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# Influence of Preparatory Workshops on Dental Students' Academic Performance and Stress on Their First Operative Dentistry Psychomotor Exam

Deborah A. Dilbone, Xiaoying Feng, Yu Su, Patricia Xirau-Probert, Linda S. Behar-Horenstein, Marcelle M. Nascimento

*Abstract:* Predoctoral dental psychomotor examinations are known to generate high levels of stress among dental students, which may compromise their academic performance. At one U.S. dental school, all 93 first-year dental students were invited to attend a series of three workshop sessions prior to enrollment in their initial operative dentistry course. The workshops were developed to facilitate academic transition from the dental anatomy course to the operative dentistry course; provide early exposure to materials, instruments, and laboratory techniques; support the early development of psychomotor and self-assessment skills; and lessen students' stress and anxiety levels regarding psychomotor examinations. The aim of this study was to assess the impact of the workshops on the students' academic performance and self-reported stress and preparedness. All students who attended the workshop sessions and all who did not were asked to complete a pre-exam survey (immediately preceding the exam) and a post-exam survey (immediately after the exam) on the day of their first operative dentistry psychomotor exam. Of the 93 students, 21 attended one, 34 attended two, and 25 attended three workshop sessions, while 13 students did not attend any. Response rates for the pre- and post-exam surveys were 100% and 98.9%, respectively. Students who attended all three workshop sessions reported being significantly less stressed about taking the exam than the other groups. The mean exam grade of students who attended the workshop sessions was significantly higher than that of students who did not attend the sessions. These findings support the development and implementation of preparatory workshops to improve academic performance and decrease the stress levels of dental students prior to the first operative dentistry psychomotor exam.

Deborah A. Dilbone, DMD, is Clinical Associate Professor and Chair, Department of Restorative Dental Sciences, College of Dentistry, University of Florida; Xiaoying Feng, PhD, is a graduate of the School of Human Development and Organizational Studies in Education, College of Education, University of Florida; Yu Su, PhD, is a graduate of the School of Human Development and Organizational Studies in Education, University of Florida; Patricia Xirau-Probert, PhD, is Assistant Professor, Department of Community and Behavioral Sciences, and Dean of Students, College of Dentistry, University of Florida; Linda S. Behar-Horenstein, PhD, is Distinguished Teaching Scholar and Professor, Colleges of Dentistry, Education, and Pharmacy, Director of CTSI Educational Development & Evaluation, and Co-Director of HRSA Faculty Development in Dentistry, College of Dentistry, University of Florida; and Marcelle M. Nascimento, DDS, MS, PhD, is Associate Professor, Department of Restorative Dental Sciences, Division of Operative Dentistry, College of Dentistry, University of Florida. Direct correspondence to Dr. Marcelle M. Nascimento, Department of Restorative Dental Sciences, College of Dentistry, University of Florida, 1395 Center Drive, Room D9-6, PO Box 100415, Gainesville, FL 32610-0415; 352-273-5858; mnascimento@dental.ufl.edu.

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Predoctoral dental education in the U.S. consists of four years of full-time coursework in didactic, preclinical laboratory, and clinical education to earn a DDS or DMD degree. In most U.S. dental schools, basic and dental sciences are taught in classroom and preclinical laboratory settings during the first two years, and hands-on clinical experiences are part of the third and fourth years. Operative dentistry is one of the dental disciplines taught in the form of preclinical and clinical courses. The Academy of Operative Dentistry has defined operative dentistry as that branch of dentistry con-

cerned with the management of teeth that are defective through disease, trauma, wear, and/or abnormal development, or are unaesthetic, to a state of normal form, function, health, and appearance.<sup>1</sup> At the University of Florida College of Dentistry (UFCD), the first preclinical operative dentistry course introduces fundamental concepts of restorative dentistry and the use of dental handpieces for tooth preparations. Students' academic performance is evaluated by didactic and psychomotor examinations. The first operative psychomotor exam is highly anticipated by students and generates stress that can affect their performance.

Students who matriculate to U.S. dental schools generally have excellent records of undergraduate accomplishment.<sup>2</sup> The American Dental Education Association (ADEA) reported that the national average of total grade point average (GPA) for dental school enrollees had steadily risen from 3.35 in 2000 to 3.55 in 2010.<sup>3</sup> The average total GPA of the UFCD Class of 2018 was 3.65. However, the curricula of dental schools require more than just didactic knowledge; they also require exhibition of fine psychomotor and cognitive skills.<sup>4</sup> Students' reliance on skills such as memory, perception, judgment, reasoning, and critical thinking that have resulted in previous academic accomplishments is usually of little consequence as they strive to master psychomotor skills.<sup>5,6</sup> Typically, entering dental students lack an awareness of the amount of time and effort required to acquire the necessary psychomotor skills. Because repeated practice is often needed, students may become frustrated with their slow progress and/or inability to develop these skills prior to their first operative dentistry psychomotor exam. We find that students are repeatedly surprised when they receive grades lower than they expected and lower than those earned in their undergraduate studies. Moreover, an intense course load and rigid criteria for academic performance in dental school tend to exacerbate students' stress and anxiety levels.

Mental health issues are becoming increasingly more common on college campuses. In a survey conducted by the Association for University and College Counseling Center Directors (AUCCCD), 73% of center directors reported an increase in the severity of student mental health concerns and related behaviors such as anxiety, depression, suicide ideation, and personality disorders in the 2014-15 academic year.<sup>7</sup> This survey also found incremental increases in the demand for counseling services over the past ten years. The findings of the AUCCCD survey mirror the University of Florida Counseling Wellness Center reports, which showed a substantial increase in the number of students seeking mental health services from 2,000 students in the 2013-14 academic year to 4,764 in the 2015-16 academic year.

A growing number of students utilizing support services has also been observed at UFCD. Two examples of this are the increased need for tutoring programs and increased number of visits to the UFCD assistant dean of student affairs. UFCD provides tutoring programs for students showing poor academic performance. A total of 660 tutoring hours were recorded for the 2012-13 academic year

versus 2,109 hours recorded for the 2016-17 year. In addition, the assistant dean of student affairs regularly counsels students struggling with personal and/or academic issues, and this administrator reported an increase from 113 to 196 visits from students in crisis from the 2013-14 to 2015-16 academic years. Anecdotally, this administrator has observed a rise in students' citing anxiety as the presenting problem when requesting support services such as tutoring and counseling in the past five years. In 2014, a series of preparatory operative dentistry workshop sessions was designed and offered to UFCD first-year dental students prior to their first operative dentistry course. The aim of this study was to assess the impact of the workshops on the students' academic performance and self-reported stress and preparedness.

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## Methods

This study was approved by the University of Florida's Institutional Review Board (IRB02# 2015-U-0208). The UFCD curriculum includes two required preclinical courses: the Dental Anatomy course in the first semester, and the Operative Dentistry I course in the second semester. In 2014, the Operative Dentistry I course director designed a series of three preparatory workshop sessions called "Building Psychomotor Skills." The objectives of the workshops were to facilitate students' academic transition from the Dental Anatomy course to the Operative Dentistry I course; provide early exposure to operative dentistry materials, instruments, and laboratory techniques; support the early development of psychomotor and self-assessment skills; and lessen students' stress and anxiety levels about psychomotor exams by increasing their feeling of preparedness pertaining to the development of psychomotor skills. Teaching assistants (UFCD third- and fourth-year dental students) served as instructors for the workshop sessions. Each session consisted of 30 minutes of didactic instructions followed by 90 to 120 minutes of laboratory exercises, which included tooth preparations using dental handpieces, Learn-A-Prep II blocks (Whip Mix, Louisville, KY, USA), and typodonts (Kilgore International, Inc., Coldwater, MI, USA). Attendees were also introduced to the UFCD preclinical grading criteria for tooth preparations and received guidance on self-assessment exercises.

The 93 students of the UFCD DMD Class of 2018 (first-year students in 2014) enrolled in the Operative Dentistry I course were invited via email to

attend the three preparatory workshop sessions. The invitation described the objectives of each workshop session and explained that students could attend one or more of the three sessions. The three sessions were provided during the two months preceding the operative course and approximately four months preceding the course's first psychomotor exam. The first psychomotor exam assessed the students' ability to perform a Class V tooth preparation and a Class V composite-resin restoration using specific grading criteria.

Students who attended and those who did not attend the workshop sessions were asked to complete a pre-exam survey and a post-exam survey on the day of the psychomotor exam. Both surveys were administered in paper and were collected from the students at the preclinical simulation laboratory where the exam took place. The pre-exam survey consisted of eight questions and was administered immediately before students began to take the exam. Using a five-point scale, the pre-exam survey asked students to rate their stress level prior to the exam, how prepared they felt, and how many hours they practiced for the exam outside of the course hours. This survey also asked the students who attended the workshop sessions to rate how the sessions influenced their stress level prior to the exam and their preparedness to take the exam. In addition, three questions required students to indicate how many of the three workshop sessions they attended.

The post-exam survey consisted of four questions and was administered immediately after students completed the psychomotor exam. Questions on the post-exam survey asked students to rate their stress level after taking the exam and their expected exam grade (seven options from A to E grades). This survey also asked students who attended the workshop sessions to rate how the sessions influenced their exam grades and whether they would increase, decrease, or not change the amount of practice time in preparation for future psychomotor exams.

The Mann-Whitney U test was used to compare the data between the students who attended the workshop sessions and those students who did not. The Kruskal-Wallis test with follow-up pairwise comparisons was used to compare the mean values among students who attended one, two or three of the workshop sessions. Independent samples t-test explored whether those who attended more workshop sessions had higher grades on the psychomotor exam than those who attended fewer sessions. All of the

statistical analysis was conducted using SPSS Version 20 software (IBM Corp., Armonk, NY, USA). The level of statistical significance was set at  $\alpha=0.05$ .

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## Results

Of the students enrolled in the Operative Dentistry I course, 21 attended one, 34 attended two, and 25 attended three of the workshop sessions, while 13 students did not attend any of the sessions. Response rates for the pre- and post-exam surveys were 100% and 98.9%, respectively. Data collected from the pre-exam survey showed that students who attended one or more of the workshop sessions spent significantly more time practicing for the exam outside of the course hours as compared to students who did not attend the sessions ( $p<0.023$ ). There was a statistically significant difference in students' perceptions of the benefit of attending the workshop sessions among those who attended one, two, or three sessions ( $p<0.005$ ). Specifically, on the scale from 1=did not help at all to 5=helped greatly, students who attended all three sessions ( $3.32\pm 1.07$ ) perceived that the sessions had significantly higher benefits on their preparedness for the exam than those who attended one session ( $2.38\pm 0.81$ ;  $p<0.001$ ) or two sessions ( $2.82\pm 0.90$ ;  $p<0.041$ ).

Data collected on the post-exam survey showed a statistically significant difference in self-reported levels of stress after the exam among students who attended one, two, or three of the workshop sessions ( $p=0.047$ ; Table 1). On the scale from 1=not stressed at all to 5=extremely stressed, students who attended all three sessions reported that they were significantly less stressed ( $2.52\pm 1.05$ ) than students who attended one session ( $3.29\pm 1.27$ ;  $p<0.024$ ) or two sessions ( $3.06\pm 1.21$ ;  $p<0.042$ ). There was also a statistically significant difference in the perception of students who attended one, two, or three of the workshop sessions concerning the sessions' influence on their exam grades ( $p<0.001$ ; Table 2). On the scale from 1=great negative influence to 5=great positive influence, students who attended only one session ( $3.43\pm 0.60$ ) reported that the workshop had less influence on their exam grade as compared to those who attended two ( $3.88\pm 0.54$ ;  $p=0.006$ ) or three ( $4.13\pm 0.61$ ;  $p=0.001$ ) sessions.

There was also a statistically significant difference in mean score on the first psychomotor operative dentistry exam between students who attended the workshop sessions (B+:  $89.2\pm 7.28$ ; Table 3) and

**Table 1. Relationship between students' self-reported stress level after exam and frequency of attendance in workshop sessions**

Student Group	N	Level of Stress	SD	Specific p-value	Total p-value
Attended 1 session	21	3.29	1.27	0.024 (vs. 3 sessions)	0.047
Attended 2 sessions	34	3.06	1.21	0.042 (vs. 3 sessions)	
Attended 3 sessions	25	2.52	1.05		

Note: The "Level of Stress" column shows the mean value of students' self-reported level of stress. Response options were 1=not stressed at all, 2=a little bit stressed, 3=moderately stressed, 4=very stressed, and 5=extremely stressed.

**Table 2. Relationship between students' perceived influence of workshop sessions on exam grade and frequency of attendance in workshop sessions**

Student Group	N	Influence of Workshops	SD	Specific p-value	Total p-value
Attended 1 session	21	3.43	0.60		<0.001
Attended 2 sessions	34	3.88	0.54	0.006 (vs. 1 session)	
Attended 3 sessions	25	4.13	0.61	0.001 (vs. 1 session)	

Note: The "Influence of Workshops" column shows the mean value of students' perceived influence of workshop sessions on exam grade. Response options were 1=great negative influence, 2=some negative influence, 3=no influence, 4=some positive influence, and 5=great positive influence.

**Table 3. Relationship between students' mean exam scores and attendance in workshop sessions**

Student Group	N	Exam Score	SD	Total p-value
Did not attend	13	86.00	12.21	p<0.004 did not attend vs. attended p>0.05 for group comparisons
Attended 1 session	20	89.70	5.89	
Attended 2 sessions	34	88.44	7.10	
Attended 3 sessions	22	89.68	8.90	

those who did not attend any of the sessions (B+: 86.0±12.2,  $p<0.004$ ). No statistically significant differences in mean exam scores were found among students who attended one, two, or three of the workshop sessions. The mean exam score of students who attended one workshop session (89.70) was very similar to those who attended three sessions (89.68) and slightly higher than those who attended two sessions (88.44).

## Discussion

This study explored the impact of preparatory workshops on first-year dental students' academic performance and self-reported stress and preparedness levels during their first operative dentistry psychomotor examination. Some of the benefits from attending the workshop were a decrease in perceived stress and an increase in practice time outside of

course hours. Students who attended the workshop spent significantly more time practicing outside of class in preparation for the exam compared to those who did not attend. Students who attended three workshop sessions reported a statistically significant positive influence from the workshop on their exam grade when compared to students who attended one or two sessions. Therefore, students' perception of the positive influence of the workshop increased significantly with workshop frequency. Perhaps attending all of the workshops augmented students' understanding of course material as well as their familiarity with course demands and grading criteria. Importantly, participation in at least one workshop session also correlated with higher grades on the first operative psychomotor exam.

The American College Health Association-National College Health Assessment II (ACHA-NCHA II) is a national research survey that asks college students to indicate which health-related

factors affect their academic performance. The 2016 ACHA-NCHA II report noted that students recognized stress (32%), anxiety (25%), sleep difficulties (21%), and depression (15%) as the most prevalent factors affecting performance.<sup>8</sup> Not surprisingly, there has been growing interest in the negative impact of stress on dental students and in the development of stress-management strategies.<sup>9,10</sup> Academic stress may lead to reduced or compromised academic performance for dental students.<sup>11,12</sup> Dental education is known to be a highly demanding and stressful field of study.<sup>13</sup> In one study, despite considerable variation in perceived stressors among students at different dental schools, the results showed that self-efficacy concerns, performance pressure, and assigned workload were the main stressors for all participating dental students.<sup>14</sup> Another factor that students considered particularly stressful in that study was exams. Experiencing higher levels of stress during exam periods has been associated with poorer average grades.<sup>12</sup> Coping strategies have been proposed as one approach to reduce stress during exams and thus improve academic performance.<sup>12,15</sup> Our study found that the implementation of preparatory workshop sessions in dental curricula might also function as a stress management strategy. The workshops for students prior to enrollment in their initial operative dentistry course resulted in less perceived stress prior to the first psychomotor exam and also higher exam grades.

Initiatives similar to the one described here have been employed in other U.S. dental schools to support early development of psychomotor and self-assessment skills and to lessen students' stress and anxiety levels regarding psychomotor exams.<sup>13,16,17</sup> Gottlieb et al.'s study investigated whether advanced simulation parameters, such as simulation exam scores, number of student self-evaluations, time to complete the simulation, and time to complete self-evaluations, served as predictors of dental students' preclinical performance.<sup>16</sup> Results from that study highlighted the importance of early psychomotor skills assessment and suggested that advanced simulation scores may allow early intervention in students' learning process and assist in efficient allocation of resources such as faculty coverage and tutor assignment. Another example came from a pilot preclinical incentive program at Midwestern University College of Dental Medicine-Arizona called Simulation Clinic Culture of Excellence in Dentistry (SUCCEED).<sup>17</sup> This program was designed to motivate preclinical dental students to strive for

excellence through positive reinforcement and to encourage preparedness for preclinical labs and exams by remaining focused throughout the day and increasing the repetition of daily projects. The goal of the program was to increase the quantity of procedures being performed by students while continuing to emphasize quality.

Our study also suggests a potentially important role for third- and fourth-year student peers, who were teaching assistants and served as instructors of the workshop sessions. Conceivably, instruction received from peers may aid in decreasing stress and motivating students to practice more frequently because the peers have experienced the same course, were exposed to the same material, and may have faced similar challenges while learning the fine motor skills associated with operative dentistry.

Limitations of this study include the fact that no test was conducted prior to the workshops to compare the baseline knowledge of students who did and did not attend the workshops, and no other tests were performed during subsequent psychomotor exams. Without controlling the pre-workshop difference for student performance, there is no way to know if taking the workshops had a true impact on performance on the first exam or subsequent exams or if the observed changes were due to inherent differences among the student cohort such as prior performance and DAT scores. Thus, future studies should explore the impact of taking workshops before subsequent exams and then taking the post survey, so that a repeated measures design can help determine the true impact of workshop attendance while controlling for potential differences in student performance and achievement. Another limitation is that the study took place at only one dental school, so the results may not be generalizable to students in other programs.

The design of future preparatory workshops should also take into consideration the number of sessions and content of each session that are needed to benefit students' academic performance as well as the cost-benefit ratio of using additional school resources to plan and conduct such workshops. Perhaps, preparatory workshops may not be needed if the course curriculum can be revised to increase calendar hours and allow more practice time prior to psychomotor exams. The workshops described in this study were conducted at a time when increasing calendar hours of the Operative Dentistry I course was not feasible. Among the benefits of implementing these workshops were improved academic performance and decreased self-perceived stress levels

prior to the first operative dentistry psychomotor exam. The costs of implementing these workshops were minimal, considering the few hours spent by the course director on planning and the fact that teaching assistants, and not faculty, served as instructors.

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## Conclusion

The study findings support the development and implementation of preparatory operative dentistry workshops. Our results suggest that such workshops may help to provide early exposure to discipline material, use of handpiece instruments, and application of laboratory techniques; promote early development of psychomotor and self-assessment skills; improve academic performance; and lessen students' stress levels regarding the first psychomotor exam.

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