Journal of
Babol University of Medical Sciences
JBUMS
e-ISSN: 2251-7170 p-ISSN: 1561-4107

An Evaluation of the Practical Competencies of General Dentistry Students

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Article Type
Research Paper

Received:
Feb 16th 2025
Revised:
Apr 5th 2025
Accepted:
May 5th 2025

ABSTRACT

Background and Objective: Considering the indicators presented in the new curriculum regarding the competencies of dental students in acquired practical skills based on their department, the present study was conducted to determine the practical competencies acquired in different clinical departments of the School of Dentistry, Guilan University of Medical Sciences, from the perspective of senior students based on the new curriculum.

Methods: This cross-sectional study included 66 senior general dentistry students at Guilan University of Medical Sciences during the 2020-2021 academic year based on a census. Data were collected and analyzed using a researcher-made online questionnaire using the latest edition of the new general dentistry curriculum, designed in 2017.

Findings: According to the results of the study, in terms of acquired practical skills, the highest score was related to the restorative dentistry department (89.22±14.56) and the lowest score was related to the pathology department (43.46±19.89) ($p<0.001$). Only the score of acquired practical competencies in the field of periodontics increased with age ($p=0.049$). The mean competency score in the field of orthodontics ($p<0.001$) and pediatric dentistry ($p=0.033$) in Anzali Pardis Faculty was higher than Rasht Faculty of Dentistry. In addition, no significant relationship was observed between acquired practical competencies and gender and marital status.

Conclusion: The results of the study showed that the practical competency of the students was at a desirable level in most cases. However, it was not desirable in the departments of periodontics and orthodontics, as it seems that necessary planning should be considered by the authorities to provide enough patients for appropriate and sufficient training based on the educational curriculum in different departments of the faculty, especially the departments of periodontics and orthodontics.

Keywords: *Practical Competencies, Education, Dentistry, Students*.

Cite this article: Khoshrang H, Dadgaran I, Pourvakhshoori N, Khoshbakht Pishkhani M, Peyrovi F, Hendi A. An Evaluation of the Practical Competencies of General Dentistry Students. *Journal of Babol University of Medical Sciences*. 2025; 27(Suppl 1): e6.

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[DOI: 10.22088/JBUMS.27.SUPPLEMENT_1,_MEDICAL_EDUCATION,_.6]

Introduction

Competency-based education is a planned collection for student development to acquire various competencies step by step and focuses on essential knowledge, professional clinical skills, and ethical principles (1, 2). This type of education has several benefits, including enhancing student performance through active participation in problem-based learning, encouraging students to critically evaluate their competencies, and improving communication with the healthcare environment regarding important issues in education (3, 4). In the field of medical education, competency-based education is considered by many experts to be the basis of medical education. This type of learning aims to emphasize clear and necessary learning outcomes for the profession, which must be taught precisely, and competencies must be carefully measured in assessments. The competency-based learning approach focuses on learners who can apply their learning and provide services following professional standards (5, 6). In dentistry, due to the high volume of practical units and the complexities of skill learning, clinical education requires special attention (7, 8). Clinical experiences during preparation and skills acquired in dental education programs have an important place (9-11). The significance of preparing students to maintain and develop practical competencies in performing desirable dental treatments throughout their careers has been well proven (12). Various institutions have also emphasized the importance of competency-based education and have included it in all stages of education, from the learning process to entering the clinical environment (13, 14). Therefore, medical universities should formulate their educational objectives and curricula based on these goals (15).

To achieve optimal clinical education and competent graduates, continuous assessment of the status of education and identification of its strengths and weaknesses should be carried out (14). Examining the effectiveness of competency-based learning requires a revision of existing curricula. For this reason, this type of education continuously requires appropriate methods for assessing students' clinical skills (16, 3). In this regard, considering the review and implementation of fundamental changes in the new educational curriculum of the general dentistry course in 2017, such as changes in the details and the minimum number of practical skills required in clinical practical units, emphasis has been placed on observing professional ethical principles with the patient. Given the lack of sufficient studies on the indices set in the new curriculum in relation to the competencies of dental students regarding acquired practical skills based on educational departments and groups, and considering that students' opinions about the content, structure, and quality of the training and finding the strengths and weaknesses of the clinical aspects of the clinical departments are an essential part of the comprehensive evaluation of the general dentistry curriculum and are an important source of information for policymakers to review, formulate, monitor, and evaluate the educational program optimally, this study was conducted to investigate the level of practical competencies acquired in different clinical departments of the School of Dentistry of Guilan University of Medical Sciences from the perspective of senor students based on the new curriculum for the general dentistry course approved in 2017.

Methods

After approval by the Ethics Committee of Guilan University of Medical Sciences with the code IR.GUMS.REC.1399.435, this cross-sectional study was conducted in 2021 with the participation of 66 senior general dentistry students (49 from Rasht branch and 17 from Anzali Pardis). The sampling method was based on a census. The inclusion criteria included being employed and willing to participate in the study, and the exclusion criterion included not completing the questionnaire completely. The data collection

[DOI: 10.22088/JBUMS.27.SUPPLEMENT_1._MEDICAL_EDUCATION,_.6]

method in this study included a researcher-made online questionnaire that was designed using the latest edition of the new general dentistry curriculum in 2017, which was calculated to be valid based on CVR=0.91 and CVI=0.88. Cronbach's alpha was used to determine reliability, and its value was 0.91. This questionnaire consists of 126 questions and 3 sections: demographic information (6 questions), practical skills acquired for observing professional ethical principles (10 questions), practical skills acquired in the field of oral and maxillofacial pathology (8 questions), practical skills acquired in the field of orthodontics (8 questions), practical skills acquired in the field of endodontics (9 questions), practical skills acquired in the field of oral and maxillofacial pathology (9 questions), practical skills acquired in the field of dental prostheses (23 questions) which included complete prostheses (9 questions), partial prostheses (5 questions), fixed prostheses (9 questions), and dental prostheses (23 questions), practical skills acquired in the field of periodontics (14 questions), practical skills acquired in the field of restorative dentistry (9 questions), practical skills acquired in the field of oral and maxillofacial surgery (9 questions), practical skills acquired in the field of in the field of oral and maxillofacial radiology (9 questions) and the ability to acquire practical skills in the field of pediatric dentistry (12 questions). The scores obtained from the questionnaire were in a five-option range, with the score for each option ranging from "I did not learn the skill at all" with a score of 1 to "I can do it alone" with a score of 5. The mean score above the 75th percentile was considered to be a student with good skills in that field, if it was between the 50th and 75th percentile, it was considered to have average skills, and if it was less than the 50th percentile, it was considered as poor skills in each area.

In this study, after the approval of the Vice Chancellor for Research and Technology and the University Ethics Committee regarding the implementation of the project and obtaining the approval from the Faculty of Dentistry, a meeting was held by the project implementers with the senior students of the field of dentistry (at the Faculty of Dentistry, Rasht Branch and Anzali International Branch) regarding the necessity of opinion polls and the role of students in improving the quality of the faculty's curriculum. Before conducting the research, the researchers explained the objective of the research to the students, and after obtaining their consent, the questionnaire was made available to the students online using the Porsline software. Considering that a code was considered for each student, it was ensured that the questionnaire was filled out twice. Descriptive statistical methods of mean and standard deviation, frequency and percentage, independent t-test, and repeated measures tests with Huynh-Feldt correction were used for data analysis. Bonferroni pairwise comparisons were used for inter-temporal comparisons in this test, and considering the lack of assumptions in some objectives, Mann-Whitney and Spearman correlation tests were used. The Shapiro-Wilk test was also used to check the normality of the data, and Levon's test was used to check the homogeneity of variance of the studied groups, and $p<0.05$ was considered significant.

Results

The study findings showed that the overall mean age of the subjects was 25.05±2.20 years, with the lowest and highest ages being 22 and 34 years, respectively. Of these, 20 (30.3%) were male and 46 (69.7%) were female. 61 (92.4%) were single and 5 (7.6%) were married. 49 (2.0%) were from Rasht Faculty, and 17 (25.8%) were from Anzali Faculty. The results of comparing the level of practical competencies acquired in dentistry based on different educational departments showed that there was a significant difference between the level of practical competencies acquired in different departments ($p<0.001$) (It is worth noting that due to the difference in the range of scores obtained in each department, all scores for each department have been converted to a range of 0 to 100 in order to equalize the scores for comparison). The highest score was for the restorative dentistry department, and the lowest score was for the pathology department

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(Table 1). On the other hand, a pairwise comparison of practical competencies acquired in dentistry based on different departments showed that the score of the pathology department was significantly lower than other departments (Table 2).

The results of comparing the level of practical competencies acquired in dentistry based on some demographic characteristics showed that some practical competencies were significantly related to age. Based on the obtained results, it was determined that there was a direct and significant relationship only between the competency score in the field of periodontics and age (p=0.049). Therefore, with increasing age, the score of practical competencies acquired in the field of periodontics increases (Table 3). (It is necessary to note that due to the difference in the range of scores obtained in each section, all scores in each section have been converted to a range of 0 to 100 in order to equalize them).

Furthermore, comparing the scores of practical competencies acquired in dentistry based on faculty showed that there is a significant relationship between competencies in the field of orthodontics (p<0.001) and pediatric dentistry (p=0.033) and faculty. Thus, the mean score of competencies in the field of orthodontics and pediatric dentistry in Anzali Pardis faculty was higher than in Rasht faculty (Table 4). However, there was no statistically significant relationship between any of the practical competencies and gender and marital status (Tables 5 and 6).

Table 1. Summary of the results of determining and comparing practical competencies acquired in the field of dentistry based on different departments

Department	Mean±SD
Pathology	19.89±43.46
Orthodontics	22.80±62.21
Endodontics	9.55±88
Oral and maxillofacial pathology	17.69±73.31
Dental prostheses	15.21±81.17
Periodontics	16.93±54.84
Restorative dentistry	14.65±89.22
Oral and maxillofacial surgery	14.13±82.61
Oral and maxillofacial radiology	12.36±87.54
Pediatric dentistry	16.13±78.50

Table 2. Pairwise comparison of practical competencies acquired in dentistry based on different departments

Department	Trauma	Orthodontics	Endodontics	Pathology	Prosthesis	Prosthesis	Periodontics	Restorative	Surgery
Orthodontics	<0.001								
Endodontics	<0.001	<0.001							
Pathology	<0.001	0.035	<0.001						
Prosthesis	<0.001	<0.001	0.021	0.187					
Periodontics	0.008	0.771	<0.001	<0.001	<0.001				
Restorative	<0.001	<0.001	0.999	<0.001	0.014	<0.001			
Surgery	<0.001	<0.001	0.115	0.028	0.999	<0.001	0.032		
Radiology	<0.001	<0.001	0.999	<0.001	0.066	<0.001	0.999	0.588	
Pediatric	<0.001	<0.001	<0.001	0.999	0.999	<0.001	<0.001	0.999	0.001

[DOI: 10.22088/JBUMS.27.SUPPLEMENT_1_MEDICAL_EDUCATION_6]

Table 3. Summary of results of the relationship between practical competencies acquired in dentistry by age

	Age*
Observing ethical principles	r=-0.014, p=0.256
Pathology	r=0.006, p=0.962
Orthodontics	r=0.15, p=0.219
Endodontics	r=0.04, p=0.696
oral and maxillofacial pathology	r=0.05, p=0.670
Dental prostheses	r=0.13, p=0.283
Periodontics	r=0.24, p=0.049
Restorative dentistry	r=0.09, p=0.447
Oral and maxillofacial surgery	r=0.18, p=0.145
Oral and maxillofacial radiology	r=-0.04, p=0.704
Pediatric Dentistry	r=0.14, p=0.257

*Spearman's

Table 4. Summary of results of determining and comparing practical competencies acquired in dentistry based on the faculty

Competency	Faculty	Number	Mean±SD	Test statistic	p-value
Observance of ethical principles**	Rasht	49	r=0.013	-1.39	0.163
	Anzali	17	r=0.13		
Pathology*	Rasht	49	18.11±41.19	-1.59	0.117
	Anzali	17	23.75±50		
Orthodontics*	Rasht	49	22.57±56.31	-3.95	<0.001
	Anzali	17	13.02±79.22		
Endodontics*	Rasht	49	10.08±88.09	0.12	0.898
	Anzali	17	8.10±87.74		
Oral and maxillofacial pathology**	Rasht	49	16.38±72.96	-0.90	0.366
	Anzali	17	21.57±74.35		
Dental prostheses*	Rasht	49	16.16±80.10	-0.97	0.334
	Anzali	17	11.94±84.27		
Periodontics**	Rasht	49	15.79±53.46	-0.47	0.633
	Anzali	17	19.85±58.82		
Restorative Dentistry**	Rasht	49	14.40±89.68	-0.37	0.707
	Anzali	17	15.74±87.91		
Oral and maxillofacial surgery*	Rasht	49	13.28±83.45	0.80	0.423
	Anzali	17	16.55±80.23		
Oral and maxillofacial radiology*	Rasht	49	12.88±87.58	0.04	0.962
	Anzali	17	11.11±87.41		
Pediatric Dentistry*	Rasht	49	16.68±76.02	-2.18	0.033
	Anzali	17	12.23±85.66		

*Independent Samples Test, **Mann-Whitney

[DOI: 10.22088/JBUMS.27.SUPPLEMENT_1._MEDICAL_EDUCATION,_.6]

Table 5. Summary of results of determining and comparing practical competencies acquired in dentistry based on gender

Competency	Gender	Number	Mean±SD	Test statistic	p-value
Observance of ethical principles**	Male Female	20 46	13.59±84.75 9.89±88.58	-1.13	0.259
Pathology*	Male Female	20 46	19.88±42.34 20.11±43.95	-0.30	0.765
Orthodontics*	Male Female	20 46	20.86±57.97 23.58±64.06	-0.99	0.322
Endodontics*	Male Female	20 46	9.54±88.05 9.66±87.98	0.02	0.978
Oral and maxillofacial pathology*	Male Female	20 46	17.96±72.22 17.76±73.97	-0.32	0.743
Dental prostheses**	Male Female	20 46	20.58±79.23 12.36±82.02	-0.16	0.872
Periodontics*	Male Female	20 46	14.94±54.82 17.88±54.85	-0.007	0.994
Restorative Dentistry**	Male Female	20 46	17.94±87.92 13.16±89.79	-0.43	0.661
Oral and maxillofacial surgery**	Male Female	20 46	12.81±86.11 14.54±81.10	-1.25	0.210
Oral and maxillofacial radiology**	Male Female	20 46	15.52±88.33 10.90±87.20	-1.18	0.237
Pediatric Dentistry*	Male Female	20 46	17.05±77.71 15.90±78.85	-0.26	0.794

*Independent Samples Test, **Mann-Whitney

Table 6. Summary of the results of determining and comparing practical competencies acquired in the field of dentistry based on marital status

Competency	Marital status	Number	Mean±SD	Test statistic	p-value
Observance of ethical principles*	Single Married	61 5	11.40±87.13 8.02±91	-0.74	0.461
Pathology*	Single Married	61 5	20.51±43.44 11.05±43.75	-0.03	0.974
Orthodontics*	Single Married	61 5	23.28±61.94 17.40±65.62	-0.34	0.731
Endodontics*	Single Married	61 5	9.46±87.98 11.85±88.33	-0.07	0.937
Oral and maxillofacial pathology**	Single Married	61 5	17.99±73.27 15.29±73.88	-0.07	0.942
Dental prostheses*	Single Married	61 5	14.95±81.43 19.80±78.04	0.47	0.636
Periodontics*	Single Married	61 5	17.44±55.44 4.48±47.50	1.009	0.317
Restorative Dentistry**	Single Married	61 5	13.64±89.89 24.64±81.11	-0.54	0.585
Oral and maxillofacial surgery*	Single Married	61 5	14.03±82.46 16.96±84.44	-0.29	0.766
Oral and maxillofacial radiology*	Single Married	61 5	12.61±87.66 9.82±86.11	0.26	0.79
Pediatric Dentistry*	Single Married	61 5	16.25±78.62 16.27±77.08	0.20	0.840

*Independent Samples Test, **Mann-Whitney

[DOI: 10.22088/JBUMS.27.SUPPLEMENT_1._MEDICAL_EDUCATION._6]

Discussion

According to the results of this study, the highest frequency in terms of competence in the fields of observance of ethical principles, endodontics, oral and maxillofacial pathology, dental prostheses, oral and maxillofacial surgery, oral and maxillofacial radiology, restorative dentistry and pediatric dentistry was at a good level, while the highest frequency in terms of competence in oral and maxillofacial pathology, periodontics and orthodontics was at an average level. It seems that, in general, the level of practical competence of senior dental students in this study was at a desirable level in most cases, which is much better compared to other studies.

In this regard, a study by Hatami et al. demonstrated that the overall mean score of practical skills in complete, partial, fixed, and dental prostheses was average (17). In a study by Ray et al., the fear of the unknown, the development of learning competencies, and the development of competencies were the concerns of the students. The findings of that study showed that the students felt that they were not fully prepared for future work environments and that the most important factor affecting the acquisition of competencies and their readiness was clinical exposure (18). In their study, Mariño et al. showed that the participants were satisfied with the theoretical and evidence-based information in their formal educational and learning activities for entering practice as dental practitioners. In some areas, newly graduated professionals felt inadequately prepared, which was often accompanied by limited exposure to clinical treatment and other contextual elements of clinical practice (19). In another study, Mariño et al. reported that dental graduates' knowledge of the profession is at a level that requires them to be familiar with activities related to clinical entrepreneurial knowledge and financial resources to safely enter the practice in Australia, in which students and graduates were least prepared, but in areas related to clinical and technical competencies, students and new graduates were less prepared in managing dental injuries and medical emergencies. On the other hand, activities around social orientation and, to some extent, professional attitudes and ethical judgments were the dimensions in which students and graduates were most prepared (20).

Based on the results of the present study, there was a significant difference between the level of practical competence acquired in different departments; the highest score was related to the department of restorative dentistry, endodontics, oral and maxillofacial radiology, oral and maxillofacial surgery, dental prostheses, and pediatric dentistry, respectively. The lowest score was related to the department of pathology, followed by periodontics and orthodontics. The results of the study of Yazdani et al. are consistent with the present study; in their study, students in the oral health department generally had the highest level of skill, and students in orthodontics had the lowest level of skill (21). Obviously, the level of student skill depends on factors such as the professor, student, patient, and evaluation and learning methods. If any of these factors are deficient or defective, it affects the skills of students. The lack of patients is one of the factors that, apart from the type of faculty and their background, can be very effective on the quality of education and skill training. It is obvious that the exact cause of the students' self-reported skill level requires a comprehensive study and consideration of all effective factors. In this regard, in a study by Shahidi et al., students were most efficient in the diagnostic, radiology, and pediatric departments and least efficient in the orthodontic department. On the other hand, the increasing trend of general dentists nationwide to perform more specialized treatments, especially in the fields of orthodontics and periodontics, is probably one of the reasons why students request such training even beyond what is provided for them in the educational curriculum. However, it seems that the authorities must plan and follow up to provide enough patients for appropriate and sufficient training based on the educational curriculum in different departments of the faculty, especially the periodontal and orthodontic departments (22).

[DOI: 10.22088/JBUMS.27.SUPPLEMENT_1._MEDICAL_EDUCATION,_.6]

Furthermore, based on the obtained results, it was determined that there was a direct and significant relationship only between the competency score in the field of periodontics and age; with increasing age, the score of practical competencies acquired in the field of periodontics increased. No significant relationship was found between age and the scores of practical courses of dental students. This result is consistent with the study of Shadman et al. (23). The results of the study of Hatami et al. showed that in all faculties, the mean scores of practical skills in complete and fixed prostheses were higher in students aged 26 and younger. Scientific skills in partial prostheses were higher in those over 26 years of age. Moreover, practical skills are generally higher in people aged 26 and older, but none showed a significant difference (17). The results of the study of Yazdani et al. showed that with increasing age, no change in the level of students' skills was observed in any department in any of the Tier 1, Tier 2, and Tier 3 universities (21). As students get older, they are expected to gain more experience and skills. However, factors such as academic pressures, social obligations, and personal concerns may contribute to anxiety and a less focused on learning, especially for younger students. In addition, in some cases, older students may have less time to study and practice effectively due to family commitments. Therefore, this discrepancy could be due to deeper social and psychological influences than just age.

Based on the results obtained in the present study, it was determined that there is no significant relationship between acquired practical competencies and gender. Based on this result, in their evaluation of the relationship between practical skills and gender in all faculties, Hatami et al. reported that women scored higher than men in scientific skills in partial prostheses, but men scored higher in complete prostheses. Higher scores were obtained in prostheses, fixed prostheses, and generally in dental prostheses, none of which were significant (17). In the study of Yazdani et al., gender did not affect the level of skill in all students (21). This difference may be due to the competitive spirit and greater effort of women to prove their skills in a field that is historically considered masculine. In addition, social and cultural effects may affect individuals' learning choices and performances. For example, in cultures where competition and superiority are less encouraged in women, the highest scores may be observed in male students.

The results of the study showed that there was no significant relationship between acquired practical competencies and marital status. Evaluation of the relationship between practical skills and marital status by Hatami et al. showed that most of the students participating in this study were single, and the mean score of scientific skills of single students in complete and partial prostheses was lower than that of married students. However, it was higher in fixed prostheses and dental prostheses in general. Finally, statistical tests did not identify any of the differences as significant, so Hatami et al. pointed out the effect of marital status on students' scores (17). This contrast could be due to differences in educational environments and the different needs of students. Married students may seek to create a balance between family and education, and, therefore, they focus on skills that help their entrepreneurship and independence. Conversely, a university where a number of single students are studying with less pressure can witness more practical activities that bring higher scores.

The results of this study also showed that there is a significant relationship between competence in orthodontics and pediatric dentistry and the faculty; the mean competence score in orthodontics and pediatric dentistry at the Anzali Pardis Faculty was higher than Rasht Faculty. The higher score of students at Anzali Pardis Faculty in these two courses could be due to the high tuition costs resulting from failing these courses in this faculty (the cost of education for students at Anzali Pardis Faculty is paid by the students). On the other hand, the high level of difficulty of these courses could be a reason for students to try twice as hard compared to other courses in order to obtain a minimum passing score and avoid financial costs resulting from failing these courses. This finding indicates that the relationship between the type of faculty and the quality of education may be based on different educational resources and teaching methods.

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In other words, faculties that place more emphasis on practical education and provide sufficient resources for practice can have a significant impact on the final results of students. Overall, according to the findings of this study, it is important to pay special attention to the quality and methods of teaching in universities, especially in fields such as dentistry that require strong practical skills. Weakness in education and a lack of sufficient practice in controlled environments can have negative consequences on the future performance of graduates in the workplace environment. Therefore, it is suggested that training courses and workshops be included in the educational curriculum of universities to improve practical and clinical skills. According to the results of this study, the presence of more experienced professors and the creation of appropriate educational environments can help improve students' practical skills and strengthen their sense of self-confidence.

Finally, given the differences and inconsistencies in the findings of this study compared with other studies, it seems that social, psychological, and educational factors simultaneously affect students' academic achievements, so more in-depth studies are required to gain a better understanding of these variables. In order to improve the quality of education, it is suggested that the teaching methods of practical courses be modified and the training time be increased. It is necessary to hold educational council meetings with the presence of faculty members to examine the challenges and provide solutions to improve the quality of education. Finally, given the low level of skills of students in some areas at the time of graduation, necessary planning should be made based on the educational curriculum of the dental field so that graduates receive sufficient competency and confidence to face patients.

One of the limitations of the present study is that it examines the competencies of dental students only in one university of medical sciences, and more comprehensive results can be achieved by conducting it in other universities and comparing them. Considering that the revision and implementation of fundamental changes in the new educational curriculum of general dentistry was done in Iran in 2017, using a standard questionnaire according to psychometric criteria is essential. Therefore, it is suggested that the researcher-made questionnaire used in the present study undergo the psychometric stages of the tool in another study with a larger sample size. Therefore, the following are suggested for future research:

Investigating and analyzing the impact of students' anxiety when facing patients on practical skills and course grades; A comparative study between different dental schools in different regions to identify the best teaching methods, analyzing teaching methods, educational resources, and their results; Investigating the role of internships in improving students' practical skills and self-confidence; Designing counseling programs to reduce anxiety and stress in dental students, especially during practical training; A deeper investigation of the impact of gender on dental students' emotions and learning behaviors; Evaluating the impact of modern teaching methods such as problem-based learning (PBL) or blended learning on improving dental students' practical skills; Studies on the physical and psychological effects of the educational environment (such as facilities, equipment, and classroom atmosphere) on dental students' performance and emotions, especially in practical courses. These suggestions can help researchers examine different aspects of dental education and identify new educational challenges and opportunities. By implementing these studies, valuable results can be obtained that will help improve the quality of education and enhance the practical skills of dental students.

Conflict of interest: The authors declare that they have no conflict of interest.

Acknowledgment

We would like to express our gratitude to the Vice Chancellor for Research and Technology, Guilan University of Medical Sciences, for providing financial support for the research, as well as to all the students who participated in the study and all the people who helped us in conducting this study.

[DOI: 10.22088/JBUMS.27.SUPPLEMENT_1._MEDICAL_EDUCATION_.6]

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