

Research Article

Comparison of Dental Students' Ability to Answer PMP-MEQ and MCQ Tests and Its Association with Educational Progress

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Abstract: Patient Management Problem (PMP) is an assessment tool for students of medical sciences, which assess the students' comprehension of different aspects of health and disease. The current study was aimed at comparing the dental students' ability to answer Patient Management Problem (PMP) and Modified Essay Question (MEQ) examination with Multiple-Choice Question (MCQ) tests, and its relation with educational progress. This descriptive-analytical cross-sectional study was performed on 62 dental students of Kerman University of Medical Sciences, Iran, who were selected by census. The first test was PMP-MEQ consisting of 2 Multiple-Choice Questions with 5 possible answers and 3 essay type questions. Two weeks later, the second stage was performed in form of an MCQ test consisting of 10 questions with 4 possible options. The student's total grade-point average (GPA) in 5 consecutive semesters, GPA of the last semester, and the score obtained in theoretical pediatric dentistry 3 course were considered as indices of educational progress and were compared with the scores achieved in the tests. Data were analyzed by using descriptive and analytical statistics. There was a statistical significant correlation between the student's educational progress and the score of MCQ test ($P < 0.001$). Meanwhile, there were no statistical significant relationship between the educational progress and the scores of PMP-MEQ test. Therefore, the result indicates that despite high grade-point average (GPA) and good practical information, the students were weak at reasoning and clinical judgments. It was also detected that the students' ability to respond PMP-MEQ tests were lower than their ability in MCQ test.

Keywords: Patient management problem (PMP), Modified essay question (MEQ), Multiple-choice question (MCQ), Educational progress, dental students.

INTRODUCTION

For almost 30 years, Problem-Based Learning (PBL) has been widely used in medical, dental, physiotherapy, occupational therapy, speech pathology, and paramedic curricula. PBL courses are mainly designed according to some educational principles such as decreasing the factual knowledge to increase self-directed learning and communication skills in students, encouraging combination of basic and clinical sciences, community-related issues in small-groups [1].

American and European Universities of Medical Sciences have been assessing the students through Multiple-Choice Questions (MCQ) for over 35 years. Nonetheless, MCQ examinations are of little value for PBL courses since they have the students concentrate more on details instead of achieving the desired skills in PBL. Moreover, measuring the

students' knowledge through MCQ tests is of limited validity and most questions are ignored [2].

Several suggestions have been made to improve the quality of MCQs [3, 4]; however, none of them could have ever enhanced the power of MCQs to evaluate the students' competence and cognitive skills [5]. Assessing dental students' competence is of high importance since they are going to handle patients' lives in future [6]. General dental students' skills must be assessed in cognitive, affective, and psychomotor domains. The cognitive domain can, in turn, be evaluated in different levels of skills such as knowledge, application, analysis, and synthesis [7]. In medical education, evaluation of problem-solving skills is so emphasized that the students should spend most of their time analyzing patients' problems [8].

Using suitable tools for cognitive assessment encourages the students in increasing abstract thinking and cognitive skills [9]. The students' knowledge can be assessed by a number of methods including free-response examinations, Multiple-Choice Questions, Key-Feature Questions, self-assessment and peer-assessment. Each of these has advantages and disadvantages and evaluates different levels of knowledge. As none of them is specifically superior, a valid and reliable assessment demands a combination of these methods [6, 9].

Patient Management Problem (PMP) is an assessment tool for students of medical sciences, which has been actively developing in recent years. It is responsive to the concerns that existed about older methods such as MCQ. Thus, PMP exam is a reliable way to assess the students' comprehension of different aspects of health and disease. PMP exams expose the students to a situation similar to real life and make them solve or treat a clinical problem. While in MCQ tests only correct responses count; PMP reveals the performance result of test-taker, as well [10].

One of the important aspects to be evaluated in students of medical sciences is their knowledge, which is effectively possible only through MCQ examinations. Meanwhile, assessing the students' clinical skills requires other tools, one of the most liked of which is PMP. The PMP is a written test beginning with a description of a patient's problem; the students must collect the required information through history and clinical examination and ultimately make a diagnosis and plan the appropriate treatment [11].

Modified Essay Questions (MEQs) are short clinical scenarios followed by a number of structured questions. This tool primarily evaluates the students' factual recall in addition to their cognitive skills such as organization of knowledge, reasoning, and problem solving. It also investigates the students' writing skills, ethical and social issues, and attitudes. Although MEQs are so flexible and fall between essay type questions and MCQs in terms of value, they must be meticulously designed with model answers [12, 13].

In a study, Zafar-Khan *et al.* compared MCQ and MEQ in assessment of medical students' cognitive skills and found that a well-constructed MCQ is superior to MEQ in testing the above-mentioned item. They also announced that it is not easy to construct an MEQ for evaluation of the students' cognitive skills since problems in writing the items occurs so frequently [8].

A different study enrolled by Mahmoodi and Dehghani revealed that the ability of nutritional sciences students in answering PMP tests was less than MCQs. Lack of correlation between the scores of MCQs and educational progress demonstrated that

students were weak at reasoning and clinical judgment [14].

Ways to evaluate the students' ability are various and must be selected with respect to the objectives and criteria [15]. Since students of medical sciences, dental students included, are involved in people's health, evaluating their performance and clinical competence is significantly important. Hence, PMP method has been introduced since 1980 to assess reasoning, competence, and clinical judgment of undergraduate and graduate students. The current study was aimed at comparing the dental students' ability to answer PMP-MEQ and MCQ tests, and its relation with educational progress.

METHODS

This descriptive-analytical cross-sectional study was performed in 2015 school-year. A total of 62 cooperative dental students who had taken theoretical pediatric dentistry 3 course in that term were selected by census. Based on the lesson plan and educational content, theoretical pediatric dentistry course was represented in form of lectures and slide shows. By the end of the term, MPM-MEQ method was explained to the students and they had 2 weeks to prepare for the test.

The first test was PMP-MEQ consisting of 2 multiple-choice questions with 5 possible answers and 3 essay type questions. Two weeks later, the second stage was performed in form of an MCQ test consisting of 10 questions with 4 possible options. The student's total grade-point average (GPA) in 5 consecutive semesters, GPA of the last semester, and the score obtained in theoretical pediatric dentistry 3 course were considered as indices of educational progress and were compared with the scores achieved in the tests. The indices of students' educational progress were ranked as following; $A \geq 18$, $17.98 \leq B \leq 16$, $15.98 \leq C \leq 14$, $13.98 \leq D \leq 12$.

Ethics were taken into considerations in this study and the students were assured that the information would be confidential. The PMP-MEQ test was prepared by the lecturer based on the practical guide proposed by Harden [16], Farmer, and Page [17]. Data were analyzed by using descriptive and analytical statistics such as absolute and relative frequency distribution, mean, standard deviation, Chi-square and t-test, as well as Pearson correlation coefficient. SPSS software, version 16, was used for all the statistical measurements performed in this study.

RESULTS

Table 1 displays the correlation between the indices of educational progress and the scores achieved in MCQ and PMP-MEQ tests. There was a significant correlation between the student's GPA and the score of theoretical pediatric dentistry 3 course and the score of

MCQ test. Meanwhile, no significant relationship existed between the educational progress indices and the scores of PMP-MCQ test.

Table 2 represents the mean \pm SD scores of PMP-MEQ and MCQ tests in the two groups of students with average A and B, and students with

average C and D, divided based on the GPA in 5 consecutive semesters and GPA in the last semester.

The frequency distribution of students' scores in PMP-MEQ and MCQ tests is shown in table 3 and 4 according to the students' GPA (A, B, C, and D).

Table-1: The correlation coefficient between the indices of educational progress and the scores achieved in MCQ and PMP-MEQ tests

Indices	GPA in 5 Semesters	GPA in the Last Semester	Score of Theoretical Pediatric Dentistry	MCQ Test Score	PMP-MEQ Test Score
GPA in 5 Semesters	1	** 0.536	** 0.560	* 0.368	-0.022
GPA of the Last Semester		1	** 0.437	0.209	0.095
The Score of Theoretical Pediatric Dentistry			1	* 0.347	0.061
MCQ Test Score				1	-0.184
PMP-MEQ Test Score					1

** P value < 0.001 * P value < 0.01

Table-2: the mean \pm SD test scores of the students in groups with GPA a and B, and C and D based on GPA in 5 semesters and GPA of the last semester

	GPA in 5 Semesters			GPA in the Last Semester		
	Average A and B N=20	Average C and D N=42	P.value	Average A and B N=15	Average C and D N=47	P.value
MCQ test scores	13.6 \pm 2.8	11.0 \pm 3.0	0.002	13.5 \pm 3.3	11.3 \pm 2.9	0.020
PMP-MEQ test scores	7.0 \pm 5.7	8.6 \pm 5.4	0.279	8.3 \pm 4.8	8.0 \pm 5.8	0.855
PMP section scores	1.0 \pm 1.5	1.4 \pm 1.7	0.333	1.3 \pm 1.6	1.3 \pm 1.6	0.907
MEQ section scores	6.0 \pm 4.8	7.4 \pm 5.3	0.307	7.0 \pm 4.1	7.0 \pm 5.5	0.984
Pediatric Dentistry scores	15.3 \pm 1.6	13.0 \pm 1.9	0.001	15.2 \pm 1.9	13.2 \pm 1.9	0.001

*A \geq 18, 17.98 \leq B \geq 16, 15.98 \leq C \geq 14, 13.98 \leq D \geq 12

Table-3: Absolute and relative frequency distribution of MCQ test scores based on GPA in 5 consecutive semesters*

MCQ Scores GPA	<12	12-14	14-16	16-18	18-20	Total
A	0	0	0	0	0	0 (0.0%)
B	3	8	3	2	4	20 (32.3%)
C	16	13	3	3	1	36 (58.1%)
D	5	0	1	0	0	6 (9.6%)
Total	24 (38.7%)	21 (33.8%)	7 (11.3%)	5 (8.1%)	5 (8.1%)	62 (100%)

*A \geq 18, 17.98 \leq B \geq 16, 15.98 \leq C \geq 14, 13.98 \leq D \geq 12

Table-4: Absolute and relative frequency distribution of PMP-MEQ test scores of students with A, B, C, and D GPA in 5 consecutive semesters*

PMP-MEQ scores GPA	<12	12-14	16-14	16-18	18-20	Total
A	0	0	0	0	0	0 (0.0%)
B	16	1	1	1	1	20 (32.3%)
C	23	5	4	4	0	36 (58.1%)
D	5	0	1	0	0	6 (9.6%)
Total	44 (71.0%)	6 (9.6%)	6 (9.6%)	5 (8.1%)	1 (1.7%)	62 (100.0%)

*A≥18, 17.98≤B≥16, 15.98≤C≥14, 13.98≤D≥12

DISCUSSION

The results of this study revealed a significant correlation between the indices of educational progress and the scores of theoretical pediatric dentistry course with the MCQ test scores. However, no significant correlation was observed between the educational progress indices and the PMP-MEQ test scores. It indicates that despite high GPA and good practical information, the students were weak at reasoning and clinical judgment. It was also detected that the students' scores in PMP and MEQ tests were lower than their scores in MCQ test, implying their low ability to respond PMP-MEQ tests. MCQ tests are employed in many training courses of medical sciences to reinforce learning [18].

MCQs are frequently used in evaluation of students of professional doctorate as a valid and reliable method. Additionally; it is suitable for assessing large number of students. This method is great for assessing knowledge; however, barely can it evaluate the students' problem-solving skills effectively. A large part of the curriculum can be assessed by this tool, besides it can be simply scored by use of specified computer software. Yet, designing an appropriate MCQ is difficult and requires special skill. Generally, MCQ causes the students study superficially only to pass the exam [19, 20].

According to the performed studies, changing the evaluation methods can make the students' obtain mental and reasoning skills in addition to knowledge and cognitive skills [8]. The students' range of capability can be accessed through various methods which must be chosen with respect to educational objectives [15]. A study enrolled in India showed that a single method cannot assess all items in dental students; rather, several methods are needed to assess dental students' knowledge and skills [21]. In order to effectively complete their education, dental students must learn a series of motor skills and treatment principles [22].

Examination and evaluation is the source of stress and anxiety for students of professional doctorate; but the fact is that it guides them in studying more efficiently and improving their clinical skills. Thus, evaluation and examination not only stimulates the

students' cognitive skills during the educational period, but also evaluates their intellectual skills and reasoning repeatedly [23-25].

Studies showed that professors usually choose assessment methods that are less time-consuming; consequently, most educational objectives are neglected. This contradicts the fact that the students' ability and competence must be evaluated through a real assessment on which adequate time is spent and is concentrated on educational objectives [26].

Based on the findings of our study, the students' unfamiliarity with PMP test might have caused them to get lower scores in this type of test compared with MCQs. Due to the numerosity of student in schools of dentistry, MCQ tests are mostly used since they require less time and are easier to correct. This has made the students to be barely familiar with PMP tests and subsequently their clinical reasoning ability is not satisfactory.

Choosing the most appropriate type of written test to assess an educational purpose is generally difficult. MCQs can be used for any type of evaluation other than the cases in which the students' creativity, hypothesizing, and practical skills are to be tested [27].

In a study in 2009, dental students' and residents' knowledge and competence on implant was evaluated by using various tests such as PMP-MEQ and MCQs. The authors concluded that the students should be assessed in all levels from basic theoretical knowledge to practical skills. They also announced that a single assessment method is not solely suitable for testing all educational aspects [28].

Albino *et al.* claimed existence of some relatively novel techniques for dental education that can comprehensively evaluate several skill domains [29]. In their systematic review, Wilkinson *et al.* reported that many studies have been conducted on the relationship between educational progress and different assessment methods. The results revealed a significant relation between the students' educational progress and their assessment scores [30]. However, the current study found no significant relationship between these two; which can be due to the differences in educational structures and assessment method in each university.

CONCLUSION

According to the findings of this study, there was a significant relationship between the educational progress indices and scores of MCQ test; while, the relation between the same indices and PMP-MEQ test scores was not significant. Furthermore, the students' scores in PMP-MEQ test was quite lower than their scores in MCQ test.

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