



## ORIGINAL ARTICLE

## Evaluation the learning styles of dental students of Mazandaran University of Medical Sciences

تقييم أساليب التعلم لطلاب طب الأسنان في جامعة  
مازندران للعلوم الطبية

Anahita Ghorbani<sup>1</sup>,  
Mahmood Moosazadeh<sup>2</sup>,  
Mohammad Ghacmi<sup>3</sup>,  
Maryam Zamanzadeh<sup>4,5</sup>  
<sup>1</sup>Department of Oral and  
Maxillofacial Medicine,  
Dental Research Center,  
Mazandaran University of  
Medical Sciences, Sari, Iran  
<sup>2</sup>Gastrointestinal Cancer  
Research Center, Non-  
communicable Diseases  
Institute, Mazandaran  
University of Medical  
Sciences, Sari, Iran  
<sup>3</sup>Dentist, Tehran, Iran  
<sup>4</sup>Department of Oral and  
Maxillofacial Pathology,  
Dental Research Center,  
Mazandaran University of  
Medical Sciences, Sari, Iran  
<sup>5</sup>Mazandaran University of  
Medical Sciences,  
Sari Dental School, Khazar  
Blvd.  
Sari, 4816895475  
Iran  
Tel: +98113-3244894  
E-mail:  
zamanzadehmaryam@gmail  
I.com

**Background:** Knowledge of students' learning styles can facilitate changing teaching methods according to their learning styles and subsequently improve their educational performance. Accordingly, this study aimed to investigate the learning styles of dental students at Mazandaran University of Medical Sciences.

**Method:** This cross-sectional descriptive study was conducted in 2020 on 184 dental students at Mazandaran University of Medical Sciences. The dental students at the 5<sup>th</sup> semester and higher academic levels were selected through the census method, and the data were collected using the VARK Learning Styles Self-Assessment Questionnaire. This is a standard 16-item multiple-choice assessment that identifies preferred learning styles: visual (V), auditory (A), reading/writing (R), and kinesthetic (K). The collected data were analyzed with SPSS V.24 and using descriptive statistics (mean, standard deviation, etc.) and inferential statistics (independent samples t-test).

**Results:** 184 students including 94 men (51%) and 90 women (49%) with an average age of 22.7 years participated in this study. The results showed that the students at Sari Dental School follow different learning styles, and the aural style (37.5%) was the most frequently preferred style for them. However, a significant difference was found between male and female students in terms of their preferred learning styles ( $p=0.608$ ).

**Conclusion:** Improving the quality of education requires taking learning styles in the teaching profession and educational tools into account. Teachers' knowledge of the types of learning styles and choosing the style that is most consistent with students' learning styles can significantly improve the efficiency of educational courses.

**Keywords:** Learning Styles, VARK Questionnaire, Dental Student, Education

الخلفية: معرفة أساليب تعلم الطلاب يمكن أن تسهل تغيير أساليب التدريس وفقاً لأنماط تعلمهم وبالتالي تحسين أدائهم التعليمي. وبناءً على ذلك، هدفت هذه الدراسة إلى التعرف على أساليب التعلم لدى طلاب طب الأسنان في جامعة مازندران للعلوم الطبية.

**الطريقة:** أجريت هذه الدراسة الوصفية المقطعية في عام ٢٠٢٠ على ١٨٤ طالب طب أسنان في جامعة مازندران للعلوم الطبية. تم اختيار طلاب طب الأسنان في الفصل الدراسي الخامس والمستويات الأكاديمية العليا من خلال طريقة التعداد، وتم جمع البيانات باستخدام استبيان التقييم الذاتي لأساليب التعلم VARK. هذا تقييم قياسي متعدد الاختيارات مكون من ١٦ عنصرًا يحدد أنماط التعلم المفضلة: البصرية (V)، والسمعية (A)، والقراءة / الكتابة (R)، والحركية (K). تم تحليل البيانات المجمعة باستخدام برنامج SPSS V.24 وباستخدام الإحصاء الوصفي (المتوسط، الانحراف المعياري، إلخ) والإحصاء الاستدلالي (اختبار t للعينات المستقلة).

**النتائج:** شارك في هذه الدراسة ١٨٤ طالبًا منهم ٩٤ رجلاً (٥١%) و٩٠ امرأة (٤٩%) بمتوسط عمر ٢٢.٧ عامًا. أظهرت النتائج أن الطلاب في كلية ساري لطب الأسنان يتبعون أساليب تعليمية مختلفة، وكان الأسلوب السمعي (٣٧.٥%) هو الأسلوب الأكثر تفضيلاً بالنسبة لهم. ومع ذلك، فقد وجد فرق كبير بين الطلاب والطالبات من حيث أساليب التعلم المفضلة لديهم ( $P=0.608$ ).

**الاستنتاج:** إن تحسين جودة التعليم يتطلب مراعاة أساليب التعلم في مهنة التدريس والأدوات التعليمية. إن معرفة المعلمين بأنواع أساليب التعلم واختيار الأسلوب الأكثر اتساقًا مع أساليب تعلم الطلاب يمكن أن يؤدي إلى تحسين كفاءة الدورات التعليمية بشكل كبير.

**الكلمات المفتاحية:** أساليب التعلم، استبيان VARK، طالب طب الأسنان، التعليم

بررسی سبک های یادگیری دانشجویان دانشکده دندانپزشکی  
دانشگاه علوم پزشکی مازندران

**زمینه و هدف:** آگاهی از سبک های یادگیری دانشجویان می تواند منجر به تغییر روش های تدریس مطابق با سبک یادگیری آنها شده و متعاقباً عملکرد آموزشی را بهبود بخشد. هدف این مطالعه بررسی سبک های یادگیری دانشجویان دندانپزشکی دانشگاه علوم پزشکی مازندران می باشد.

**روش:** مطالعه حاضر یک مطالعه توصیفی-مقطعی است که در سال ١٣٩٩ بر روی ١٨٤ نفر از دانشجویان دندانپزشکی دانشگاه علوم پزشکی مازندران انجام شد. دانشجویان دندانپزشکی ترم پنج به بالا به صورت سرشماری وارد مطالعه شده و پرسشنامه سبک های یادگیری VARK ابزار پژوهش حاضر بود. این پرسشنامه استاندارد و شامل شانزده سؤال در چهار حیطه یادگیری شامل: ١- دیداری ٢- شنیداری ٣- خواندنی و نوشتنی ٤- مهارتی (جنبشی، حرکتی) می باشد. اطلاعات به وسیله نرم افزار SPSS V.24 و با استفاده از آمارهای توصیفی (میانگین، انحراف معیار و...) و تحلیلی (آزمون t مستقل) آنالیز شد.

**یافته ها:** ١٨٤ دانشجو شامل ٩٤ پسر (٥١%) و ٩٠ دختر (٤٩%) با میانگین سنی ٢٢/٧ سال در این مطالعه شرکت کردند. نتایج نشان داد دانشجویان دانشکده دندانپزشکی ساری از سبک های یادگیری مختلفی استفاده میکنند. سبک ارجح در میان آنها سبک شنیداری (٣٧/٥٪) بود. بین دانشجویان دختر و پسر از نظر سبک یادگیری ارجح تفاوت معناداری یافت نشد ( $p=0/608$ ).

**نتیجه گیری:** بهبود کیفیت تحصیلی نیازمند توجه به سبک های یادگیری در تدریس و ابزارهای آموزشی می باشد. اطلاع اساتید از انواع سبکهای یادگیری و انتخاب سبک مناسب با نوع یادگیری دانشجویان در بهبود کارایی دوره های آموزشی تأثیر بسزایی دارد.  
**واژه های کلیدی:** سبک های یادگیری، پرسشنامه VARK، دانشجوی دندانپزشکی، آموزش

مازندران یونیورسٹی آف میڈیکل سائنسز کے ڈینٹل طلباء کے سیکھنے  
کے انداز کا اندازہ

**پس منظر:** طلباء کے سیکھنے کے انداز کا علم ان کے سیکھنے کے انداز کے مطابق تدریسی طریقوں کو تبدیل کرنے اور بعد میں ان کی تعلیمی کارکردگی کو بہتر بنا سکتا ہے۔ اسی مناسبت سے، اس تحقیق کا مقصد مازندران یونیورسٹی آف میڈیکل سائنسز میں دانتوں کے طلباء کے سیکھنے کے انداز کی چھان بین کرنا تھا۔

**طریقہ:** یہ کراس سیکشنل وضاحتی مطالعہ ٢٠٢٠ میں مازندران یونیورسٹی آف میڈیکل سائنسز کے ١٨٤ ڈینٹل طلباء پر کیا گیا تھا۔ ٥١س مسٹر اور اعلیٰ تعلیمی سطحوں پر دانتوں کے طلباء کا انتخاب مردم شماری کے طریقہ کار کے ذریعے کیا گیا تھا، اور ڈیٹا کو VARK لرننگ اسٹائلز سیلف ایسمنٹ سوالنامہ کا استعمال کرتے ہوئے اکٹھا کیا گیا تھا۔ یہ ایک معیاری ١٦-آئٹم کثیر انتخابی تشخیصی ہے جو ترجیحی سیکھنے کے انداز کی نشاندہی کرتا ہے: بصری (V)، سمعی (A)، پڑھنا/لکھنا (R)، اور کائینٹیک (K)۔ جمع کردہ ڈیٹا کا تجزیہ SPSS V.24 کے ساتھ کیا گیا اور وضاحتی اعدادوشمار (مطلب، معیاری انحراف، وغیرہ) اور تخمینہ شماریات (آزاد نمونے ٹی ٹیسٹ) کا استعمال کرتے ہوئے کیا گیا۔

**نتائج:** ١٨٤ طلباء بشمول ٩٤ مرد (٥١%) اور ٩٠ خواتین (٤٩%) جن کی اوسط عمر ٢٢.٧ سال تھی۔ نتائج سے پتہ چلتا ہے کہ ساری ڈینٹل اسکول کے طلباء مختلف سیکھنے کے انداز کی پیروی کرتے ہیں، اور ان کے لیے اوپر اسٹائلز (٣٧.٥%) سب سے زیادہ ترجیحی انداز تھا۔ تاہم، مرد اور خواتین طالب علموں کے درمیان ان کے پسندیدہ سیکھنے کے انداز کے لحاظ سے ایک اہم فرق پایا گیا ( $p=0.608$ )۔

**نتیجہ:** تعلیم کے معیار کو بہتر بنانے کے لیے تدریسی پیشے اور تعلیمی آلات میں سیکھنے کے انداز کو مدنظر رکھنے کی ضرورت ہے۔ سیکھنے کے اسلوب کی اقسام کے بارے میں اساتذہ کا علم اور اس انداز کا انتخاب کرنا جو طلباء کے سیکھنے کے انداز سے سب سے زیادہ مطابقت رکھتا ہو تعلیمی کورسز کی کارکردگی کو نمایاں طور پر بہتر بنا سکتا ہے۔

**کلیدی الفاظ:** سیکھنے کے انداز، VARK سوالنامہ، دانتوں کا طالب علم، تعلیم

## INTRODUCTION

One of the issues faced by most students during their studies is the quality of the learning process (1). One of the variables related to learning is learning style. Learning happens in the social context and, thus, a student's learning style can be detected by observing the student's behavior and responses in the learning environment. In other words, learning style is habitual and distinctive behavior for acquiring knowledge, skills, or feedback obtained through study or experience (2).

Bertolami believed that one of the main factors leading to students' frustration with the educational program is the disparity between the learning object and the teacher's teaching style (3). Thus, to enhance students' motivation and improve their performance, and respond to different types of their preferred learning styles, it is necessary to adapt and update teaching approaches and evaluate their effectiveness (4). In other words, despite the criticisms directed at the effect of learning styles, awareness of these styles has been confirmed as a small part of the learning process (5). An awareness of these styles can help teachers teach a broader range of students by creating a better fit between the teacher and learners' styles (6).

One of the tools used to assess learning styles is the VARK Questionnaire developed by Fleming (1998) at Lincoln University and New Zealand. This questionnaire divides learning styles into four areas: Visual style by which students learn better by seeing. Aural style by which students learn the material better through listening and oral teaching. Reading-writing style by which learners learn the material better by reading and writing the notes, and kinesthetic style: in which the learners learn the material better through manipulating of objects in a physical way (7).

Given the nature of their field of study and the significance of their professions, students of medical sciences need a special method of practical teaching, which requires professors to use different styles to teach them. Consequently, an awareness of the student's characteristics and their needs in the teaching-learning process helps the teacher in the logical design of lesson plans and teaching materials (8). Accordingly, this study sought to investigate these styles in dental students of Mazandaran University of Medical Sciences.

## METHODS

This descriptive-analytical and cross-sectional study was conducted on students of the Faculty of Dentistry of Mazandaran University of Medical Sciences in 2020. Due to the limited size of the research population, all the students in the 5<sup>th</sup> semester and at higher academic levels were selected as the participants through census sampling. The total number of students was 196, due to the refusal of some students and incomplete responses to some questionnaires, 184 people were enrolled in this study.

After obtaining the participants' consent, the data were collected using two instruments. A general information questionnaire was used to collect the students' demographic data, grade point average, and year of admission to the

university, and the VARK questionnaire was used to specify the students' learning styles.

The inclusion criteria were all students of the 5th semester and higher academic levels of the dental faculty of Mazandaran University of Medical Sciences and the exclusion criterion was the refusal of students to participate in the study and filling incomplete questionnaire.

The VARK Questionnaire is a simple 16-item multiple-choice assessment that identifies preferred learning styles: Visual (V), Auditory (A), Reading/Writing (R), and Kinesthetic (K). This questionnaire has also been translated into Persian, and its reliability was estimated to be 96.8% using Cronbach's alpha coefficient (9). The items in the questionnaire measure the respondent's performance in different situations. Each item consists of four options, each evaluating one of the dimensions of the learning style, and each respondent can choose more than one option.

The students were asked to choose the option A, B, C, and D representing their preferred styles (visual, aural, read/write, and kinesthetic styles). Finally, according to the selected options, the sum of the assigned scores was calculated. A comparison of the scores assigned to each option determined the student's preference for a given style. A student's score for a given style varied from 0 to 16 (9). A higher score assigned to a learning style indicated the student's greater preference for that style. A student who has the same score for two or more styles is assumed to have a learning style with multiple modalities.

The collected data were analyzed using SPSS-24 software. The qualitative variables were described using descriptive statistics including percentages, and the quantitative variables were described using measures such as mean, median, standard deviation, quartile, minimum, maximum, and range. The normal distribution of the quantitative variables was assessed using the Shapiro-Wilk test. Moreover, the chi-square test, independent samples t-test, and correlation coefficients were used to compare the learning styles according to the independent variables.

## RESULTS

An analysis of the demographic data for 184 students indicated that 94 students (51%) were male and 90 students (49%) were female. The students' mean age was 22.7 years (with an age range of 19 to 28 years). The students aged 22 years had the highest frequency (24.4%). They were divided into two groups based on general point average (GPA): The students with a GPA greater than or equal to 17 were considered high-performing students (13.9%) and those with a GPA less than 17 were classified as low-performing students (86.07%). The maximum GPA in the Iranian education system is 20.

The data indicated that 148 students (80.43%) had one learning style, 29 students (15.76%) had two learning styles, and 7 students (3.8%) had three learning styles. The aural style was the most preferred style for 37.5% of the students followed by the read/write style (22.8%) and the visual style (15.7%). In general, 19.56% of students followed multiple styles. The most common mixed style was the aural-read/write style used by 6.52% of the

students. Table 1 shows the frequency of different learning styles in the students.

Learning styles	Frequency (Percentage)
Visual	29 (15.7%)
Aural	69 (37.5%)
Read/write	42 (22.8%)
Kinesthetic	8 (4.3%)
Visual/aural	9 (4.8%)
Visual/reading	2 (1.08%)
Visual/ kinesthetic	1 (0.5%)
Aural /reading	12 (6.52%)
Aural/ kinesthetic	1 (0.5%)
Kinesthetic/reading	4 (2.1%)
Visual/ kinesthetic/reading	7 (3.8%)
Total	184 (100)

As shown in Table 2, there was no significant difference between students' learning styles and their gender or GPA. Besides, the analysis showed that except for the students admitted in 2018 who mostly followed the reading style, the preferred learning style was the aural style for the students admitted in other years. However, there was no significant difference in the learning styles adopted by the students admitted to the university in different years (0.406).

## DISCUSSION

The present study examined the learning styles adopted by dental students at Mazandaran University of Medical Sciences in 2020. An analysis of the students' learning styles indicated that 80.43% of the students followed a single learning style. Besides, the aural style was the most common style adopted by 37.5% of the students. Similarly, Mehdipour et al. (2018) showed that 86% of the students at Shahid Beheshti University of Medical Sciences had a single learning style and aural was the most frequent style preferred by 34.4% of the students (10).

In Shrestha's study in Nepal (2020), 35.3% of dental students had unimodal learning preferences. bimodal, trimodal, and

quadrimodal accounted for 21.8%, 15.4, and 27.3% of learning preferences, respectively. Among unimodal preferences, kinesthetic preference was the most common, followed by auditory preference (11). Meza et al. (2022) reported that most of the Brazilian students was unimodal (80.2%). Most unimodal students were distributed between kinesthetic (27.1%), auditory (23.8%), and writing/reading (20.0%) styles, and no statistically significant differences were found between the variables studied (12).

Moreover, studies conducted by Zamani et al. (2017) at Hamadan University of Medical Sciences (13), Javadinia et al. (2012) at Birjand University of Medical Sciences (14), and Nazhat et al. (2011) in Saudi Arabia (15) showed that the aural style was the most dominant learning style adopted by medical students. Learning by active listening, mental processing, and memorization of what is heard is one of the most common learning styles adopted by students. In addition, students prefer to write down important points while listening to deepen their learning. Furthermore, most students adapt their learning according to the teaching method used by teachers. Thus, the adoption of the aural style can depend on the type of teaching methods used by teachers.

However, the results reported in some studies differed from the data in the present study. For instance, Taheri et al. (2019) found that the read/write style was the dominant learning form of the students of Library and Information Science of Isfahan University of Medical Sciences (16). Furthermore, Hejazi et al. (2014) reported that the read/write style was the dominant learning style adopted by the students of North Khorasan University of Medical Sciences (17).

Moreover, many studies conducted in other countries on medical students have shown that the aural style was not their preferred style. For example, Lujan (2006) and Baykan (2007) found that the kinesthetic style was the most preferred style for students (18, 19). Murphy et al. (2004) also reported that a majority of dental students preferred the visual style (20). These conflicting results could be attributed to environmental and cultural differences and variations in teaching methods. Subsequently, the student's reading and learning approaches are chosen based on the use of visual sense and they learn the concepts better through conceptual maps, figures, diagrams, patterns, and models. Therefore, the style most preferred by students in these studies tended to be the visual style.

Learning styles	Gender		P-value	GPA		P-value
	Female	Male		≥17	< 17	
Visual	18 (20.0%)	11 (11.7%)	0.08	3 (13.6%)	19 (13.9%)	0.694
Aural	34 (37.7%)	35 (37.2%)		10 (45.45%)	51 (37.5%)	
Reading	19 (21.1%)	23 (24.4%)		5 (22.72%)	30 (22.0%)	
Kinesthetic	4 (4.4%)	4 (4.2%)		2 (9.0%)	6 (4.4%)	
Mixed styles	15 (16.6%)	21 (22.3%)		2 (9.0%)	30 (22.0%)	

**Table 3. Frequency of learning styles according to students' years of entry into the faculty**

Learning styles		Year of entering the faculty					Total
		2014	2015	2016	2017	2018	
Visual	Frequency	2	10	7	4	6	29
	%	7.6	19.2	14	17.3	18.18	15.76
Aural	Frequency	8	23	19	7	12	69
	%	30.7	44.2	38	30.4	36.3	37.5
Reading	Frequency	11	8	8	4	11	42
	%	43.3	15.3	16	17.3	33.3	22.8
Kinesthetic	Frequency	1	1	2	2	2	8
	%	3.8	1.9	4	8.6	6.06	4.3
Mixed styles	Frequency	4	10	14	6	2	36
	%	15.3	19.2	28	26	6	19.5
Total	Frequency	26	52	50	23	33	184
	%	100	100	100	100	100	100

The data in the present study indicated that 15.29% of the students followed multiple learning styles, with the read/write/kinesthetic style being the most dominant learning style. Mehdipour et al. (2018) reported that 14% of the students adopted two learning styles, and the auditory-kinesthetic style was the most common style used by 7.4% of the students (10). Ranjbar (2007) reported that the majority of students followed four learning styles (21). Besides, most students with three styles preferred the visual-aural-kinesthetic style. These inconsistent findings can be attributed to factors such as the teacher's teaching methods, individual differences, environment, motivation, individual interests, course content, and individual experiences. Since medical and especially dental students require clear examples and seeing objective and real examples outside of the educational environment to learn things better, the use of teaching methods such as evidence-based education, scientific tours, role-playing, reporting of similar cases, practical illustration, practice, repetition, problem-solving, brainstorming, and computer simulation can help to better meet the educational needs of these students (22). The current study showed no statistically significant difference in preferred learning style between men and women. Likewise, Hejazi et al. (2014) found no significant differences in this major (17). However, Mehdipour et al. (2018), found differences between male and female students in terms of their learning styles, with female students preferring the aural style while male students following the kinesthetic style as the dominant learning style (10). Taheri et al. (2019) also observed that the dominant style followed by male students was the aural style, while female students adopted the read/write style (16). Fahim et al (2021) showed that 60.62% of Pakistani students preferred the multimodal style. Female students' preferred learning styles as auditory, visual, and kinesthetic, while male students preferred visual and kinesthetic (23). Hashem et al (2022) observed that both

genders showed a higher percentage of unimodal learning preference, with 41% of males preferring the kinesthetic style, followed by auditory (26%). Female students preferred the kinesthetic style (42%) followed by visual (27%) (24).

### CONCLUSION

The findings of the present study and the observations made in other studies indicated that medical students do not follow a single study, but rather students in a single class may follow several learning styles, and sometimes several styles may be used simultaneously or alternately in a training session or even to teach a subject and content. This study highlighted the need for university professors and faculty members in various academic fields to be aware of the different preferences of their students and the role of different senses in learning, and also use multiple presentation methods and various educational media as much as possible.

Limitations of this study included the reluctance of all students to participate in the study and incomplete completion of some questionnaires, which were excluded from the study.

### Ethical Considerations:

Ethical issues including plagiarism, informed consent, misconduct, data fabrication and/or falsification, double publication and/or submission, redundancy, etc. have been completely observed by the authors. The ethics committee of Mazandaran University of Medical Sciences approved this research, ethics code IR.MAZUMS.REC.1398.4751.

### ACKNOWLEDGEMENTS

This article reported the results of a DDs thesis approved under the code 2281 by the Faculty of Dentistry and the Vice-Chancellor of Research and Technology of Mazandaran University of Medical Sciences. The authors would like to

appreciate all students and staff who contributed to conducting this study.

**Financial Support:** The project was financially supported by

Mazandaran University of Medical Sciences.

**Conflict of interest:** The authors declare that there was no conflict of interest.

## REFERENCES

- Mahamad Z, Embi MA, Yunus MM, Lubis MA, Chong OS. Comparative learning styles of Malay language among native and non-native students. *Procedia-Social and Behavioral Sciences*. 2010;9(4):1042-7.
- Amira R, Jelas ZM. Teaching and Learning Styles in Higher Education Institutions: Do They Match? *Procedia-Social and Behavioral Sciences*. 2010;7(3):680-4.
- Bertolami CN. Rationalizing the dental curriculum in light of current disease prevalence and patient demand for treatment: form vs. content. *Journal of Dental Education*. 2001;65(8):725-35.
- Coffield F, Moseley D, Hall E, Ecclestone K. Learning styles and pedagogy in post-16 learning: A systematic and critical review. *J of Learning & Skills Res Centre London*. 2004;4(2):112-20.
- Norman G. When will learning style go out of style? *Advan in Health Sci Educ*. 2009;14(1):1-4.
- Laight DW. Attitudes to concept maps as a teaching/learning activity in undergraduate health professional education: influence of preferred approach to learning. *Med Teach*. 2006;28(2):64-7.
- Sandmire DA, Boyce PF. The pairing of opposite learning styles among allied health students: effects on collaborative performance. *J of Allied Health*. 2004;33(2):156-63.
- Veenman MV, Prins FJ, Verheij J. Learning styles: Self-reports versus thinking-aloud measures. *British J of Educ Psychol*. 2003;73(3):357-72.
- Amini N, Zamani BE, Abedini Y. Medical Students' Learning Styles. *Iranian J of Med Educ*. 2010;10(2):605-19. Persian.
- Mehdipour M, Mortazavi H, Yazdani J, Dastan pour S, Namdari M, M M. Learning Styles of Dental Students at Shahid Beheshti University of Medical Sciences Using VARK Questionnaire. *Iranian J of Med Educ*. 2018;18(0):176-82. Persian.
- Shrestha A, Marla V, Shrestha S, Rimal J. Learning preferences of undergraduate dental students using VARK analysis. *J Kathmandu Med Coll*. 2020;9(4):207-12.
- Meza CAH, Vilaça Ênio L, Tiboni F, Santos LFFD, Ignácio SA, Orsi JSR, etc. Learning Styles among students of three different Universities in Dentistry in Brazil: Transversal study. *RSD [Internet]*. 2022Sep.21 [cited 2023Oct.21];11(12):e483111234397. Available from: <https://rsdjournal.org/index.php/rsd/article/view/34397>
- Zamani N, Kaboodi A. Evaluation of the VARK model learning styles selection in medical students. *Health Res J*. 2017; 2(2):109-15. Persian.
- Javadinia A, Sharifzade G, Abedini M, Khalesi M, Erfaniyan M. Learning styles of medical students in Birjand University of medical sciences according to VARK model. *Iranian J of Med Educ*. 2012;11(6):584-9. Persian.
- Nazhat A, Salem RO, Quadri MS, Hamdan A-. learning style preferences of medical students: a single-institute experience from Saudi Arabia. *Int J Med Educ*. 2011; 2(1): 70-3.
- Taheri A, Zare Abdollahi S, Yousefianzadeh O, Hashemian Mr. Comparing the learning style of students majoring in Librarianship and Information Sciences at Isfahan University of Medical Sciences and Isfahan University Based on Vark Model. *Development Strategies in Med Educ*. 2019;6(2):75-86. Persian.
- Hejazi A, Taherpour M, Sobhani KH, Hosseini S, Hedayati SH, A B. Evaluation of students learning Styles of North Khorasan University of Medical Sciences based on VARK model. *J of North Khorasan Uni of Med Sci*. 2014;6(1):81-7. Persian.
- Lujan HL, DiCarlo SE. Too much teaching, not enough learning: what is the solution? *Advances in Physiol Educ*. 2006;30(1):17-22.
- Baykan Z, Naçar M. Learning styles of first-year medical students attending Erciyes University in Kayseri, Turkey. *Advances in Physiol Educ*. 2007;31(2):158-60.
- Murphy RJ, Gray SA, Straja SR, Bogert MC. Student learning preferences and teaching implications. *Journal of Dental Education*. 2004;68(8):859-66.
- Ranjbar H, Esmaili H. A Research on the Learning Styles and preferences of the Students at Torbat Heydariyeh Nursing and Midwifery, 1386. *J of Nurs and Midwife Urmia Uni of Med Sci*. 2007;5(4):64-76. Persian.
- Valizadeh L, Fathi AE, Zamanzadeh V. Nursing and midwifery students' learning styles in Tabriz medical university. *Journal of Dental Health*. 2006;30(5):490-524. Persian.
- Fahim A, Rehman S, Fayyaz F, Javed M, Alam MA, Rana S, Jafari FH, Alam MK. Identification of Preferred Learning Style of Medical and Dental Students Using VARK Questionnaire. *Biomed Res Int*. 2021 Oct 18;2021:4355158. doi: 10.1155/2021/4355158. PMID: 34708122; PMCID: PMC8545508.
- Hashem D. Preferred Learning Styles of Dental Students in Madinah, Saudi Arabia: Bridging the Gender Gap. *Adv Med Educ Pract*. 2022;13:275-282 <https://doi.org/10.2147/AMEP.S358671>