Original Article Open Access

Evaluation of Learning Styles of Clinical Dental Students in Ardabil University of Medical Sciences and Determining Their Relationship with Satisfaction with Education Status

Leili Khayyam[1], Haleh Valizadeh Haghi [*1], Yasamin Azimi[2], Amin Saedi Germi[2], Afshan Sharghi[3]

[1] Department of Operative Dentistry, faculty of Dentistry, Ardabil University of Medical Sciences, Ardabil, Iran.
[2] Student research committee, faculty of Dentistry, Ardabil University of Medical Sciences, Ardabil, Iran.
[3] Community Medicine School of Medicine and Allied Medical Sciences Ardabil University of Medical Sciences, Ardabil, Iran.

Article Info

Article history:
Received 17 Apr 2019
Accepted 30 Oct 2019
Published 21 Dec 2019
Keywords:
Learning style
Kolb
Satisfaction
Student
Dentistry

***Corresponding author:**
Haleh Valizadeh Haghi, Department of Operative Dentistry, faculty of Dentistry, Ardabil University of Medical Sciences, Ardabil, Iran.
Email: h.valizadeh@arums.ac.ir

Abstract

Background & Objective: Education and learning are affected by different variables, such as learning style, which can affect educational performance and higher education output. This study aimed to evaluate the learning styles of dental students and their satisfaction with education at the dental school.

Materials and Methods: This descriptive-analytical study was performed on 109 clinical dental students in 2016-2017. After completing the Kolb learning style questionnaire, the satisfaction of students with the education at the dental school was assessed with one question scored in a range of 0-10 (from completely dissatisfied to completely satisfied). In addition, a P-value of less than 0.05 was considered significant.

Results: In this study, the learning styles of converging (57.8%), assimilating (21.6%), diverging (12.8%), and accommodating (7.8%) were the most-to-least used styles, respectively. According to the results, no relationship was observed between the learning model and variables of gender, GPA, and academic semester. Moreover, there was no significant association between mean educational satisfaction of students (4.8±2.6) and their learning style (P=0.4).

Conclusion: According to the results of the present study, converging and assimilating learning styles were the most frequently applied learning models among dental students. It is recommended that problem-focused education along with lecture-based teaching be applied as a suitable training method.

Copyright © 2019, This is an original open-access article distributed under the terms of the Creative Commons Attribution-noncommercial 4.0 International License which permit copy and redistribution of the material just in noncommercial usages with proper citation

Introduction

Proper policy-making, correct implementation of programs by professors and accurate receiving of education by students are necessary for achieving educational goals (1). Due to the direct impact on human tissue and attention to maintaining human health, the area of medical sciences (e.g., medicine and dentistry) must pay special attention to education quality (2). While the type of education, the educational environment, the attention to local and regional needs, the teaching model of teachers and educators, and the educational facilities affect learning, the learning process and its quality depend on many factors. Meanwhile, the learning models that make the most use of what students have learned are important (2, 3). The learning process is a dynamic condition in the nervous system. The first stage of conscious learning is the internal or external motivation that leads to the student being present in the classroom, is hopeful about what they will learn, and focuses on the educational topic. Afterwards, the student codes the learned content in combination with previous experiences and teachings.

[Downloaded from edujournal.zums.ac.ir on 2026-11-09]
[DOR: 20.1001.1.22519521.1398.12.35.3.9]
[DOI: 10.29252/edcj.12.35.1]

[Downloaded from edujournal.zums.ac.ir on 2026-11-09]

[DOR: 20.1001.1.22519521.1398.12.35.3.9]

[DOI: 10.29252/edcj.12.35.1]

Information is stored in the short-term (in seconds and hours) and long-term (in hours and days) memories depending on how much information is remembered. In addition, the student extends the same learning process to other teaching materials (4).

Similar to different eye colors and height, people have a variety of learning methods. In other words, individual differences affect the appropriate teaching style for people. The individual learning model or learning style determines what approach a person learns and how they will respond to the instruction received (5). Despite the presentation of various learning models, there is still a lack of consensus on the best model. In 1984, David Kolb presented a suitable model entitled experiential learning style for describing the learning process of adults based on the work of Kurt Lewin. In this model, Kolb mainly emphasizes on the role of experience in learning. In the kolb model, learning is an active process and the result of an individual's interaction with the environment and his life situations. This scholar believes that people learn in different ways. According to Kolb, everyone goes through his learning cycle in learning content, and this cycle is probably repeated several times until complete learning. He mentions that not all learners can be successful in all stages of this cycle in a similar way and that some people perform better at some stages (6).

The Kolb model encompasses four "learning styles", including concrete experience, reflective observation, abstract conceptualization, and active experimentation. These four styles have a cyclic state and are determined by a questionnaire. In fact, it shows the individuals' tendency to use information in the range of abstract to objective and active to reflective, which ultimately results in four diverging, converging, assimilating, and accommodating learning styles (7). Accordingly, attention to diversity and coverage of student learning models reinforces the effectiveness of educational efforts, empowering students, and achieving higher education goals. In addition, attention to the learning model of students during education will be associated with higher satisfaction levels and better test scores (8). In Iran, education is provided by the traditional methods of lectures in most medical science centers, which might not cover all aspects of education relating to the learning model of students (9, 10). The reports in Iran show a wide range of reasons for decreased learning among students, including inefficient skills of professors, lecture-based teaching, improper education environment, low educational facilities, and no proper education program (9, 10). Moreover, students have low-moderate satisfaction with lecture-based education (11-13). Therefore, it is essential to find suitable solutions to improve learning in students and increase their satisfaction. In this regard, the first step is the evaluation of learning models of education recipients. Given the lack of research in this field in the Ardabil dental school, the present study aimed to assess the learning model of dental students in Ardabil University of Medical Sciences, Ardabil, Iran as a factor affecting their learning. Another objective was assessing the relationship between educational satisfaction and academic performance.

Materials and Methods

This descriptive-analytical study was performed on dental students enrolled in the Ardabil University of Medical Sciences in 2017 and studying in the seventh or higher academic semester, who gave their consent to participate in the study. The research questionnaire contained three parts of individual characteristics, KOLB learning model (14), and an item on the overall satisfaction of the participants. The individual characteristics included age, gender, last GPA (14-17 and ≥17), and the GPA of the last semester of students. In the section of the learning model, data were collected using the standard KOLB questionnaire, the Farsi version of which was formerly introduced and its validity and reliability were confirmed (15). The KOLB questionnaire encompasses 12 sentences with four alternatives, each showing one of the four learning methods of concrete experience, reflective observation, abstract conceptualization, and active experimentation. The responders gave a score of one-four to each of the alternatives based on their preference. The sum of these options scores is four, indicating four learning modes. In

[Downloaded from edujournal.zums.ac.ir on 2026-11-09]

[DOR: 20.1001.1.22519521.1398.12.35.3.9]

[DOI: 10.29252/edcj.12.35.1]

this technique, four learning models of diverging, assimilating, converging, and accommodating were obtained from the two-by-two difference in learning styles of concrete observation-abstract conceptualization and reflective observation-active experimentation. The learning pattern was determined from the intersection of two numbers obtained on the coordinate axis (14, 15).

In the third part of the questionnaire, the overall satisfaction of students was assessed by asking them to answer the question of "how satisfied are you with your dental school education from zero to ten?". A higher score is indicative of greater satisfaction. The validity of the question was approved by three professors in the group of dental school. In this respect, the question was asked from two groups of 10 students before the study, and its reliability was approved at the Cronbach's alpha of %71. The data collection process was carried out in the presence of the researcher in theory classes after explaining the research objectives, receiving their consent, and having them complete the questionnaire. From 141 clinical students, 18 individuals due to unwillingness to participate in the study, 7 individuals due to error in the questionnaire completion and 7 individuals due to lack of delivery of the questionnaires were excluded from the study. In the end, 109 (77% eligible) individuals were entered into the study. It is worth noting that the present study was approved by the ethics committee of Ardabil University of Medical Sciences with the code of IR.ARUMS.REC.1396.123. Data analysis was carried out in SPSS version 17 using descriptive data, Spearman's test (to evaluate the data's correlation), as well as t-test, Kruskal-Wallis test, Chi-square, and one-way ANOVA (for intergroup comparison). In addition, a P-value of less than 0.05 was considered statistically significant.

Results

In this study, the age range of the students was 20-26 years with a mean of 23±1.75 years. In terms of gender, 59.6% of the participants were female and the rest were male. Regarding the academic semester, the students were studying in 7-12 semesters, except for the 11th semester that did not exist based on the university admission exam. In addition, the GPA of the subjects was classified into two levels of above 17 and 14-17. The distribution of demographic characteristics is shown in Table 1. According to the KOLB questionnaire, the items' distribution of scores related to the learning styles is reported in Table 2. According to the evaluation of the level of satisfaction of dental students, the mean score was 4.8±2.6, which demonstrated a moderate level in this regard. On the other hand, the results of the Kruskal-Wallis test (Table 3) were indicative of no significant difference between the mean satisfaction and learning styles of students (P=0.4).

Moreover, the Mann-Whitney U indicated no difference between men and women in the independent groups regarding the preferred way of receiving information, with the exception of reflective observation. In this respect, women received a significantly higher score in the dimension of reflective observation (P<001). On the other hand, no difference was observed in GPA groups regarding the preferred ways to receive information using the Kruskal-Wallis test (P>0.05). In the end, no significant difference was observed between academic semesters in each dimension of receiving information using Kruskal-Wallis test (P>0.05). Table 4 illustrated the distribution of four learning models of KOLB. In the present research, seven subjects had zero scores for the calculation of the learning model and could not be classified. Among the remaining 102 people, the converging style was the most common learning style among students. The models of assimilating, converging, and accommodating constituted the other items, respectively. The results of Chi-square were indicative of no difference between male and female participants in terms of learning style (P=0.8). Moreover, no significant difference was found between learning styles in different academic semesters (P=0.8) and GPA groups (P=0.2) (Table 4).

Table 1: Distribution of demographic characteristics

Age	Max	Min
	26	20
Gender	**Number**	**%**
Male	44	40.4
Female	65	59.6
Total	109	100
Academic semester	**Number**	**%**
7	13	11.9
8	24	22
9	32	29.4
10	24	22
12	16	14.7
Total	109	100
GPA	**Number**	**%**
14-17	100	91.7
>17	9	8.3
Total	109	100

Table 2: Distribution of learning style item's score

Learning style	Min	Max	Mean	SD
Concrete experience	14	45	27.08	6.47
Reflective observation	16	43	33.00	6.21
Abstract conceptualization	17	46	33.51	6.35
Active experimentation	19	48	35.98	6.98

Table 3: Difference between the mean satisfaction and learning styles of students

Learning Style	Mean Satisfaction	SD	Number	Rank	P
Diverging	5.08	3.50	13	36.63	
Assimilating	4.50	1.95	22	48.77	
Accommodating	3.50	2.33	8	54.77	0.429
Converging	5.05	2.49	59	54.81	
Total	4.81	2.52	102	-	

[Downloaded from edujournal.zums.ac.ir on 2026-11-09]
[DOR: 20.1001.1.22519521.1398.12.35.3.9]
[DOI: 10.29252/edcj.12.35.1]

Table 4: Difference between male and female participants in terms of learning style

Gender / Learning style	Male		Female		P
	Number	%	Number	%	
Diverging	26	63.41	33	54.10	0.8
Assimilating	7	17.08	15	24.60	
Accommodating	5	12.20	8	13.11	
Converging	3	7.31	5	8.19	
Total	41	100	61	100	

Discussion

Given the importance of finding suitable methods to improve learning and education among students, the present study aimed to evaluate the learning styles of dental students at Ardabil University of Medical Sciences based on the KOLB learning model and its relationship with the level of students' satisfaction with the school's educational status. To date, little research has been conducted on the learning model of dental students based on the KOLB model inside and outside the country, yielding results that are relatively similar to our findings. According to the results of the present study, the most common learning style among students was converging, followed by assimilating, diverging and accommodating styles, respectively. In this regard, two-thirds of the cases used converging and assimilating models. On the other hand, no significant relationship was observed between the students' learning styles and their level of satisfaction with education at the school. In a research by Hosseini et al. (2015) on dental students in Mashhad, Iran, the learning method of assimilating had the highest prevalence among the students, followed by converging, diverging and accommodating methods, respectively (15).

Similar results have been obtained in other studies related to medical sciences in Iran, the practical and theoretical dimensions of which are similar to the dental field. In 2013, Ghafari et al. evaluated basic medical students in Tabriz, Iran, reporting that 47% and 45% of students used the learning methods of assimilating and converging, respectively (16). Assessing basic and clinical medical students in Tehran University of Medical Sciences, Ala et al. (2013) concluded that the students mostly used the converging learning style, followed by accommodating, diverging and assimilating methods, respectively (17). In 2014, Nasirzadeh et al. evaluated students in various fields of study at Gilan University of Medical Sciences, Gilan, Iran. Similar to our findings, the converging and assimilating learning styles had the highest prevalence among the participants (18).

AlQahtani et al. (20) (2018) described the learning methods of Arabic dental students as diverging, accommodating, assimilating, and converging, respectively, which showed a lower prevalence in terms of the converging style, compared to the present study, and a greater prevalence regarding the diverging and accommodating styles. However, the two studies were consistent in terms of the assimilating learning style. These differences might be due to climatic and educational differences and study time. In a research by Chung et al. (2009), about 81% of medical students in South Korea had assimilating and diverging learning styles (19). Burger et al. (2014) reported the learning styles of assimilating, converging, accommodating and diverging as the most prevalent learning styles among basic medical students in Germany (20). This lack of consistency between our findings and the results of the mentioned studies might be due to the type of population assessed (e.g., history of education during school and individuals' adapting to that educational style and discipline). Furthermore, the academic year of students could affect their learning style (10, 21, 22).

In general and based on the results of the present study, consistent with similar studies in Iran, it seems that the converging style based on Kolb's model is the

[Downloaded from edujournal.zums.ac.ir on 2026-11-09]
[DOR: 20.1001.1.22519521.1398.12.35.3.9]
[DOI: 10.29252/edcj.12.35.1]

[Downloaded from edujournal.zums.ac.ir on 2026-11-09]

[DOR: 20.1001.1.22519521.1398.12.35.3.9]

[DOI: 10.29252/edcj.12.35.1]

most prevalent learning method used by medical students, including dental students. With a converging style, people have a greater desire to solve problems and make rational decisions. In other words, problem-focused education is the best learning style for these individuals. Moreover, students with assimilating learning styles have a more theoretical approach, only focus on concepts and prefer receiving information with a systematic structure. In other words, lecture-based education is the best method for these people. On the other hand, students with a diverging learning style are theorists and have less desire for practical activities to learn. Finally, individuals with an accommodating learning style more rely on the information of others and tend to explore and do practical work and research. Therefore, people with converging and accommodating learning styles have a practical approach, whereas those with assimilating and diverging styles have a theoretical approach (7).

In the present study, the dental students had moderate satisfaction with the education method at the dental school. However, the learning style had no impact on satisfaction. It seems that other factors are involved in the decrease in students' satisfaction with education, including the education setting, educational content, teaching style and shortage of clinical facilities, which need further evaluation. According to the results of the present research, no relationship was observed between gender and learning style of the participants, which is consistent with the results obtained by AlQahtani et al. (2018), Gurpinar et al. (2011) and Ghaffari et al. (2013) (16, 23, 24). However, in a research by Buali et al., Arabic male medical students more used the converging and accommodating styles, whereas female students more applied the diverging and assimilating styles (25). This lack of consistency can be attributed to the cultural and social differences and the different status of female and male individuals in Saudi society. In the present study, no significant relationship was observed between the learning pattern and the academic semester of students. In other words, the passing of time might not have led to a change in the learning pattern of students, which is inconsistent with the results obtained by Gurpinar et al. (23), Ala et al. (17), and Change et al. (19) in studies on medical students. This lack of consistency might be related to the evaluated degree in the study by Ala et al. (pre-clinical level), which is different compared to the current research (clinical level). Moreover, no association was found between Kolb learning model and GPA of students, which is in line with the results obtained by Hosseini et al. (15). In other words, the Kolb learning model might have no negative effect on academic performance. Similar results have been reported in studies assessing students with the use of VARK questionnaire (26-28).

Our findings can be used to adopt suitable educational methods that can improve the quality of education and learning among dental students. According to the results of the study, problem-focused education along with lecture-based teaching can be used as a proper educational method. However, given the limitations of the present study (e.g., small sample size due to limited number of students studying in the selected university and participation of 77% of these individuals), it is suggested that more comprehensive studies be performed on larger sample sizes and in other universities.

Conclusion

According to the results of the present study, converging and assimilating learning were the most frequently used learning models of dental students at the Ardabil School of Medical Sciences, and there was no difference in the learning model of students based on gender and academic semester. Moreover, no relationship was observed between the learning model and the overall satisfaction of students.

According to the results of the present study, it is recommended that problem-focused and lecture-based education be applied as suitable methods to teach dental students. However, given the importance of complete planning for the education system, it is suggested that more comprehensive studies be performed. Moreover, the evaluation of common teaching methods in dental schools and the level of students' satisfaction with teaching styles based on their learning model and finding the reason for the dissatisfaction of students

could provide beneficial results in the field of education quality increase.

Acknowledgments

This article was extracted from a PhD dissertation (No. 85) with the ethical code of IR.ARUMS.REC.1396.123. Hereby, we extend our gratitude to Dr. Afshan Sharghi for providing statistical counseling.

References

1. Chalmers D, Fuller R. Teaching for Learning at University: Theory and Practice. *Psycho. Pres*.; 1996.

2. Coffield F, Moseley D, Hall E, Ecclestone K, Coffield F. Learning styles and pedagogy in post-16 learning: A systematic and critical review. *LRSC*. 2004.

3. Pashler H, McDaniel M, Rohrer D, Bjork R. Learning styles: Concepts and evidence. *Psychol. Sci. Public Interest*. 2008;9(3):105-119.

4. Cantillon P, Wood D, Yardley S. ABC of Learning and Teaching in Medicine: *JWS*. 2017.

5. Riding R, Rayner S. Cognitive styles and learning strategies: Understanding style differences in learning and behavior: *David Fulton Publishers*; 2013.

6. Cassidy S. Learning styles: An overview of theories, models and measures. *Educ Psychol*. 2004; 24(4):419-444.

7. McLeod S. Kolb's Learning Styles and Experiential Learning Cycle. *Simply Psychology*. 2017. https://www.simplypsychology.org/learning-kolb.html

8. Brown A, Ward-Panckhurst L, Cooper G. Factors affecting learning and teaching for medicines supply management training in Pacific Island Countries-a realist review. *RRH*. 2013;13(1).

9. Eslamipour F, Shirban F, Refaei P. Assessment of dental students' satisfaction of clinical departments in Isfahan dental school. *IJME*. 2011;10(5).

10. Bakhshi H, Bakhshialiabad M, Hassanshahi G. Students' perceptions of the educational environment in an Iranian Medical School, as measured by The Dundee Ready Education Environment Measure. *Bangladesh Med. Res. Counc. Bull*. 2014;40(1):36-41.

11. Gogate RV. Problems of Education in India. *NASSP*. 1928;12(20):15-30.

12. Ryder MI, Morio I. Current challenges for dental education in Japan and the United States. *JDSR*. 2011;47(1):23-30.

13. Sung J, Gluch JI. An Assessment of Global Oral Health Education in U.S. Dental Schools. *JDE*. 2017;81(2):127-134.

14. Kolb A, Kolb DA, Seel NM. Encyclopedia of the Sciences of Learning. *Kolb's Learning Styles*. 2012;2012:1698.

15. Hosseini SM, Amery H, Emadzadeh A, Babazadeh S. Dental Students' Educational Achievement in Relation to Their Learning Styles: A Cross-sectional Study in Iran. *Glob. J. Health Sci*. 2015;7(5):152.

16. Ghaffari R, et al. The analysis of learning styles and their relationship to academic achievement in medical students of basic sciences program. *RDME*. 2013;2(2):73.

17. Aalaa M, Mirzazadeh A, Gharib M, Baradaran HR. Assessing Learning Styles of the Medical Students and Faculty in Pre-Clinical Stage of Medical Education at Tehran University of Medical Sciences. *JMED*. 2013;6(10):1-12.

18. Nasirzadeh F, Heidarzadeh A, Shirazi M, Farmanbar R, Monfared A. Assessing Learning Styles of Students in Guilan University of Medical Sciences. *Med. Educ*. 2014;6(1):28-38.

19. Chung E-K, Oh S-A, Yoon T-Y, Lee S-J, Woo YJ, Rhee JA, et al. Comparison of Learning Styles between Medical College Students and Professional Graduate Medical School Students. *Korean J Med Educ*. 2009;21(2):125-131.

20. Burger PH, Scholz M. The learning type makes the difference–the interrelation of Kolb's learning styles and psychological status of preclinical medical students at the University of Erlangen. *GMS J Med Educ*. 2014;31(4).

21. Ahmadinejad Z, Ziaee V, Morravedgi A. A survey on students satisfaction of clinical education and its related factor. *IJME*. 2002;2:15-16.

22. Zamanzad B, Moezzi M. Rate of satisfaction and evaluation of medical students (interns and externs) from the quality of clinical education in the Shahre-kord university of medical sciences-2005. *koomesh*. 2007;9(1).

23. Gurpinar E, Bati H, Tetik C. Learning styles of medical students change in relation to time. *Adv Physiol Educ*. 2011;35(3):307-311.

24. AlQahtani N, AlMoammar K, Taher S, AlBarakati S, AlKofide E. Learning preferences among dental students using the VARK questionnaire: A comparison between different academic levels and gender. *JPMA*. 2018;68(1):59-64.

25. Al BuAli WH, Balaha MH, Al Muhaidab NS. Assessment of learning style in a sample of Saudi medical students. *Acta Informatica Medica*. 2013;21(2):83.

26. Urval RP, Kamath A, Ullal S, Shenoy AK, Shenoy N, Udupa LA. Assessment of learning styles of undergraduate medical students using the VARK questionnaire and the

[Downloaded from edujournal.zums.ac.ir on 2026-11-09]

[DOR: 20.1001.1.22519521.1398.12.35.3.9]

[DOI: 10.29252/edcj.12.35.1]

influence of sex and academic performance. *Adv Physiol Educ*. 2014;38(3):216-220.

27. Almigbal TH. Relationship between the learning style preferences of medical students and academic achievement. *Saudi Med. J*. 2015;36(3):349.

28. Liew S-C, Sidhu J, Barua A. The relationship between learning preferences (styles and approaches) and learning outcomes among pre-clinical undergraduate medical students. *BMC Med. Educ*. 2015;15(1):44.

Khayyam L, Valizadeh Haghi H, Azimi Y, Saedi Germi A, Sharghi A. Evaluation of Learning Styles of Clinical Dental Students in Ardabil University of Medical Sciences and Determining Their Relationship with Satisfaction with Education Status. J Med Educ Dev. 2019; 12 (35) :1-8

[Downloaded from edujournal.zums.ac.ir on 2026-11-09]

[DOR: 20.1001.1.22519521.1398.12.35.3.9]

[DOI: 10.29252/edcj.12.35.1]