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Original article

Comparison of Performance on MCQ and Preclinical Practical Assessment at the End of Two Different Fixed Prosthodontic Semesters

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ABSTRACT

Objectives: *This study's objective was to examine the outcomes of pre-clinical practical tests and multiple-choice questions on fixed prosthodontics from various semesters for the same student group.* ***Material and Methods***: *This correlational study was conducted at the University of Tripoli's - Tripoli Dental Faculty - in the fixed prosthodontics department. The results of the MCQs and preclinical practical assessments were taken at the end of two different semesters. The group of dental students who were involved in this study was the same but they studied in two different semesters. The first semester was in Autumn 2018 and the second was in Spring 2019. The result of MCQs was obtained from the first semester at the end of the Autumn 2018 semester and the result of the preclinical practical assessment was obtained at the end of the Spring 2019 semester. These results were analyzed by using SPSS in order to compare these results.* ***Results***: *Data was collected from 232 students. The distribution of data was normal. The mean and standard deviation of scores for students were 34.61±6.66 for MCQs and 19.88±7.53 for the preclinical practical assessment. For the total number of students (N=232), a paired t-test was used to compare the results of the two exams (t = 23.314, d = 231, p 0.001). In order to use independed t-test, the number of females was reduced randomly to 47 students to ensure that female and male samples are similar in terms of number. The findings show that there was no statistically significant difference in both genders, however, females performed slightly better in both exams than males.* ***Conclusion***: *The achievement according to the domain varied. In the MCQs than in the preclinical practical exam, students did better. They had poor performance in the preclinical skills. Comparatively, female students performed better.*

Keywords: Knowledge, Skills, Multiple-choice question, Preclinical practical assessment, Miller's Pyramid.

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INTRODUCTION

The teaching and learning of dental students have always been a complicated process. Even the best teachers at the time may struggle in communicating knowledge and assessing its uptake. In addition, training in the laboratory for clinical procedural skills is considered an essential part of the core undergraduate dental curriculum. The basic undergraduate dentistry curriculum is deemed to be incomplete without laboratory training for clinical procedural skills. Simulated clinical and practical tools have recently gained popularity across the world. Therefore, the three aspects of assessment for knowledge, skills, and attitude must be provided to

evaluate the course. Policymakers are required to define the knowledge, skills, and attitudes that students are expected to acquire at various levels of their study and upon graduation under the outcome-based system of medical or dental education, which is becoming more common [1].

Assessment of gained knowledge is probably more difficult than delivering it. It requires an understanding of how well a student has learned and retained the information. In addition, assessing knowledge is important to provide feedback and make sure people are retaining what they learn. This can often require more specific methods to measure the comprehension of the student. There are a few ways to assess student knowledge and understanding, for example, traditional tests. These can be written tests or multiple-choice questions (MCQs). Multiple-choice questions (MCQs) are frequently used in testing courses because they are dependable, economical, and time-saving [2].

A clinical skill evaluation is far more crucial and difficult since it is directly related to patient care. The acquisition of an outcome indicates that the graduate is capable of completing clinical and practical tasks that are relevant to the condition of the patient and the theoretical knowledge. The student's assessments should be focused on achieving those outcomes, which are specifically stated in the training program's learning objectives. Teachers use assessment to determine whether or not the learning objectives of a given course have been met. The results of assessments have limited relevance in assessing a student's achievement if the tools used to collect the data are not properly matched with the desired learning outcomes [3]. To achieve these requirements, the student needs some background knowledge, the required skill, and the desired behavior to complete the required activity for each learning outcome or competence. Therefore, a successful undergraduate medical or dental education program should prepare the students with the knowledge, skills, and attitudes that assist them to achieve the desired outcomes. According to Millar 1980, the three fundamental pillars of medical and dental education are knowledge, skills, and attitude. Instead of focusing on just one of these factors, the assessment methods should be able to evaluate all three. A variety of assessment methods have been used to evaluate the effectiveness and comprehensiveness of the educational and clinical training that students have received [4].

The teaching and learning of dental students have always been a complicated process. In the clinical skills laboratory, using of simulated clinical and practical tools has recently gained popularity across the world. According to Taylor in 2013, the instruments which are available for evaluations for the preclinical practical procedure are addressed, with special emphasis on those used to gauge the clinical proficiency of dental students. Traditional teacher-led evaluations include subjectivity and assessor variability issues, which are noted. The use of glace and grade, checklists, and training are discussed. All assessment approaches for the dental clinic have their drawbacks and those that have been used to try to overcome them have been emphasized. Traditional techniques have a serious problem with subjectivity, but newer electronic gadgets that promise objectivity still need to be developed before the perfect evaluation tool can be made [5]. Therefore, clinical skill evaluation is far more crucial and challenging for teachers.

The present study was conducted to compare the assessment of dental students' competence and performance through the MCQ method and at the clinical skills laboratory in a fixed prosthesis course. By using Miller pyramidal, the same students were assessed in two different semesters. Know and know-how is evaluated for students who were in the fourth semester by using MCQs, while how was evaluated in the fifth semester by assessing students' performance (i.e. Tooth Preparation)? So, the purpose of the study is to evaluate and contrast the results from these two tests to determine if the undergraduate student has learned the knowledge and can apply it practically.

Null hypothesis: No relation exists between student performance (scoring) in MCQs and preclinical practical's in fixed prosthodontics, College of Dentistry, University of Tripoli.

METHODS

The sample of students (Total number = 232) was selected from the fourth semester of Autumn 2018, and the same students were also selected from the fifth semester of Spring 2019 to conduct this co-lateral study. In fact, the number of females (N= 185) was more than males (N= 47). Accordingly, the number of females was equalized with the number of males (N= 47 for each gender) to keep the sample in both groups equal when the independed t-test was used. The selection of the female's sample was random by using SPSS.

In the fourth semester, the students attended lectures on principles of tooth preparation, full coverage tooth preparations, and other subjects. The students this semester were examined theoretically by giving traditional multiple choice questions (MCQs) at the end of the semester (i.e. Autumn 2018). 50 multiple-choice questions (MCQs) with one correct answer formed the theoretical test. Each correct response received a score of one, while the incorrect response received a score of zero. There was a minimum score of 0 and a maximum score of 50 as a result. The teaching staff in the department of fixed prosthodontics corrected these questions.

In the fifth semester (i.e. Spring 2019), the same students attended pre-clinic sessions at the clinical skills laboratory. These sessions are related to all ceramic tooth preparations for the upper central incisor. In the first session, instructors provided an introduction for this task as a tutorial presentation. The students prepared artificial teeth of the upper central incisor to receive all ceramic crowns. They trained on artificial teeth for the entire duration of this semester. There were two instructors supervising each pre-clinic practice session in order to teach and evaluate the students' daily activities. At the end of the fifth semester, two instructors evaluated the performance of the students using a valid and reliable checklist. The average scores of pre-clinic exams for each student that were gained by two instructors were taken. The final score was a maximum of 30. This score was changed to 50 in order to compare it with the theoretical score of 50. Theoretical (i.e. MCQs) and preclinical practical assessments were part of exams at the end of the fourth and fifth semesters respectively.

The data was analyzed by SPSS software (version 22), using mean, standard deviation, paired, and in-depended t-test. P≤0.001 was considered significant. In addition, when using a t-test statistic, it is important to assume that the data follows some kind of normal distribution so that different outcomes based on an expected result can be accurately predicted probabilities.

RESULTS

Two hundred thirty-two students enrolled in two different semesters of fixed prosthodontics examination. The number of male students was 47, while female students were 185. Before the data analysis, the distribution of this data should be checked. Figure (1) illustrates that MCQ scores follow a normal distribution with a mean (34.61) and standard deviation (±6.664). Most of the scores cluster around the mean with fewer scores further away from it. The bell curve shape of this type of graph demonstrates how likely these data points are to fall within certain ranges relative to the mean value. This indicates that the questions were varied at different levels for the most of students.

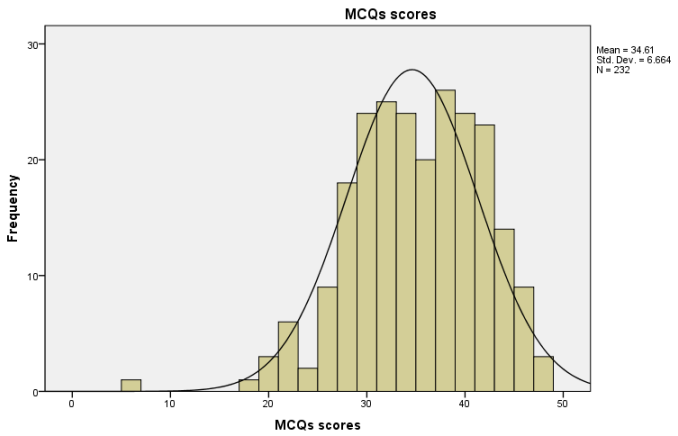

Figure 1: An overview of normal distribution for MCQs scores

On the other hand, figure (2) shows that preclinical scores follow normal destruction with a mean (19.88) and standard deviation (±7.524). The mean of preclinical practical scores is located under 20, while the mean of MCQ scores is over.

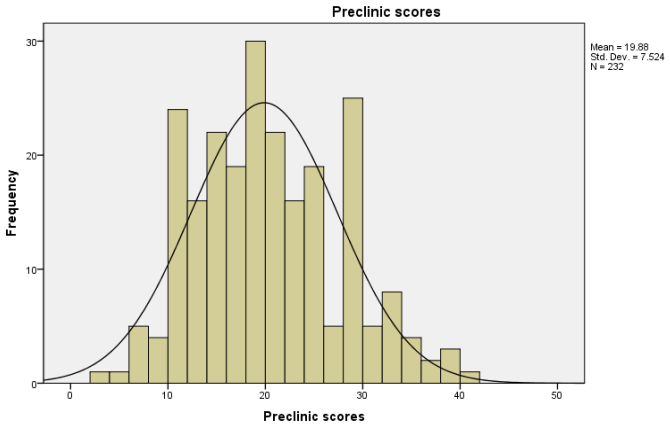

Figure 1: An overview of normal distribution for preclinical practicial scores

Table (1) shows the mean and standard deviation of scores obtained in the theoretical exam (MCQs) and scores taken on pre-clinical practical performance (34.61±6.664 and 19.88±7.524 respectively). The scores of the theoretical exam were better than the scores of the pre-clinical practical performance for the total group of students.

Table 1: Means and standard deviations of MCQs and preclinical practical scores for 232 students

Variables	Number of student	Mean	Standard deviation
Theoretical exam (MCQs)	232	34.61	6.664
Preclinical practical exam	232	19.88	7.525

Paired t-test was calculated for the total group (N=232) of students to compare between two exams in Table 2 (t = 23.314, d = 231, p < 0.001).

Table 2: Comparison of means of MCQs and preclinical practical exam result (Paired t-test) for 232 students

Variables	t	df	Significant <0.001
Theoretical exam (MCQs) - Preclinical practical exam	23.314	231	0.000

The number of female students and male students was 185 and 47 respectively. To apply the independed t-sample test, the number of female and male students should be equal. Some female students (N= 47) were chosen randomly from (N= 185) using SPSS to compare them with male students (N= 47) in terms of the theoretical (MCQs) and pre-clinical practical exams. To confirm the sub-set group (47 female + 47 males = 94), which represents the total sample of students (N= 232), mean, standard deviation, and paired t-test were calculated for the MCQs and pre-clinical exam (34.23±7.342 and 19.94±7.775 respectively) (t= 14.505, d= 93, p < 0.001) (Table 3 and 4). In addition, table 4 shows that there was a significant difference between the two exams for the subset group.

Table 3: Means and standard deviations of MCQs and preclinical practical scores for 94 students

Variables	Number of student	Mean	Standard deviation
Theoretical exam (MCQs)	94	34.23	7.342
Preclinical practical exam	94	19.94	7.775

Table 4: Comparison of means of MCQs and preclinical practical exam result (Paired t-test) for 94 students

Variables	t	df	Significant <0.001
Theoretical exam (MCQs) - Preclinical practical exam	14.505	93	0.000

Table (5) illustrates means and standard deviations for both exams by gender. The performance of two exams shows that female students were better than male. Table 6 shows that there was no significantly different when the means of MCQs scores compared with the mean of preclinical practical scores in both gender.

Table 5: Means and standard deviations of MCQs and preclinical practical exam result according to gender for 94 students

Variables	Gender	Number of student	Mean	Standard deviation
Theoretical exam (MCQs)	Male	47	34.00	7.135
	Female	47	34.47	7.612
Preclinical practical exam	Male	47	19.85	7.596
	Female	47	20.02	8.031

Table 6: Comparison of means of MCQs and preclinical practical exam result (independed t-test) by genders for 94 students

Variables		t	df	Significant <0.001
Theoretical exam (MCQs)	Equal variances assumed	-0.308	92	0.759
	Equal variances not assumed	-0.308	91.617	0.759
Preclinical practical exam	Equal variances assumed	-0.106	92	0.916
	Equal variances not assumed	-0.106	91.716	0.916

DISCUSSION

The objective of the dentistry curriculum is to create clinically competent dentists who can work independently, are capable and critical thinkers, and are lifelong learners [6]. To get experience as a dentist, dental students take a variety of practical and clinical courses [7,8]. Numerous studies have determined the characteristics that dental educators believe make an effective laboratory instructor, such as setting clear objectives and expectations for practical courses [4,5]. Multiple-choice questions (MCQs) and preclinical practical evaluations are crucial parts of end-of-semester exams in fixed prosthodontics courses. According to studies, preclinical skills tests are more suited for testing procedural activities like the clinical hand skills needed to treat patients [4,5], but MCQs can measure most learning objectives linked to theoretical information accurately [2,4].

Multiple-choice questions (MCQs) are a more reliable way of assessment when it comes to gauging higher-order cognitive (Theory Exam) abilities than modified essay questions (MEQs), which only cover cognitive (Theory Exam) level III of the modified Bloom's taxonomy in 40% of circumstances [9]. According to Khan and Aljarallah, students who scored well in the MCQs also produced superior results in the short answer questions (SAQs); this link was statistically significant. This association shows that although both evaluation techniques assessed the same cognitive domain, they were different [10]. MCQs are simple to mark but extremely challenging to develop with good validity and integrity, particularly at higher levels of cognitive evaluation [2,11]. Seventy percent of students believed that going through previous papers and books with solved MCQs is sufficient to pass MCQ exams, whereas 20% of students disagreed that MCQ papers covered a wide range of information. This suggests that they were employing the surface learning strategy, which may have contributed to them receiving lower marks in the written evaluation [10]. On the other hand, Miller's pyramid provided a guideline for creating multiple choice questions that provides helpful tips on writing effective MCQs. Some of these points are that: only one correct answer can be selected; the language of the question must be clear and understandable; the questions must be at balance difficulty levels such as some questions easy, some medium, and some hard [4]. So, if the MCQs are valid and reliable, a knowledge assessment can be done.

When evaluating students' performance in the clinic, a significant range of examiner variability has been noted, with inconsistent results about the likely causes. In an attempt to improve consistency and agreement, researchers have concentrated on assessment tools [5]. As Manogue et al. in 2001 found, although the "glance and grade" method is a commonly utilized tool for assessment in dentistry education, assessors do not regard it highly, however, this method is widely used [12]. Using the criteria and checklist, Goepferd and Kerber discovered an improvement in both intra- and inter-examiner agreement [13]. So, the checklist for this study was selected in order to assess student performance at the preclinical skills laboratory.

From previous, MCQs, generally, are used as a means for determining if students understand key concepts related to a particular area of study without needing any additional information besides what is presented in the question itself [14]. Preclinical practical performance refers to how well students can actually perform tasks related to their field of study – such as preparing teeth for crowns or bridges [5]. A successful score would demonstrate that students have learned these skill sets and are able to apply their knowledge practically during clinical situations [14]. MCQs and preclinical practical skill performance were chosen as a result and comparing these performances became essential.

This study is the first to be conducted in a dentistry college setting in Tripoli. The purpose of the study was to examine the relationship between students' performances on MCQs and their preclinical practical assessment in fixed prosthodontics at the dental college. During the end of two different semesters of fixed prosthodontics exams, it appears that there is a discernible difference between performance levels on MCQs and preclinical practical skill assessments (Psychomotor), emphasizing the significance of using both evaluations within the educational setting for this subject area. Additionally, patterns in the data were examined; for example, did student performance increase with time? Did the performance on MCQs and preclinical practical skills differ in any way? to determine which course had more productive results. The results show that there was a significant difference between students' MCQ scores and preclinical practical performances – with students scoring higher overall in their MCQ scores compared to their preclinical practical assessment scores. This is likely due to several factors, including increased familiarity with answering traditional paper-based tests like MCQs, the greater difficulty associated with performing complex procedures under time constraints during an exam setting, or simply anxiety associated with having someone observing them carrying out the procedure [15]. On the other hand, the psychomotor (practical, clinical, OSCE, and OSPE) domain requires improvement in the abilities of undergraduates [10]. Before a test, the students should have enough time to practice the skill. The teachers should be in direct control at all times. To prepare for each practical or clinical practice, have the students create a skills checklist. Correct performances or demonstrations of the skill should be made at the conclusion of each practical or clinical session [16]. In addition, the students acquired the knowledge from the fourth semester and then applied it in the fifth semester. The period between the two exams, which was long, may be the reason for the lack of connection between theory and practice for dental students.

Although the study of Faisal et. al., found no differences in academic performance on the basis of gender [17], the findings of Memon and Shaikh showed that female students performed better than male students in both exams. Their findings supported our results [10]. On the other hand, there is no significant difference between the means of scores of female and male students in MCQs and preclinical practical procedure. In spite of that the result showed that there is no clear difference in both exams according to gender, scores of female students in both exams have slightly better than the male students. The discrepancy may be due to the fact that female students typically choose group discussion and deep learning methods for their coursework, which led to better results in both assessment domains despite the differences in the content, environment, assignment, and examiners [18].

The findings of this study support the claim that there are differences in domain-based achievement among dental graduate students who are in the fourth and fifth semesters. So, they support the null hypothesis. In addition, if there is a big gap (i.e. time) between the knowledge and skills, it will lead to reducing the relationship between students' scores in MCQs and preclinical practical performance.

CONCLUSION

The comparison between students' performances in MCQs and preclinical practical procedures demonstrates that students' knowledge of theoretical concepts is not always transferable to a real-world scenario. Therefore, there is a significant difference between the two exams. In order for students to become fully competent practitioners, they must develop both a strong base of theoretical understanding and the skills necessary to apply this knowledge in practical settings. This requires an integrated approach involving hands-on learning experiences, simulation-based activities, and personalized feedback from students and faculty members. Ultimately, by emphasizing both theory and practice within dental curricula, educators can create safe learning environments where students develop the confidence needed to become successful dentists for both genders.

Limitation of the study

The main limitation of this type of study is that it can be difficult to measure how well students actually understand and apply knowledge in real-world setups. Furthermore, exams such as MCQs may not accurately reflect all aspects of a student's knowledge or performance in a clinical setting. Additionally, there may be other factors at play that could influence a student's success on these exams, such as atmosphere, prior experience, or motivation levels.

Recommendation

The recommendations that must be presented are as follows:

- Not presenting the theoretical in one semester or year and the practical in another.
- Take into account the quality of the questions as well as the practical.
- The theoretical and practical period is short in the semester system, so it should be extended more.
- The quality of teaching and teaching methods in the college must be evaluated.
- Creating another research in order to confirm that the theoretical and the practical must be inseparable (correlative) with each other for the same year.
- Should be known the cause of this outcome may be based on the psychological makeup of the dentistry students, the theoretical curriculum, or the teacher's abilities

Disclaimer

The article has not been previously presented or published, and is not part of a thesis project.

Conflict of Interest

There are no financial, personal, or professional conflicts of interest to declare.

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