worms.”⁵ A papyrus dating back to 500 BC describes dental pathologies and recommended herbal treatment. Greek and Roman texts by Hippocrates and Galen detail preventative strategies.¹

During the Renaissance in Western societies, dentistry became more isolated from medicine, changing to a trade instead of a profession. Dental procedures became commonly performed by barbers. However, a shift toward dentistry as a branch of medicine began again in the 1500s, coinciding with advances in microbiology, such as Anton van Leeuwenhoek’s discovery of microscopic organisms in dental plaque. In the 1700s, Pierre Fauchard published several dental textbooks, suggesting the need for formal dental schools.¹

In 1840, the first dental school, Baltimore College of Dentistry, opened its doors. By the early 1900s, dozens more educational institutions had formed. Regulatory standards and licensing examinations were soon developed. The Carnegie Foundation for the Advancement of Teaching funded several educational studies, including the 1910 Flexner Report, which outlined recommendations for medical and dental school curricula.⁶ To further advance the field, another Carnegie report was written by William Gies in 1926. The Gies Report elevated dentistry to the level of medicine, instead of simply a trade. It also provided recommendations for a basic science-based curriculum.⁷

The Crossroads report also summarizes the more recent history of dental education, reporting that throughout the remainder of the 20th century, dentistry underwent an evolution. Research has played a more critical role in the profession, and data has been gathered regarding dental treatment,

dental materials, diagnostic technology, and public health. The late 20th and early 21st centuries saw an increased focus on the systemic health of the dental patient, dental insurance, and educational reform. Debates on the subject of dental education have included program length, association with medical schools, the number of dental schools and class size, licensing and accreditation standards, and curriculum format and philosophy.¹

In 1995, The IOM's Crossroads report also outlined five major concerns with dental education:¹

- 1.) "Basic science concepts are weakly linked to clinical education.
- 2.) Curriculum is insufficiently attuned to current and emerging dental science and practice.
- 3.) Comprehensive patient care as a model for clinical education is plagued with many problems.
- 4.) Links between medicine and dentistry are weak.
- 5.) Overcrowded dental curriculum gives students too little time to consolidate concepts and develop critical thinking skills to prepare them for lifelong learning."

The report suggests that the fifth objective may be achieved in part by shifting the current instructional methods. The report advises "melding basic science principles and information with realistic analyses of clinical dental problems" via new methods of active learning. It further indicates that more research is needed to assess the effectiveness of different approaches to active learning.¹

B. Development of Active Learning

The most basic principles of active learning can be found in a 1926 report by Lindeman, which was revisited by Crawford, et al. in 2006^{8,9}. Many aspects of "adult learning," described in these

publications conflict with the traditional lecture-based format of most dental schools at the time of the IOM's report.

Therefore, a traditional lecture-based curriculum is not the ideal learning platform for dental students. With an interactive approach, students learn in the context of real life cases. Moreover, students gain knowledge through social interaction in small groups and are encouraged to think independently, instead of simply absorbing information.

The ADEA CCI encouraged dental schools to re-vitalize their teaching methodologies. Beginning in 2005, the commission issued a series of articles, known as the ADEA CCI White Papers, which provided a rationale and call to action for educational institutions². By 2009, over half of U.S. dental schools had incorporated some form of active learning into their curriculum.¹⁰

C. Types of Active Learning

The definition of active learning is often debated. Some educators assert that any activity that encourages student engagement may be considered active learning.⁴ Thus, if a lecturer uses a clicker response system, or even asks questions throughout a presentation, this may arguably constitute active learning. Others, however, believe that active learning should require students to actively construct knowledge and engage in higher order learning processes.⁴ Collaborative learning is defined as any activity in which students work together in groups to achieve a common aim. Cooperative learning is defined as students working in small groups toward a common goal while being assessed individually.⁴

Two major approaches to active learning are problem-based learning and case-based learning. Both approaches are typically collaborative in nature and may also be considered cooperative learning, depending on how they are implemented. Problem-based learning (PBL) utilizes small-group tutorial

sessions with students and a faculty facilitator in which a single case typically acts as the foundation for learning. In PBL, learning is developed through the exploration of the topics within the case, typically without prior preparation. Case-based learning (CBL) employs cases to enhance foundational knowledge or highlight a particular topic. CBL may involve preparation outside of the discussion session, and each case is typically focused on one particular topic. Both methods are viable approaches to help initiate the shift to more active learning that encourages critical thinking.¹¹

PBL typically requires less foundational knowledge than CBL and serves as the primary teaching instrument. On the other hand, CBL is typically utilized to enhance the acquisition of foundational knowledge. CBL case discussions usually last for one session, while PBL sessions often spread one clinical case out over many sessions.¹²

Team-based learning (TBL) is another approach to active learning that some educational institutions have adopted. In this method, students prepare for a session on their own, and then take an individual assessment at the beginning of class. Students then convene in teams to reconcile their answers. Some educators believe that this approach may also confer the skills of team-building and collaborative learning; however, more research is needed to address its effectiveness.¹³

For the study that is to be described in this paper, CBL was chosen as the active learning modality for several reasons. First, this method has been favored in preference surveys of both students and faculty alike. A notable 2007 study compared both PBL and CBL at two different U.S. medical schools to assess students' preferences. Two hundred and sixty-six students and 31 faculty members were surveyed after participation in both methods. The study determined that both students and faculty alike showed a strong preference for CBL over PBL. Eighty-nine percent of students and 84 percent of faculty preferred CBL to PBL.¹⁴ Another reason that CBL was chosen for this study was convenience; this

method blended more feasibly into the existing lecture-based curriculum that has been in place for the pre-doctoral pediatric dentistry course for many years.

D. Active Learning: Review Articles

Studies performed in many disciplines in the health sciences and other fields have assessed the effects of active learning. The majority of studies found in this review discussed the use of PBL to educate medical students.

In 2012, the Best Evidence Medical Education (BEME) Collaboration published a systematic review regarding active learning (specifically CBL) and preferences and knowledge. This review included 104 studies from 1965-2010 on case-based learning and dental education. The article concluded that students were overwhelmingly satisfied with CBL and believed that it enhanced their learning. A small number of studies looked at differences in acquiring knowledge. Although improvements with CBL were seen in several articles, it cannot be definitively concluded that CBL alone orchestrated this change.¹⁵

In 2009, a review article was published from McMaster University in Ontario, Canada, where the first known PBL curriculum was proposed at its medical school in 1969. In the 40 years since, the article concluded that in the realm of cognitive psychology, arguments exist to both support and refute the use of PBL in medical schools' curricula. In addition, the article explains that PBL curricula have shown both positive and negative correlations with knowledge. The study also referenced one systematic review on clinical competency, which could not draw any significant conclusions regarding the incorporation of a PBL-based curriculum and future clinical success.¹⁶

A systematic review by Hartling, et al. from 2010 included 30 studies that assessed PBL and knowledge acquisition.¹⁷ This article explores some of the earliest publications in this field. Of note, it

discusses Schmidt's 1987 systematic review that established PBL as a method that encourages students' curiosity and participation in the learning process. However, it found that students in a traditional curriculum performed slightly better on conventional measures of academic achievement (i.e. multiple choice examinations) than their PBL counterparts. It also found a weak correlation between improved clinical competency and PBL. However, the study cited the need for additional studies with improved designs to accurately assess PBL's effectiveness.

Hartling's paper also discussed several systematic reviews from the 1990's, which drew varied conclusions about the merits of PBL. While no significant differences were seen in students' test scores, most researchers noted that participants in PBL found the curriculum more enjoyable and nurturing to students. Of note, a 1993 study by Albanese and Mitchell recommended a hybrid approach, where cases should be intermingled with lectures, instead of PBL alone. This study provided an early rationale for CBL. The majority of later studies from the 21st century also showed no significant differences in knowledge, but some highlighted that PBL students had stronger interpersonal skills and maturity levels. Several studies surveying diagnostic accuracy of practitioners who had been trained in PBL settings showed that they had better clinical judgment in this area than their traditionally trained counterparts.¹⁷

Finally, a systematic review specific to the dental setting was conducted in 2014. This review specifically addressed the role of PBL in prosthodontics, and 41 studies were included. Overall, PBL students rated themselves as well prepared for clinical prosthodontics, with the exception of one study, in which students felt unprepared to begin clinical work. Of the studies that investigated knowledge, PBL had either a positive or a neutral effect on examination scores. The review also concluded that less class time was necessary for the same material when a PBL format was utilized, which is another promising aspect of active learning.¹⁸

E. Active Learning and Knowledge

A separate review of the literature for experimental studies on active learning and knowledge was performed via PubMed. Knowledge was assessed in the below articles using multiple-choice exams of varying lengths. Exam types included quizzes, midterms, finals, and national board exams. Ten of the studies report higher scores on such exams for students in an active learning program when compared to students in a conventional, lecture-based curriculum. Eight studies showed no statistically significant difference in knowledge scores between the two groups.¹⁹⁻³⁶

Of note, one study included above took place at the University of Southern California (USC) Herman Ostrow School of Dentistry. This was one of the first U.S. institutions to create a PBL curriculum. The school utilized a unique pilot program from 1997-2001, in which some students were enrolled in a PBL curriculum while others remained in a traditional lecture-based format. Researchers used the results of the National Board Dental Examinations (NBDE), Part I to assess knowledge. From 1997-2001, six different sets of NBDE I exams were taken by both groups. In all of the six years in which both groups took the NBDE I, the PBL pilot students' average scores were higher than the students in the traditional, lecture-based curriculum.³⁷

Moreover, during the ten years before the school adopted PBL, the average first-time pass rate on the NBDE Part I was 88.2 percent. Over the following ten years after PBL was implemented, the first-time pass rate on the exam jumped to 92.7 percent.²² Similar increases in NBDE scores were reported in a later study from Harvard School of Dental Medicine (HSDM).²⁴

F. Active Learning and Student Preferences, Satisfaction, and Confidence Levels

Another review of the literature for experimental studies that surveyed students' opinions on active learning was performed. Eight studies showed that students were more satisfied with or preferred the active learning method to a traditional, lecture-based format. Two studies revealed no difference in scores on surveys regarding satisfaction with or preference for either teaching method. The studies mentioned above all followed a control group (traditional lecture format) and an experimental group (active learning) and surveyed participants in each group.

Five additional studies found included surveys of students' self-confidence on the topics studied in their lectures or active learning-based sessions. Like the previous articles, these studies all followed both a control and experimental group. The studies utilized a self-reported Likert scale to assess self-confidence. Four of the studies found that students who had participated in an active learning curriculum were more confident in the material, and one study showed no difference in confidence.²⁸⁻

31,34

The above review suggests that students who participate in active learning programs may be more satisfied with this educational method and more confident in the material they learn, compared to students in a traditional, lecture-based curriculum.

G. Curriculum Change at the University of Illinois at Chicago College of Dentistry (UIC COD)

In 2006, faculty at the UIC COD published a paper outlining the rationale for re-vitalizing the school's curriculum.⁹ The report described the lecture-based format used by the UIC COD and detailed their evidence-based rationale for changing to an active learning environment. Since this publication, the UIC COD has indeed instituted such a curriculum. Students use a combination of open inquiry and

guided inquiry as they explore the biomedical and clinical sciences. Because of its deviation from more traditional definitions of problem-based learning and case-based learning, the UIC COD characterizes its method as small group learning (SGL). This approach to teaching foundational knowledge has been implemented for many pre-doctoral courses. Other active learning tools, such as tablet software, and clicker response systems are also being used. However, content for the pre-clinical pediatric dentistry course has been delivered in a traditional, lecture-based format, until now.

III. MATERIALS AND METHODS

All methods used in this study were approved as exempt by the Institutional Review Board of the University of Illinois at Chicago (protocol #2016-0317; see Appendix A). All dental students at the UIC College of Dentistry in their second year of the DMD program during the 2016 summer semester were invited to take part in the study. Table I details the demographics of the group.

TABLE I. DEMOGRAPHICS OF UIC COD SECOND YEAR DENTAL STUDENTS IN PRE-DOCTORAL PEDIATRIC DENTISTRY (Source: UIC College of Dentistry; Profile of DMD Entering Classes; Classes 2016-2020, Office of Student and Diversity Affairs, 2016)

Gender	
Male	52%
Female	48%
Education Level	
Bachelor's	100%
Master's	13%
Race	
Caucasian	60%
Asian	29%
Hispanic	6%
2 or more races	6%
African American	4%

The study's principal investigator presented an informed consent document (see Appendix B) to all students on the first day of class for the semester. The document described that students' grades would be analyzed for research purposes, with the goal of improving the curriculum. All students were required to participate in the lectures, quizzes, and course discussions but could decline to sign the informed consent document and not have their grades used as part of the study. All lectures, quizzes,

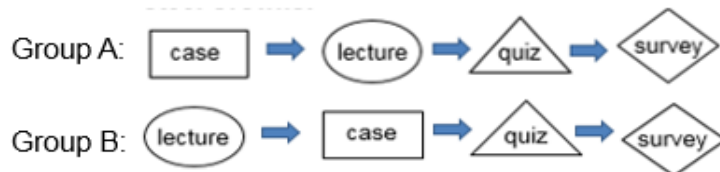
and course discussions occurred during normal class time. The informed consent document explained that neither students' participation nor withdrawal from the study would have an effect on their grades or standing in the course, and this was reiterated to students verbally on the first day of class.

The students who agreed to participate were then divided randomly into two groups (Group A and Group B) using Microsoft Excel's randomize function (Microsoft® Excel for Windows 2016, Microsoft). The students who did not consent to participate were also randomly distributed into the two groups so that the number of participants was similar for both groups. Three content units were chosen for our study: stainless steel crowns, pulp therapy, and space maintenance. The course professor chose these units to implement the cases, as he reported that students struggle with these particular topics. Additionally, this material is wholly new to students in contrast to other material, such as direct restorations, with which students have some prior familiarity.

See Figure 1 for a summary of the study procedures described in the following section. For the unit on stainless steel crowns, Group A first took part in a 60-minute case-based discussion session on the topic. All students came together to hear a 90-minute lecture on the topic immediately following this session. After the lecture, Group B took part in the same case-based discussion as Group A had earlier. Approximately one week later, students took a quiz on the subject, which consisted of seven true/false and multiple-choice questions. The quizzes were part of the students' coursework, and the course's professor wrote all quiz questions. Following the quiz, students took a survey (see Appendix C) regarding their confidence on the subject matter. Students were surveyed using a five-point Likert scale on confidence in their overall knowledge (question 2), treatment planning abilities (question 3), clinical knowledge (question 4), and didactic knowledge (question 5). For the unit on pulp therapy, the same protocol took place; however, Group B had the case-based discussion first, and Group A had their discussion after the lecture. For the last unit on space maintenance, students did not have a case-based discussion. They attended a lecture and took a quiz and survey a week later. Participants were given a

final survey on their last day of class regarding their preferences for active learning and overall experiences.

Stainless Steel Crowns:



Pulp Therapy:



Space Maintenance:



Figure 1: Study Design

The principal investigator, who is also a teaching assistant facilitator and resident in pediatric dentistry, facilitated all the discussions. She completed a week-long training program on facilitation of small group learning and had prior experience in PBL facilitation. Students were permitted to reference textbooks, the Internet, or class notes during the case-based discussions. Students worked through a five-page case, one page at a time, with the facilitator moderating the conversation. At the end of each case, students were given a set of learning objectives that were to have been covered during the session and were encouraged to discuss whether the objectives had been achieved.

Students' grades and responses were kept confidential during the study. After the course grading was complete, the principal investigator assigned students a random ID number. Association of students' names and ID numbers were only accessible to the course director and teaching assistant, solely for the purposes of collating the research data. The surveys were anonymous and not linked to the quiz scores; students were only asked to identify themselves as part of Group A or Group B. All surveys had an attached cover letter describing the purpose of the research, and indicating that students had the option to turn in a blank survey if they did not wish to participate.

All data were then analyzed using SPSS (IBM Corp. Released 2013. IBM SPSS Statistics for Windows, Version 22.0. Armonk, NY: IBM Corporation).

IV. RESULTS

A. Quiz Scores

Forty-five students out of the 52 enrolled as second year dental students at UIC COD consented to having their grades in pediatric dentistry used in the study (87%). For Quiz 1 on stainless steel crowns, 43 participants were present, 22 in Group A and 21 in Group B. For Quiz 2 on pulp therapy, 44 participants were present, 23 from Group A and 21 from Group B. For Quiz 3 on space maintenance 42 participants were present, 21 from each group.

Table II shows the means (out of seven possible points) and standard deviations of the three quizzes by group.

TABLE II. MEAN QUIZ SCORES BY TIMING OF CASE DISCUSSION

Quiz	Group	N	Mean	Std. Deviation
Quiz 1 (stainless steel crowns)	A (case before lecture)	22	5.8	1.0
	B (case after lecture)	21	6.2	1.1
Quiz 2 (pulp therapy)	A (case after lecture)	23	5.9	1.0
	B (case before lecture)	21	5.2	1.5
Quiz 3 (space maintenance)	A (no case)	21	6.3	0.9
	B (no case)	21	6.2	0.8

Table III reflects the mean scores for the three quizzes, with the scores from Groups A and B pooled together. A one-way ANOVA was performed to assess the differences in the overall scores for all

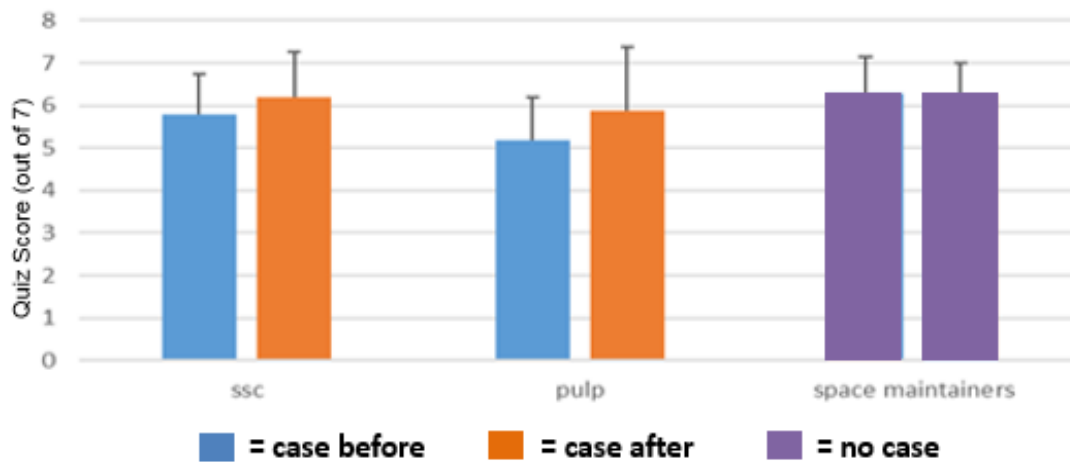
three quizzes. Quizzes 1 and 3 were not different; however, Quiz 2 had a significantly lower mean score than the other two (repeated measures two-way ANOVA: Quiz 1 vs. 2: $F = 5.2$, 1df, $p = 0.028$; Quiz 2 vs. 3: $F = 1.6$, 1df, $p = 0.002$; Quiz 1 vs. 3: $F = 1.6$, 1df, $p = 0.21$).

TABLE III. MEAN QUIZ SCORES BY CONTENT

Quiz	N	Mean	Std. Deviation
Quiz 1 (stainless steel crowns)	43	6.0	1.0
Quiz 2 (pulp therapy)	44	5.6	1.3
Quiz 3 (space maintenance)	42	6.3	0.8

Quiz 1 vs. 2: $F = 5.2$, 1df, $p = 0.028$ *Quiz 2 vs. 3: $F = 1.6$, 1df, $p = 0.002$ *Quiz 1 vs. 3: $F = 1.6$, 1df, $p = 0.21$

Next, a repeated measures two-way ANOVA test was performed to assess differences in quiz scores when students had a case discussion before vs. after the lecture. When a group had the case-based discussion after the lecture, the group performed significantly better on the quiz: $F=8.68$, 1df, $p=0.005$. This is represented graphically in Figure 2.



F=8.68, 1df, p=0.005

Figure 2: Mean Quiz Scores: Case Discussion Before Versus After Lecture

B: Surveys on Student Self-Confidence

Independent samples T tests were performed to determine whether students' self-confidence differed with by timing of the case discussion. For Survey 1, which was administered after the unit on stainless steel crowns, 48 out of 52 students returned the survey. Only one question showed a difference between groups: question 4. Group B, which had the lecture on stainless steel crowns after the lecture, had a higher level of confidence in their clinical knowledge, with a mean score of 3.2 out of 5, compared to 2.8 for Group A (P = 0.04). The overall confidence levels approach significance, with the mean for Group B as 13.1, compared to 11.8 for Group A (P = 0.051) (Tables IV-V).

TABLE IV. CONFIDENCE IN KNOWLEDGE OF STAINLESS STEEL CROWNS: MEAN SCORES BY GROUP AND TIMING OF CASE DISCUSSION

Question	Group	N	Mean	Std. Deviation
2 (overall knowledge)	A (SSC case before)	24	3.0	0.8
2 (overall knowledge)	B (SSC case after)	24	3.4	0.7
3 (treatment planning)	A (SSC case before)	24	3.0	0.8
3 (treatment planning)	B (SSC case after)	24	3.3	0.6
4 (clinical knowledge)	A (SSC case before)	23	2.8	0.7
4 (clinical knowledge)	B (SSC case after)	24	3.2	0.7
5 (didactic knowledge)	A (SSC case before)	23	2.8	0.5
5 (didactic knowledge)	B (SSC case after)	24	3.1	0.7
Summed Score	A (SSC case before)	23	11.8	2.1
Summed Score	B (SSC case after)	24	13.1	2.3

TABLE V. INDEPENDENT SAMPLES T TEST FOR STAINLESS STEEL CROWN CONFIDENCE BY GROUP AND TIMING OF CASE DISCUSSION

Question	P value
2 (overall knowledge)	0.08
3 (treatment planning)	0.2
4 (clinical knowledge)	0.04
5 (didactic knowledge)	0.1
Summed Score	0.05

For the survey following the second unit on pulp therapy, 43 students participated. Only the responses for the question on treatment planning were different between the two groups. Group A, which had a case after the lecture in this unit, showed more confidence in treatment planning, compared to Group B. Group A showed an average response of 3.2 on this question, compared to Group B with 2.8 ($p = 0.02$) (Tables VI-VII).

TABLE VI. CONFIDENCE IN KNOWLEDGE OF PULP THERAPY: MEAN SCORES BY GROUP AND TIMING OF CASE DISCUSSION

Question	Group	N	Mean	Std. Deviation
2 (overall knowledge)	A (pulp case after)	19	3.2	0.7
2 (overall knowledge)	B (pulp case before)	24	3.0	0.6
3 (treatment planning)	A (pulp case after)	19	3.2	0.5
3 (treatment planning)	B (pulp case before)	24	2.8	0.6
4 (clinical knowledge)	A (pulp case after)	19	2.9	0.7
4 (clinical knowledge)	B (pulp case before)	24	2.8	0.6
5 (didactic knowledge)	A (pulp case after)	19	3.0	0.8
5 (didactic knowledge)	B (pulp case before)	24	2.8	0.6
Summed Score	A (pulp case after)	19	12.3	2.3
Summed Score	B (pulp case before)	24	11.4	1.9

TABLE VII. INDEPENDENT SAMPLES T TEST FOR PULP THERAPY CONFIDENCE BY GROUP AND TIMING OF CASE DISCUSSION

Question	P value
2 (overall knowledge)	0.3
3 (treatment planning)	0.02
4 (clinical knowledge)	0.7
5 (didactic knowledge)	0.4
Summed Score	0.2

Forty-six students completed the survey following the unit on space maintenance, in which no case discussions were held. None of the questions differed by group, as shown in Tables VIII-IX.

TABLE VIII. CONFIDENCE IN KNOWLEDGE OF SPACE MAINTENANCE: MEAN SCORES BY GROUP

Question	Group	N	Mean	Std. Deviation
2 (overall knowledge)	A	23	3.7	0.9
2 (overall knowledge)	B	23	3.6	0.7
3 (treatment planning)	A	23	3.5	0.9
3 (treatment planning)	B	23	3.6	0.8
4 (clinical knowledge)	A	23	3.4	0.9
4 (clinical knowledge)	B	23	3.3	0.7
5 (didactic knowledge)	A	23	3.6	0.7
5 (didactic knowledge)	B	23	3.4	0.8
Summed Score	A	23	14.1	3.0
Summed Score	B	23	13.8	2.7

TABLE IX. INDEPENDENT SAMPLES T TEST FOR SPACE MAINTENANCE CONFIDENCE BY GROUP

Question	P value
2 (overall knowledge)	0.7
3 (treatment planning)	0.6
4 (clinical knowledge)	0.7
5 (didactic knowledge)	0.3
Summed Score	0.7

The responses from the confidence questions were summed and compared by content (stainless steel crowns vs. pulp therapy) and by whether the case discussion occurred before or after the lecture. The students who had the case discussion after the lecture rated their self-confidence higher than those who had the case discussion before the lecture (two-way ANOVA: $F = 5.56$, 1df, $p = 0.02$).

TABLE X. SUMMED CONFIDENCE SCORES BY TIMING OF CASE DISCUSSION AND CONTENT AREA

Survey	Timing	Mean	Std. Deviation
1 (SSC)	Before	11.8	2.1
1 (SSC)	After	13.1	2.3
2 (pulp therapy)	Before	11.4	1.9
2 (pulp therapy)	After	12.3	2.3
Total (1&2)	Before	11.6	2.0
Total (1&2)	After	12.7	2.3

Total scores: $F = 5.56$, 1df, $p = 0.02$

C. Surveys on Student Preferences

Forty-seven out of 52 students responded to a survey of overall experiences and preferences. Results are depicted in Tables XI-XII. Students preferred holding a case discussion after a lecture, compared to before a lecture (Table XI: $\chi^2 = 7.68$, 1df, $p = 0.01$). When asked about modality preference,

21 students preferred a case with a lecture, 13 preferred lecture alone, and 13 preferred both methods equally (Table XI). This distribution was not significant ($\chi^2 = 2.72$, 2df, $P = 0.3$).

TABLE XI. STUDENT PREFERENCES FOR TIMING OF CASE DISCUSSION (N=47)

Timing	Expected N	Observed N
Case before lecture	23.5	14
Case after lecture	23.5	33

$\chi^2 = 7.68$, 1df, $p = 0.01$

TABLE XII. STUDENT PREFERENCES FOR MODALITY (N=47)

Modality Preference	Expected N	Observed N
Lecture with case	15.7	21
Lecture only	15.7	13
Liked both equally	15.7	13

$\chi^2 = 2.72$, 2df, $P = 0.256$

V. DISCUSSION

The students' quiz scores when the case discussion occurred after the lecture were higher than with the case discussion before the lecture. This was true for both groups and on two different subjects, stainless steel crowns and pulp therapy. The crossover design of the study helped establish that one group did not have an inherently higher ability than the other, as both groups had similar scores on the third quiz, where no discussion was held.

This novel finding suggests that if a case-based discussion is used, the case discussion may be more effective when held after a lecture presenting foundational knowledge. The case-based discussion thus serves to consolidate the information students learned in the lecture and reinforces new concepts in a practical manner.

Students performed similarly on the quizzes on stainless steel crowns and space maintenance but had lower quiz scores on the unit on pulp therapy. This may have been due to the differences in the inherent difficulty levels of the topics for each unit. Pulp therapy may be a broader and more complex subject than stainless steel crowns or space maintainers, especially for second year dental students who have not yet had a basic endodontics course. Moreover, the unit on space maintenance was held later in the semester, when students may have been more comfortable with the structure of the course and the basics of pediatric dentistry. This may be one explanation for why they scored the highest overall in this unit.

The results about student self-confidence supports the idea that students prefer learning with a case-based discussion after, instead of before, a lecture. Another possible explanation for the after groups' higher quiz scores is that their increased self-confidence levels led to their superior performance. Students may have felt more comfortable with the material after solidifying their knowledge during the discussion after the lecture, and thus, performed better on the quiz.

However, higher self-confidence levels do not always lead to higher quiz scores. A notable 2006 study by Roediger and Karpicke on test-enhanced learning also studied students' self-confidence and performance on a test. The study concluded that while students were more confident after studying material repeatedly, students who tested themselves more often were the ones who actually had higher test scores.³⁸ Thus, even though the study described in this thesis showed that students with higher self-confidence levels also attained higher quiz scores, this is not always the case.

When surveyed about their overall experiences, students showed a strong preference for holding a case-based discussion after a lecture, instead of beforehand. Moreover, the greatest number of students preferred having a case with a lecture as their teaching modality. Thus, all of the above data suggests that students may perform better on assessments of knowledge, feel more self-confident, and enjoy having a case-based discussion when it takes place after a lecture on the same topic.

The limitations of this study include the variability of the subject matter. As previously discussed, each subject may have had an inherently different level of difficulty. While this factor may have influenced the overall quiz scores, it should not have had an impact on the between-group comparisons, due to the crossover design. It would have been impossible, however, to have the same groups of students exposed to the same material and then switch, as the material would not be new to each group.

A second limitation is that the quizzes used were not independently validated but were created by a content expert in the field. The multiple-choice quizzes may also not have been the ideal measure of outcomes; clinical activities, short-answer exams, or oral exams are other possibilities that may have served as superior measures of student learning. It is possible that holding the case-based discussion before the lecture served to enhance students' clinical skills, although it did not help students didactically.

Another limitation was that there was some variability in the content of the discussion sessions with each group. The study attempted to control for this difference by using the same facilitator for each session and using the same case and script. The facilitator also passed out a set of learning objectives that each student should have gleaned from the session at the end. However, it is possible that different points were discussed during the different sessions, which may have influenced students' quiz scores and self-confidence.

Moreover, this research is limited to selected topics in pediatric dentistry and may not apply to all topics, or even all disciplines. These findings also may only apply to new didactic material. It is possible that students would not need a lecture before a case when discussing a topic about which they already had a baseline level of knowledge. This research is also limited to case-based learning, applied in the manner described in this paper. It is unclear whether these results are applicable to problem-based learning, team-based learning, or other active learning modalities.

Future studies may also consider assessing students' clinical abilities with each method (i.e. performing the procedures from each unit on mannequins). In addition, further research should apply the same protocol used in this study to other disciplines in dentistry, to confirm the findings of this study as well as broaden the application of this teaching method. Others may wish to extend this investigation to other health professional schools, or other graduate courses of study.

VI. CONCLUSIONS

The following conclusions may be drawn from this study:

1. Students scored higher on multiple-choice quizzes when a case-based discussion was held after, instead of before, a lecture.
2. Students had higher overall self-confidence levels when a case-based discussion was held after a lecture, compared to before a lecture.
3. Students preferred holding a case-based discussion after, instead of before a lecture.
4. This study found no evidence for a case-based discussion improving quiz scores.

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APPENDIX A: IRB Approval Letters

UNIVERSITY OF ILLINOIS AT CHICAGO

Office for the Protection of Research Subjects (OPRS)
Office of the Vice Chancellor for Research (MC 672)
203 Administrative Office Building
1737 West Polk Street
Chicago, Illinois 60612-7227

Exemption Granted

April 6, 2016

Jaime Chowaniec, DMD

Pediatric Dentistry

801 S. Paulina Street

M/C 850

Chicago, IL 60612

Phone: (312) 996-7532 / Fax: (312) 413-8006

RE: Research Protocol # 2016-0317
"Effects of a case-based discussion on educational outcomes in dental students"

Sponsors: None

Dear Dr. Chowaniec:

Your Claim of Exemption was reviewed on April 6, 2016 and it was determined that your research meets the criteria for exemption. You may now begin your research.

Exemption Period: April 6, 2016 – April 6, 2019

APPENDIX A (CONTINUED)

Performance Site: UIC

Subject Population: Adult (18+ years) subjects only

Number of Subjects: 52

The specific exemption category under 45 CFR 46.101(b) is:

(1) Research conducted in established or commonly accepted educational settings, involving normal educational practices such as (i) research on regular and special education instructional strategies, or (ii) research on the effectiveness of or the comparison among instructional techniques, curricula, or classroom management methods.

Please note the Review History of this submission:

Receipt Date	Submission Type	Review Process	Review Date	Review Action
03/21/2016	Initial Review	Exempt	03/24/2016	Modifications Required
03/25/2016	Response to Modifications	Exempt	04/06/2016	Approved

You are reminded that investigators whose research involving human subjects is determined to be exempt from the federal regulations for the protection of human subjects still have responsibilities for the ethical conduct of the research under state law and UIC policy. Please be aware of the following UIC policies and responsibilities for investigators:

1. Amendments You are responsible for reporting any amendments to your research protocol that may affect the determination of the exemption and may result in your research no longer being eligible for the exemption that has been granted.
2. Record Keeping You are responsible for maintaining a copy all research related records in a secure location in the event future verification is necessary, at a minimum these documents include: the research protocol, the claim of exemption application, all questionnaires, survey instruments, interview questions and/or data collection instruments associated with this research protocol, recruiting or advertising materials, any consent forms or information sheets given to subjects, or any other pertinent documents.
3. Final Report When you have completed work on your research protocol, you should submit a final report to the Office for Protection of Research Subjects (OPRS).
4. Information for Human Subjects UIC Policy requires investigators to provide information about the research protocol to subjects and to obtain their permission prior to their participating in the research. The information about the research protocol should be presented to subjects as

APPENDIX A (CONTINUED)

detailed in the research protocol and Claim of Exemption application utilizing the approved recruitment and consent process and document(s).

Please be sure to use your research protocol number (2016-0317) on any documents or correspondence with the IRB concerning your research protocol.

OPRS does not send hard copies via campus mail of protocol-related correspondence to investigators, research staff and Department Heads. For more information, please refer to the following:

<http://research.uic.edu/node/4117>

We wish you the best as you conduct your research. If you have any questions or need further help, please contact the OPRS office at (312) 996-1711 or me at (312) 355-2908. Please send any correspondence about this protocol to OPRS at 203 AOB, M/C 672.

Sincerely,

Charles W. Hoehne

Assistant Director, IRB #7

Office for the Protection of Research Subjects

cc: Larry B. Salzmman (faculty sponsor), Pediatric Dentistry, M/C 850

APPENDIX A (CONTINUED)

**UNIVERSITY OF ILLINOIS
AT CHICAGO**

Office for the Protection of Research Subjects (OPRS)
Office of the Vice Chancellor for Research (MC 672)
203 Administrative Office Building
1737 West Polk Street
Chicago, Illinois 60612-7227

Exemption Determination

Amendment to Research Protocol – Exempt Review

UIC Amendment #1

August 19, 2016

Jaime Chowaniec, DMD

Pediatric Dentistry

801 S. Paulina Street

M/C 850

Chicago, IL 60612

Phone: (312) 996-7532 / Fax: (312) 413-8006

RE: Protocol # 2016-0317
“Effects of a case-based discussion on educational outcomes in dental students”

Dear Dr. Chowaniec:

The OPRS staff/members of Institutional Review Board (IRB) #7 have reviewed and approved this amendment to your research and have determined that your amended research continues to meet the criteria for exemption as defined in the U. S. Department of Health and Human Services Regulations for the Protection of Human Subjects [(45 CFR 46.101(b))].

The specific exemption category under 45 CFR 46.101(b) is:

APPENDIX A (CONTINUED)

(1) Research conducted in established or commonly accepted educational settings, involving normal educational practices such as (i) research on regular and special education instructional strategies, or (ii) research on the effectiveness of or the comparison among instructional techniques, curricula, or classroom management methods.

You may now implement the amendment in your research.

Please note the following information about your approved amendment:

Exemption Period: August 19, 2016 – August 19, 2019

Amendment Approval Date: August 19, 2016

Amendment:

Summary: UIC Amendment #1: Investigator's Summary:

- 1) Dr. Larry Salzmann, listed as my faculty sponsor, will be leaving UIC at the end of the month. He will continue serving as a professor at University of Michigan Dental School. Dr. Salzmann has agreed to stay on the committee from University of Michigan and will inform the IRB at that institution of this as well. No research will be done at that site. All of my data has already been collected. However, Dr. Salzmann will remain on the committee to assist in data analysis and as an advisor.
- 2) Thus, I am requesting that Dr. Anne Koerber, previously listed as a co-investigator, serve as my faculty sponsor.
- 3) Dr. Charles LeHew will also be joining my committee. He is also a member of the Dept. of Pediatric Dentistry and previously was listed as a key research personnel on my initial submission.

You are reminded that investigators whose research involving human subjects is determined to be exempt from the federal regulations for the protection of human subjects still have responsibilities for the ethical conduct of the research under state law and UIC policy. Please be aware of the following UIC policies and responsibilities for investigators:

5. Amendments You are responsible for reporting any amendments to your research protocol that may affect the determination of the exemption and may result in your research no longer being eligible for the exemption that has been granted.
6. Record Keeping You are responsible for maintaining a copy all research related records in a secure location in the event future verification is necessary, at a minimum these documents include: the research protocol, the claim of exemption application, all questionnaires, survey instruments, interview questions and/or data collection instruments associated with this research protocol, recruiting or advertising materials, any consent forms or information sheets given to subjects, or any other pertinent documents.

APPENDIX A (CONTINUED)

7. Final Report When you have completed work on your research protocol, you should submit a final report to the Office for Protection of Research Subjects (OPRS).

Please be sure to use your research protocol number (2016-0317) on any documents or correspondence with the IRB concerning your research protocol.

We wish you the best as you conduct your research. If you have any questions or need further help, please contact me at (312) 355-2908 or the OPRS office at (312) 996-1711.

Sincerely,

Charles W. Hoehne, B.S., C.I.P.
Assistant Director, IRB #7

Office for the Protection of Research Subjects

cc: Marcio Da. Fonseca (department head), Pediatric Dentistry, M/C 850

Anne Koerber (faculty sponsor), Pediatric Dentistry, M/C 850

APPENDIX B: Informed Consent Documents

Leave box empty - For office use only

University of Illinois at Chicago

Research Information and Consent for Participation in Social Behavioral Research

Effects of a case-based discussion on educational outcomes in dental students

You are being asked to participate in a research study. Researchers are required to provide a consent form such as this one to tell you about the research, to explain that taking part is voluntary, to describe the risks and benefits of participation, and to help you to make an informed decision. You should feel free to ask the researchers any questions you may have.

Principal Investigator Name and Title: Dr. Jaime Chowaniec, Resident

Department and Institution: Dept. of Pediatric Dentistry, UIC College of Dentistry

Address and Contact Information: 801 S Paulina St., M/C 450, Chicago, IL 60612,
jchowa2@uic.edu.

Why am I being asked?

- You are being asked to be a subject in a research study about educational methods in pre-doctoral pediatric dentistry.
- You have been asked to participate in the research because you are a second year dental student, enrolled in a class that will be employing various techniques to help students better learn course material. Approximately 52 subjects may be involved in this research at UIC.
- Your participation in this research is voluntary. Your decision whether or not to participate will not affect your current or future dealings with the University of Illinois at Chicago. **If you decide to participate, you are free to withdraw at any time without affecting that relationship.**

What is the purpose of this research?

- Researchers are trying to learn more about educational methods to enhance learning in the pre-doctoral pediatric dental curriculum.

What procedures are involved?

→

APPENDIX B (CONTINUED)

- This research will be performed at UIC College of Dentistry, 801 S Paulina St., Chicago, IL 60612 (lecture halls and classrooms).
- This study will not require any additional time commitment from you outside of normal classroom hours.
- All students will participate in all required course activities. Students will be randomly split into groups for some activities in the course. You will be given four optional, anonymous surveys during class time that should take approximately five minutes to complete. Students are not required to complete the surveys and may turn in a blank survey, should they choose not to participate. However, you will still be required to remain in the classroom during the class time allotted for the surveys.
- If you agree, your quiz and test scores will be de-identified by using a code so that no one will be able to identify your scores during data analysis.
 - Note that some individuals in the College normally have access to your grades (specifically, the course directors, course TAs, staff in Academic Affairs, etc). However, for the purposes of research analysis, all grades will only be viewed using the code assigned to you, and your data will be pooled with others. Thus, your grade information will not be available to individuals who cannot normally view it as part of their role in the College.
- If you elect not to participate in the study, you will still be required to participate in all course activities. However, your grades in the class will not be used in the pool of de-identified data for research purposes. You may also turn in a blank survey when surveys are handed out if you wish.

What are the potential risks and discomforts?

- There are no known risks to participating in the study.

Will I be told about new information that may affect my decision to participate?

- During the course of the study, you will be informed of any significant new research information (either good or bad), such as changes in the risks or benefits resulting from participation in the research or new alternatives to participation, that might cause you to change your mind about continuing in the research. If new information is provided to you, your consent to continue participating in this research may be re-obtained.

Are there benefits to taking part in the research?

- Taking part in this research study may not benefit you personally, but the researchers may learn new things that will help future students.

APPENDIX B (CONTINUED)

What other options are there?

- You have the option not to participate in this study. If you withdraw consent, your de-identified evaluation scores will not be used for data analysis. However, you still must participate in required course activities, including all lectures, discussion sessions, quizzes, and exams.

What about privacy and confidentiality?

- The people who will know that you are a research subject are the members of the research team. Otherwise information about you will only be disclosed to others with your written permission, or if necessary to protect your rights or welfare (for example, when the UIC Office for the Protection of Research Subjects monitors the research or consent process) or if required by law.
- Study information which identifies you, and the consent form signed by you, will be looked at and/or copied for checking up on the research by the Institutional Review Board at UIC.

A possible risk of the research is that your participation in the research or information about you might become known to individuals outside the research.

- This is highly unlikely, as all students in the course will be required to participate in course activities. All students will also be required to be present in class at the time of the surveys. Students may turn in a blank survey if they do not wish to fill one out. However, all D2 students are candidates for participation in this study.
- When the results of the research are published or discussed in conferences, no information will be included that would reveal your identity. Only de-identified data will be used in analysis.

What are the costs for participating in this research?

- There are no costs to you for participating in this research.

Will I be reimbursed for any of my expenses or paid for my participation in this research?

- You will not be offered payment for being in this study.

What if I am a UIC student?

You may choose not to participate or to stop your participation in this research at any time. This will not affect your class standing or grades at UIC. The investigator may also end your

APPENDIX B (CONTINUED)

participation in the research. If this happens, your class standing or grades will not be affected. You will not be offered or receive any special consideration if you participate in this research.

Your participation in this research is voluntary. Your decision whether or not to participate will not affect your current or future relations with the University. If you decide to participate, you are free to withdraw at any time without affecting that relationship.

Can I withdraw or be removed from the study?

If you decide not to participate, you are free to withdraw your consent and discontinue participation at any time. The Researchers also have the right to stop your participation in this study without your consent if they believe it to be in your best interests.

You may withdraw your consent at any time by sending an e-mail to Dr. Jaime Chowanec at ichowa2@uic.edu with the subject: WITHDRAWAL FROM RESEARCH STUDY.

Who should I contact if I have questions?

Contact the researchers, Dr. Jaime Chowanec, ichowa2@uic.edu or Dr. Larry Salzmann, lbs@uic.edu

- if you have any questions about this study or your part in it,
- if you have questions, concerns or complaints about the research.

What are my rights as a research subject?

If you feel you have not been treated according to the descriptions in this form, or if you have any questions about your rights as a research subject, including questions, concerns, complaints, or to offer input, you may call the Office for the Protection of Research Subjects (OPRS) at 312-996-1711 or 1-866-789-6215 (toll-free) or e-mail OPRS at uicirb@uic.edu.

Signature

I have read (or someone has read to me) the above information. I have been given an opportunity to ask questions and my questions have been answered to my satisfaction. I agree to participate in this research. I will be given a copy of this signed and dated form.

APPENDIX B (CONTINUED)

Signature

Date

Printed Name

Signature of Person Obtaining Consent

Date (must be same as subject's)

Printed Name of Person Obtaining Consent

APPENDIX B (CONTINUED)

Effects of a case-based discussion on educational outcomes in dental students

Principal Investigator: Dr. Jaime Chowaniec, Resident, Dept. of Pediatric Dentistry, UIC College of Dentistry jchowa2@uic.edu

Faculty advisors: Drs. Salzmann, Doubleday and Koerber, lbs@uic.edu, adouble@uic.edu, and akoerber@uic.edu

Dear Students,

Earlier this semester, you received a description of a research study we are conducting in this class. Part of that study is to complete the following anonymous survey.

Participation in this research study is voluntary. If you choose not to participate, you are expected to remain in class for the duration of the survey (approximately five minutes).

The purpose of the survey is to determine your reaction to case based discussions connected with didactic material. Your responses will help us improve our teaching methods.

This survey is anonymous. We will not know how or whether you responded. There are no risks involved other than your time. If you choose not to respond, there are no consequences.

If you have any questions about the study, you may communicate with any of the persons mentioned above. If you have any concerns about your rights as a research subject, you may contact the Office for the Protection of Research Subjects (OPRS) at 312-996-1711 or 1-866-789-6215 (toll-free) or e-mail OPRS at uicirb@uic.edu.

Sincerely,

Jaime Chowaniec, DMD

Larry Salzmann, DDS

APPENDIX C: Surveys 1-4

Survey 1

Q1A_ Which of the following best describes you?

- 1.) I participated in a case-based discussion on stainless steel crowns **before** our lecture
- 2.) I participated in a case-based discussion on stainless steel crowns **after** our lecture
- 3.) I was absent for the case-based discussion on stainless steel crowns

Please use the following scale when answering the questions below:

- 1 – Totally lost on the subject
- 2 – Understand some of the main points
- 3 – Understand most main points but not completely confident
- 4 – Confident on almost all of the main points
- 5 – Ready to take a Board exam tomorrow on this topic!

Q2A_ How do you feel about your overall understanding of the subject of stainless steel crowns?

1

Totally lost on
the subject

2

Understand
some of the
main points

3

Understand most
main points but not
completely
confident

4

Confident on
almost all of the
main points

5

Ready to take a
Board exam
tomorrow on the
subject!

Q3A_ How do you feel about your **didactic knowledge** of the subject of stainless steel crowns?

1

Totally lost on
the subject

2

Understand
some of the
main points

3

Understand most
main points but not
completely
confident

4

Confident on
almost all of the
main points

5

Ready to take a
Board exam
tomorrow on the
subject!

Q4A_ How do you feel about your **treatment planning abilities** regarding stainless steel crowns?

1

Totally lost on
the subject

2

Understand
some of the
main points

3

Understand most
main points but not
completely
confident

4

Confident on
almost all of the
main points

5

Ready to take a
Board exam
tomorrow on the
subject!

Q5A_ How do you feel about your **clinical knowledge** regarding stainless steel crowns?

1

Totally lost on
the subject

2

Understand
some of the
main points

3

Understand most
main points but not
completely
confident

4

Confident on
almost all of the
main points

5

Ready to take a
Board exam
tomorrow on the
subject!

APPENDIX C (CONTINUED)

Survey 2

Q1B_ Which of the following best describes you?

- 1.) I participated in a case-based discussion on pulp therapy **before** our lecture
- 2.) I participated in a case-based discussion on pulp therapy **after** our lecture
- 3.) I was absent for the case-based discussion on pulp therapy

Please use the following scale when answering the questions below:

- 1 – Totally lost on the subject
- 2 – Understand some of the main points
- 3 – Understand most main points but not completely confident
- 4 – Confident on almost all of the main points
- 5 – Ready to take a Board exam tomorrow on this topic!

Q2B_ How do you feel about your overall understanding of the subject of pulp therapy?

1

2

3

4

5

Totally lost on
the subject

Understand
some of the
main points

Understand most
main points but not
completely
confident

Confident on
almost all of the
main points

Ready to take a
Board exam
tomorrow on the
subject!

Q3B_ How do you feel about your **didactic knowledge** of the subject of pulp therapy?

1

2

3

4

5

Totally lost on
the subject

Understand
some of the
main points

Understand most
main points but not
completely
confident

Confident on
almost all of the
main points

Ready to take a
Board exam
tomorrow on the
subject!

Q4B_ How do you feel about your **treatment planning abilities** regarding pulp therapy?

1

2

3

4

5

Totally lost on
the subject

Understand
some of the
main points

Understand most
main points but not
completely
confident

Confident on
almost all of the
main points

Ready to take a
Board exam
tomorrow on the
subject!

Q5B_ How do you feel about your **clinical knowledge** regarding pulp therapy?

1

2

3

4

5

Totally lost on
the subject

Understand
some of the
main points

Understand most
main points but not
completely
confident

Confident on
almost all of the
main points

Ready to take a
Board exam
tomorrow on the
subject!

APPENDIX C (CONTINUED)

Survey 3

Q1C_ Which of the following best describes you?

- 1.) I participated in a case-based discussion on stainless steel crowns **before** our lecture and a case-based discussion on pulp therapy **after** our lecture.
- 2.) I participated in a case-based discussion on pulp therapy **before** our lecture and a case-based discussion on stainless steel crowns **after** our lecture.
- 3.) I was absent for the case-based discussion on pulp therapy

Please use the following scale when answering the questions below:

- 1 – Totally lost on the subject
- 2 – Understand some of the main points
- 3 – Understand most main points but not completely confident
- 4 – Confident on almost all of the main points
- 5 – Ready to take a Board exam tomorrow on this topic!

Q2C_ How do you feel about your overall understanding of the subject of space maintainers?

1

Totally lost on
the subject

2

Understand
some of the
main points

3

Understand most
main points but not
completely
confident

4

Confident on
almost all of the
main points

5

Ready to take a
Board exam
tomorrow on the
subject!

Q3C_ How do you feel about your **didactic knowledge** of the subject of space maintainers?

1

Totally lost on
the subject

2

Understand
some of the
main points

3

Understand most
main points but not
completely
confident

4

Confident on
almost all of the
main points

5

Ready to take a
Board exam
tomorrow on the
subject!

Q4C_ How do you feel about your **treatment planning abilities** regarding space maintainers?

1

Totally lost on
the subject

2

Understand
some of the
main points

3

Understand most
main points but not
completely
confident

4

Confident on
almost all of the
main points

5

Ready to take a
Board exam
tomorrow on the
subject!

Q5C_ How do you feel about your **clinical knowledge** regarding space maintainers?

1

Totally lost on
the subject

2

Understand
some of the
main points

3

Understand most
main points but not
completely
confident

4

Confident on
almost all of the
main points

5

Ready to take a
Board exam
tomorrow on the
subject!

APPENDIX C (CONTINUED)

Survey 4:

During this course, you experienced a few case-based discussion sessions in addition to lectures regarding some topics that dental students often find to be confusing. For one unit, you received the case before your lecture and another unit, you received the case after your lecture.

Please reflect on your experiences by answering the following questions:

Q1D_ Which of the following best describes you?

- 1.) I had a case-based discussion **before** the lecture on stainless steel crowns and a case-based **after** the lecture on pulp therapy.
- 2.) I had a case-based discussion **after** the lecture on stainless steel crowns and a case-based **before** the lecture on pulp therapy.
- 3.) I missed one or more of the case-based discussions.

Q2D_ Which timing of the case-based discussion did you prefer?

- 1.) Case-based discussion before lecture
- 2.) Case-based discussion after lecture

Q3D_ Which modality do you prefer?

- 1.) Lecture with a case
- 2.) Lecture only
- 3.) I liked both methods equally

VITA

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doi:10.1136/annrheumdis-2012- 201431.

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