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A Study of Learning Styles Using VARK Questionnaire and Its Relationship with Academic Achievement in the Core and Non-Core Lessons in Students of Medical Education in Shiraz University of Medical Sciences, 2018-2020

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Abstract

Learning process is the center of training process. Study of the factors influencing learning is important for educational progress. One of these factors is learning styles. Recognition of learning styles for learners is important and is considered as one of the responsibilities of teachers. The aim of this study is to determine the relationship of learning styles in core and non-core lessons with the students' academic achievement.

Keywords: *Training; Learning; Learning Styles; VARAK Questionnaire; Core and Non-Core Courses*

Introduction

Teaching is successive and regular presentation of realities, ideas, experiences, knowledge, skills, and information by teachers. This process is not as simple as it is understood because some teachers are not successful in spite of their knowledge about the teaching subject and probably the learning styles to reach their determined aims or learners' satisfaction (1). Keniston defined the main aims of higher education as "creating a knowledgeable and responsible citizen and preparing a person for a personally acceptable and socially useful job." (2) Although this definition was presented in 1960, it is still reliable (3).

Changes are happening so that the individuals employed in the healthcare system need to acquire specific knowledge and skills to face with challenges in future and it is necessary to pay attention to their learning (4). This is especially important in medical education that students should memorize, remember and apply a lot of published information during their education (5).

Medical education is very broad, and students must gain a lot of knowledge in a limited time period. They have a vast spectrum of variety in their learning styles, and this is always a challenge for teachers to meet their students' needs. (6) There is nothing to do but move toward more effective teaching to increase their learning. (4)

The process of learning is the core of the process of general education, aiming at changing behavior (7). Learning is one of the processes that could change the individuals' behavior and style of thinking. In general, humans can learn from different senses of seeing, listening, smelling, tasting, and bodily feeling. Learning is essential as a necessary element in the educational process (8).

Many factors including teacher, student, course plan and educational environment affect learning. During years, a gradual conversion in medical training has occurred from inactive teacher-based to the student-based and active learning approach (5). Promotion of medical education is a continual attempt toward reaching a turning point. New teaching strategies in education are being examined with a gradual change in focus and from inactive to active learning (9). Research on the factors influencing learning is important for development of education. Samples of these factors include learning styles, learning materials, and teaching styles (5, 8, 10). Biggs (1999) pointed out that consistency is important in course plans (11). One of the most effective approaches in the study of learning is learning styles that has been compiled emphasizing a relatively new framework in recent years (12).

Now, it is a confirmed reality that different individuals learn differently, and psychologists have tried to introduce a variety of characteristics for different learners during years and classified them based on learning styles (13). Perhaps one of the reasons that some learners do not learn the subjects well, in spite of having the best teachers, is lack of conformity between teaching and learning styles. Therefore, they receive the teaching concepts in different ways based on their individual characteristics. Accordingly, harmony between teaching style by the teacher and learning style by the learner is effective on the achieving the course objectives, academic success, and eradication of educational system insufficiencies (14). A study indicated that adults' learning is "learner-based" in which each person prefers his own learning style (6). During recent years, medical education has become more student-based. The contents of the curriculum of medical education are numerous (15). Teacher-based strategies could be changed to student-based approaches in the learning environment, and it needs knowledge about learning styles of learners and its conformity with teaching strategies (16).

For a few decades, student-based learning or concept of learner-based approach have been used in the last few decades. Student-based learning approach is a change in learning styles in which learners play independent and more active roles to increase their knowledge by collecting, composing and analyzing of data and knowledge. Learners must obtain many learning skills such as research skills through learning styles, critical thinking, problem solving skills, and others (8). Therefore, the role of learning styles in the general learning could be considered (8).

As Samadi reports, the term of learning style was introduced by Thelan for the first time (12). Learning style is defined as a combination of recognition, emotional and physiological characteristics which act as relatively stable indices of understanding, interaction, and action of a learner to the learning environment (17). Educational researchers assume that all individuals have different learning styles. One of the characteristics of learning style is that it defines the desirable condition of learning based on the way the learners prefer to obtain new data by learners (10).

Numerous definitions have been presented for learning styles (10,11,13,16,17). Zeynep Baykan (2007) reports the definition Keefe gives for learning style as "a combination of cognitive, emotional and

physiological characteristics" that act as a relatively stable indices of understanding, interaction, and action circumstances of a learner to the learning environment (10). Samadi (2011) defined the learning style as tendency of a person to learn and conform with the environment (12). Duff (2004) defined learning styles as personal difference in data processing with attention to the pioneering works of Witkin and Asch (18).

Learning style of a person includes the strategies used for interaction with data and these strategies are unique (19). In another definition, learning style is a specific style of person to acquire expertise, knowledge and attitude by training and experiences (20). Learning style is defined as a process by which learners understand, process, save, and remember what they must learn (15). Fleming (2011) defined learning style as "characteristics of a person and preferential styles for collecting, organizing and thinking in relation to data." (21).

In another study, learning styles of learners have attracted more attention in higher education. Conformity of learning styles of students with a learning framework resulted in improvement of test grades. However, lack of consistency between learning styles and course plan resulted in low educational achievement (22).

Recognition of learning styles is important for learners and is considered as a responsibility of teacher. To reach the maximum performance, tenures must adjust themselves with learning styles of their students. Learning style is a complex problem (15). Knowledge of the differences between learning styles helps to teachers to regulate better their styles for better coincidence with learners preferences (19,23). Theory of learning styles found out difference of personal potential for analyzing resulting considerable difference in learning (13).

VARAK questionnaire, as an instrument for assessment of learning styles preferences, has obtained a vast usage between different study populations in undergraduate and graduate contexts. This is due to simplicity, relatively easy performance, good confidence capability, and its reliability (17). This questionnaire was compiled by Fleming in the University of Lincoln in New Zealand in 1998(16). VARAK focuses on the educational preferences because it is involved in perceptional conditions. VARAK is the acronym of the words visual(V), aural(A), reading/writing(R), and kinesthetic (K)(13). This approach is based on three principles: 1. Everyone has the potential to learn academic subjects, but everyone has his specific style. 2. Motivation to learn increases while the teacher considers the learners' learning styles. 3. The teaching content is best learned through the senses and perceptions (14).

Fleming and Miles defined 4 types of learning: visual, aural, reading/writing and performance. However, VARK has defined 4 learning types of visual, aural, reading/writing, and kinesthetic. According to him, the visual learners prefer to learn through printed materials, figures, and tables. Aural learners tend to use the information using their sense of hearing, so they prefer discussions, lectures, and sharing their own material with others. Those with reading/writing style learn the new information through reading and writing, using books, notes, lists and glossaries. Kinesthetic learning style is a combination of different senses to learn the new materials. Those with this type of learning style like to experience and simulate the real experience of others through field activities, exhibitions, samples, pictures, and role playing. Some of the learners prefer to use one style (uni-modal), while others use multi-modal style to learn the materials. Therefore, multi-modal learners use 2,3, or 4 learning styles. (10,13,16,17).

VARK model is based on the fact that learners process the information with different approaches, which they call them their preferred style. The use of their appropriate styles of learning greatly affects their behavior and learning. The preferred learning styles should match with their learning strategies (13). The instructors can use it to facilitate the students' learning. Moreover, the students can use this knowledge for changing their learning habits. (9)

VARK questionnaire contains 16 questions which focus on content and relationship with others. Fleming and Miles' questionnaire is a highly used tool for assessing the learners' learning styles (5,6,13,16,22). It is one of the most practical and easy-to-use tools for evaluating the learners' learning (23).

In the last few decades various changes have been made in medical education, and the use of different strategies has effectively improved the medical education system. The program-based strategy and selective courses were first introduced by General Medicine Council. This happened not only because they wanted to find an answer to the load of information, but this is one of the most complex educational issues proposed (24). Curriculum can increase the social responsiveness in health and education. Further, it meets the individuals' increasing needs with respect to cost-effectiveness and standards (25). Its recognition leads to management and amendment of medical education, resulting in improvement in the quality of care since with a course plan, we can be aware of the graduates' learning, assessment strategies and features (26).

In 1960, for the first time, the concept of medical education was used in North America. (25). In education, curriculum defined as the plan for education; in other words, curriculum is a means of acquiring knowledge in the field of science, skills, and attitude. (27-29)

The main objective of the curriculum is training competent people to perform specific duties; therefore, the curriculum should be designed in a way that it meets 3 main objectives: personal development, personal and social competence, acquisition of continuous learning skills. (30-33)

Core courses should be based on higher cognitive and skill processes which should be continually revised considering the health, treatment, and educational processes. (34). Awareness of core lessons which cover knowledge, skill and attitude guarantees the educational standards (24).

According to Yamani (2016), Harden and Davis have defined core lessons in4 parts: core lessons as the basics of ant major, as basic competence for action, as the study of the main majors, and as study bases related to many disciplines. Accordingly, some cases as practical, disciplinal and related issues can be found for core lessons. (25)

Any curriculum contains some core and non-core lessons. Some believe that the core lessons should be considered more in the exams, and non-core lessons are of less importance (35). Core lessons are the compulsory courses in the major, while non-core lessons are those designed to be taken as additional units based on personal interests; therefore, core lessons are compulsory and non-core ones are selectively taken by the students (36). Anyway, in any discipline core lessons should be a general program, covering all the competencies including knowledge, skill, and attitude for that specific profession in high standard level (24).

As Yamani reports, Kirk indicated that core lessons should be taken by all medical students and are a part of the curriculum. Blite believes that core lessons can answer the questions of why, how, where, which as related to education. Also, some researchers consider are organized in 3 parts: they should definitely know, they should know, and they would be better to know (25).

The main competencies have been defined as a combination of characteristics such as knowledge, skills, and practical attitudes which enable one to effectively perform his/her duties in a standard level (26). The content of a comprehensive curriculum should also contain research, training, faculty development, clinical affairs, management, and services (37).

Methodology

This is a descriptive cross-sectional and applied study. The results of this study could be used to adapt courses with learning styles. The present study was done on the students of Shiraz University of Medical Sciences and enrolled three groups of the students who entered the university in the years 1396-1398. The sampling method used was available sampling. One of the inclusion criteria was the students who had passed three semesters in the university. The study population included all medical education students who announced their cooperation by filling out the relevant forms to collect information. After receiving the code from the ethical committee, with the number IR.SUMS.REC.1400.368, and obtaining the informed consent of the students, the questionnaires were given to the students. 29 students of year 1396, 20 students of year 1397, and 17 students of year 1398 were studied. The students' final grades in the core and non-core courses were considered as their academic achievement. Two questionnaires were used for data collection in this study. The first questionnaire was related to the demographic data including age, sex, the year of study, and field of study. VARK questionnaire with 16 questions was used to determine the students' learning styles.

Reliability and validity of the VARAK questionnaire was approved in many articles (19,38,39). Peyman et al. reported the reliability of the questionnaire with the ratio of Cronbach alpha equal to 86% (40). Anumeha Baghat et al. reported the reliability of this questionnaire with the Cronbach ratio equal to 0.923(41). We consulted the faculty members of medical education and used the curriculum to divide the courses into core and non-core. The students' final grades in core and non-core courses were used to record the students' achievement. The questionnaires were distributed among the students through their representatives of each year who monitored, and the participants' questions were answered by the researcher via phone calls.

To report the descriptive data, we used frequency, and for quantitative data mean and standard deviation were used. T-test was used to analyze and determine the relationship between grades considering different learning styles. Chi-square test was used to determine the relationship between the learning styles and qualitative variables. SPSS software version 22 was used for data analysis.

Categorizing the courses into core and non-core was done based on the final revised version of educational program of the Master of medical education that was approved in 45th higher council session for programming of medical sciences and after coordination with the faculty members. Core courses consisted of course planning (2), research methods in education (1), research methods of education (2), curriculum evaluation methods (2), student evaluation methods (2), teaching and learning models in medical sciences, leadership and management in teaching of medical sciences and economy of education, clinical teaching, computer application in education (2), Designing, holding, and evaluating educational workshop. Also, non-core courses included course planning (1), learning theories and introductory skills of teaching, inter-personal and the physician-patient relationship skill, methods of program evaluation (1), methods of student evaluation (1), application of computer in education (1), English language, Evidence-based medical education, and application of computer in education. (3)

Findings

Totally, 65 students who had entered the university in three consecutive years were enrolled: 29 students of year 1396, 20 students of year 1397 and 17 students of year 1398. The results revealed that 21 male students (32.3%) and 45 (67.7%) female students were studied. The studied students' age range was between 22 and 58 years (with a standard deviation of 8.271 and mean of 36.75 years). Frequency distribution test of students indicated that 23 students (35.4%) had bachelor's degree, 23 students (35.4%) had Master's degree, 11 students (16.9%) were physician (MD), 3 students had PhD degree (4.6%), and 5 students (7.7%) had specialty and sub-specialty degrees.

To study the learning styles, we had to categorize the students based on their majors; nursing and midwifery was the first group, medicine in the second, and anesthesia, health, speech therapy, radiology, operation room, management, and librarianship were in the third group. (Table 1)

Table 1: Frequency distribution of students based on majors

percent	**frequency**	**Majors**	**Subgroup name**	**The main subgroup**
41.5 7.6	27 5	Nursing Midwifery	Nursing	**1**
24.6	16	Medicine	Medicine	**2**
3 10.7 1.5 3 4.6 1.5 1.5	2 7 1 2 3 1 1	Anesthesia Health Speech therapy Radiology Management Librarianship Operation romm	others	**3**

From all students, 28 students (43.1%) preferred uni-model style and the remaining had two or three learning styles. None of them used 4 styles (Table 2).

Table 2. The frequency of Learning style used by male and female students

Total		**Percent**		**Frequency**		**Learning style**	
Percent	Frequency	Woman	Man	Woman	Man		
4.6	3	3	1.5	2	1	Visual	**1**
16.9	11	13.8	3	9	2	Aural	**2**
18.4	12	13.8	4.6	9	3	Reading/writing	**3**
3	2	0	3	0	2	Kinesthetic	**4**
3	2	1.5	1.5	1	1	Visual/aural	**5**
4.6	3	3	1.5	2	1	Visual, reading/writing	**6**
3	2	1.5	1.5	1	1	Visual, kinesthetic	**7**
6.1	4	4.6	1.5	3	1	A Aural, kinesthetic	**8**

10.7	7	6.1	4.6	4	3	Aural, kinesthetic	**9**
4.6	3	1.5	3	1	2	Reading/writing, kinesthetic	**10**
4.6	3	1.5	3	1	2	Visual, aural, reading/writing	**11**
9.2	6	1.5	7.6	1	5	Visual, aural, kinesthetic	**12**
1.5	1	0	1.5	0	1	Visual,reading/writing,kinesthetic	**13**
9.2	6	9.2	0	6	0	Aural, reading/writing, kinesthetic	**14**
0	0	0	0	0	0	Al 4 styles	**15**

We determine the frequency considering the number of learning styles used; the results are shown in Figure 1(total), Figure 2 (with respect to sex, uni- and multi-modals), Figure 3 (with respect to sex and number of learning styles), and Table 3 (different learning styles).

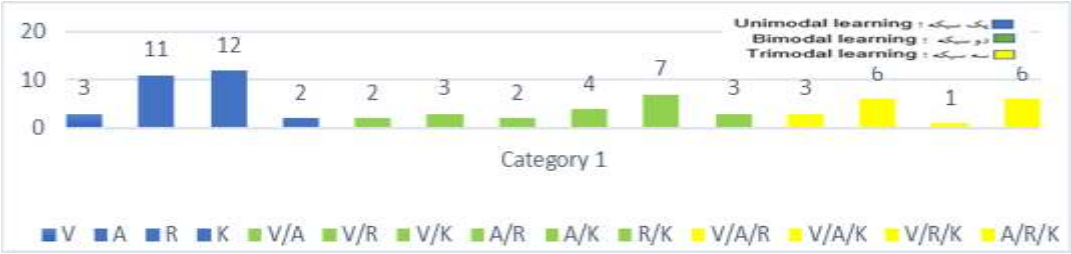

Figure 1. The frequency of the learning styles used

Figure 2. The frequency of the learning styles used with respect to sex and the number of styles used

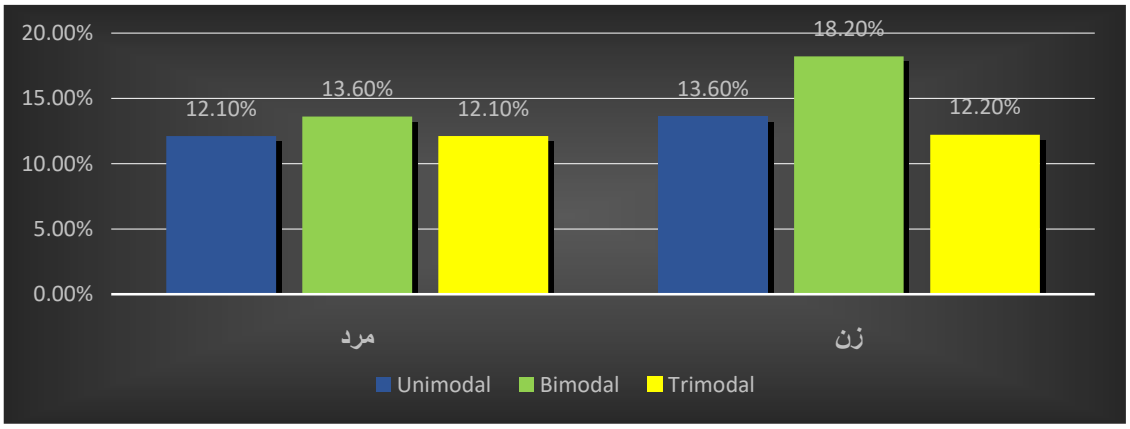

Figure 3. Different learning styles used

Table 3. The distribution of learning styles based on Uni-modal and Multi-modal styles

Uni-modal	**Multimodal**	
	Bimodal	**Trimodal**
% 43.07	% 29.26	% 27.65
visual10.71% aural39.28% reading/writing42.85% kinesthetic7.14%	visual, aural9.52% aural,reading/writing14.28% visual, kinesthetic9.52% aural,reading/writing19.04% aural, kinesthetic33.33% reading/writing, kinesthetic-14.28%	visual,aural,reading/writing18.75% visual, aural,kinesthetic37.5% visual,reading/writing,kinesthetic 6.25% aural,reading/writing, kinesthetic37.5%

Among the students, 28 (43.1%) used one learning style, 21 (32.3%) used 2 learning styles and 16 (24.6%) used 3 learning styles. Among unimodal learning styles, learning styles of reading/writing had the most frequency and among multimodal learning styles, learning styles of aural and reading/writing styles had the most frequency. 28 students (43.1%) used uni-modal style and 37 (56.9%) preferred multimodal style. (Figure 2)

The results of our study indicated that the males' and females' learning priority was bi-modal learning style but there was not statistically significant difference between them. Different uses of learning styles based on uni-modal and multimodal styles are shown in Table 3. Mode of learning style was determined with yes and no in each style; its frequency is displayed in Figure 4.

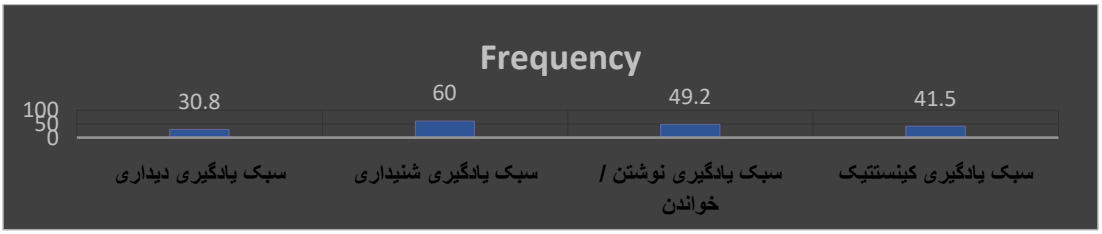

Figure 4. The frequency distribution of learning styles in percentage

The students' dominant learning styles were aural (39 students), writing/reading (32 students), Kinesthetic (27 students), and visual (20 students), respectively.

Relationship between Learning Styles and Demographic Data

Chi-square test was used to determine the relationship between learning style and sex among the students of Shiraz medical education. The results indicated that there was no significant difference between the learning styles used. Also, it was shown that there was a significant relationship between sex and learning style only Aural style. ($P<0.05$)

One-way Anova was used to determine the relationship between age and the number of learning styles used. The results indicated that there was no significant difference between them. Independent sample t-test was used to determine the relationship between age and type of learning style. The results indicated a significant difference only for aural style($P<0.05$).

Cramer V-test was used to determine the relationship between learning styles and year of study. The results revealed there was a relationship between aural learning style and year of study. Also, there was no significant relationship between the variables of year and number of learning styles. Chi-square test showed a significant relationship only between aural style and year of study. Cramer V-test was used to determine the relationship between learning styles and the students' majors, which showed no significant relationship between them.

Relationship between Demographic Features of the Students and Their Academic Achievement in Core and Non-Core Courses

Independent sample test indicated no meaningful difference between sex and mean scores in core and non-core lessons. Pearson correlation test was used to determine the relationship between age and mean of academic achievement in core and non-core courses. The results indicated no meaningful relationship between them for core lessons, but there was a significant relationship between them in non-core lessons ($P<0.05$). The relationship was reported -0.471 that shows a reverse relationship between the two factors. It means that with increasing age, the mean score of non-core courses decreases and vice versa. One-way Anova was used to determine the relationship between the year of study and academic achievement as determined by the mean scores of the core and non-core courses and between the degree and academic achievement. There was no meaningful difference between degree and academic achievement in core lessons, but there was a significant relationship between the degree and mean of non-core courses. ($P<0.05$) One-way ANOVA was used to show the relationship between the students' majors and academic achievement. The results indicated that there was no significant difference in the mean scores of core lessons in three groups, but there was a meaningful relationship between the studied groups and mean score of non-core courses. ($P<0.05$)

Relationship between Learning Styles and Academic Achievement in Core and Non-Core Courses

Independent samples t-test was used to determine the relationship between the type of learning styles and academic achievement as determined by the mean score of core and non-core courses. The results indicated that there was a meaningful relationship between aural style and mean score in non-core courses and reading/writing learning style with the mean score of core courses and between kinesthetic aural style with the mean score of core courses. ($P<0.05$) Also, this test was used to determine the relationship between the number of styles and academic achievement. The results showed that there was no meaningful difference between the number of styles and mean score of courses, but it was meaningful for non-core courses. ($P<0.05$) The results are shown in Table 4.

Table 4. Relationship between learning styles and academic achievement in core and non-core courses

Non-core courses			**Core courses**			**Learning style**
P value	SD	mean	P value	SD	mean	
0.00	0.58	15.89	0.64	0.39	16.65	**Style 1**
	0.23	16.58		0.26	16.76	**Style 2**
	0.66	16.81		0.84	16.87	**Style 3**

Relationship between Learning Styles and Core and Non-Core Lessons

Independent samples test was used to determine the relationship between learning styles and core and non-core courses. The results revealed that for all students, there was a meaningful relationship between aural learning style for core courses with research methods in education (1), research methods in education (2), evaluation method of students (2) with a P value <0.05. Also, there was a meaningful relationship between aural learning style with non-core courses such as course planning (1), method of program evaluation (1), English language (1), English language (2), application of computer in education (3), and digital and remote learning. (P<0.05)

There was a significant relationship between aural learning style and application of computer in education (2) in core courses, and with theory of learning and introductory of teaching methods, application of computer in education (3), digital and remote learning, and evidence-based medical education for non-core courses. (P<0.05)

Reading/writing learning style showed to have a significant relationship with learning and teaching methods for core courses, but no relationship for non-core courses. (P<0.05) There was a meaningful relationship between Kinesthetic learning style and methods of program evaluation. (2) Methods of student evaluation (2), models of teaching and learning, and application of computer in education (2) for core courses, and also with course planning (1) and application of computer in education (1) for non-core courses. (P<0.05)

Discussion

This study aimed to determine the relationship between learning styles and academic achievement and their relationship with the students' scores in core and non-core courses. The results showed that visual learning style was associated with the students' score in non-core courses and kinesthetic learning styles in reading and writing was related to the mean score of core courses. The researcher could not find a direct study on the subject of this research; however, a study conducted by Kamal (2021) in Malaysia could not find a significant relationship between learning styles and the mean score of students in different courses. Moreover, no relationship was found between the students' learning styles and academic performance among the students of health. (42). Also, in Mozaffari et al.'s study (2020), No significant relationship was found between learning styles and academic achievement although the learning style of students were similar (43). On the other hand, in Paiboonsithiwong et al.'s study conducted in 2016, there was a negative relationship between the students' kinesthetic learning style and their GPA in the first semester (44).

In the current study, we found a significant relationship between the number of learning styles used and the mean score of non-core courses. There was also a relationship among educational degree, major and age and mean score of non-core courses. However, this relationship was non-significant. In this

regard, Karalliyadda in 2017 showed that the students with two learning styles showed better academic achievement (45).

Also, Karimi et al. (2019) indicated that there was a difference in the use of learning styles in different educational stages (46). In another study by Sarabi et al. (2015), a significant relationship was reported between educational level and preferred learning style (16). Also, Akhlaghi et al. in their study showed a significant association between reading and writing learning style and academic performance (47). In contrast, Javid et al.'s study (2019) revealed no statistically significant relationship between learning style and academic achievement (48). Also, in the study of Kamal (2021) in Malaysia, there was no relationship between learning styles and academic performance among undergraduate health students (42).

As to core and non-core courses and their relationship with learning styles, the frequency of non-core courses in visual learning style was higher and all the courses related to kinesthetic learning style were of practical courses. Some courses like methods of student assessment (2), application of computer in education (2), and learning and teaching models (2) were related to some learning styles. No course was related to 3 or 4 learning styles

Among the learning styles, audio style (60%) was the most and visual style the least learning style used (30.8%). This finding is consistent with those of Aldosari et al. (2018); they reported the most styles used by the students with one, style and those with audio style (19). Also, Sarabi et al. (2015) revealed that the common style among female students was audio (16). Also, in the study carried out by Akhlaghi et al. (47), Borjalilu et al. (49), aural style was the most common learning style used by the learners

The results of these two studies were in the same line with ours. Moreover, in the studies conducted on the students of other countries, different learning style have been reported to be used by the learners. For example, Stirling (2017) reported kinesthetic style as the dominant learning style used be learners (50). Also, Mozaffari et al. (2020) reported reading/writing (43) and Narius et al. in 2020 indicted the audio style as the most commonly observed style used (51). Another study carried out in Malesia by Kamal (2021) revealed that in their country the students mostly have one style, and the most common ones were audio and reading/writing. It is noteworthy that multi-style learning, two style and then 3 and 4 style ones were used (42).

In the present study, the majority of the students (56.8%) had multi-modal learning styles. This is consistent with the findings of Paiboonsithiwong et al. (44) and Ojeh et al. (5), Mashhood (15) and Karalliyadda (45). However, in Sterling et al.'s study, most of the students had adopted uni-modal styles (50). Also, in Kamal's study the most common style was uni-modal one. (86.8%) and only 13.2% of them preferred to use multi-modal styles (42). The results of the 2 above-mentioned studies are not in the same line with those of the present study. On the other hand, these results were consistent with those of Sarabi et al., Akhlaghi et al., and Borjalilou et al. (16,47,49), showing that most of our students use bimodal and trimodal styles.

It was found in our study that among those who had multimodal, the most frequently used ones were bimodal (reading/writing and kinesthetic) and there was no tetra-modal style user among the students. This is inconsistent with the findings of Ojeh et al. who reported tetra-modal style as the most commonly used style. (5). Also, Javid et al. in Pakistan showed that no participant preferred to use uni- and bi-modal styles and mostly used tri- and quadri-modal styles (48).

According to our findings, there was no relationship between gender and the number of learning styles, but a reverse relationship was found between gender and audio learning style. The study conducted by Paiboonsithiwong et al. and Hassanzadeh et al. showed no relationship between gender and learning styles (44,52). In this regard, Aldosari et al. found a significant relationship between these two factors (19). However, Akhlaghi et al. found no such relationship (47). In Sarabi et al.'s study female students

use aural style more than the males, while the male students preferred kinesthetic style more than females. (16)

In Amini et al.'s study, it was found that although there was no difference in the male and female students' learning style, the difference was not statistically significant. the dominant style among the females was reading/writing and that among the males was audio style. (53) In Kamal's study (2021), the mostly preferred style among male and females was visual. In contrast, the other style preferred was reading/writing (42).

Conclusion

The results of this study provide evidence for the teachers that multimodal styles of learning should be used in their teaching so that they can promote the students' learning. It is supposed that the curriculum, students' background in different fields have a role in the discrepancies in determining the learning style. According to the results, blended teaching method is often effective in meeting the needs of various learning styles. This approach is useful for multimodal learners since they use different styles to learn effectively. As to the relationship between kinesthetic learning style and practical courses, it is worth mentioning that the instructors should adopt teaching styles that focus on the students' learning styles in order to guarantee the students' academic achievement. This highlights the importance of the students' learning styles.

As to core and non-core courses related to specific learning styles, finding the dominant learning style among the students and designing strategies for the teachers to adjust their teaching method with learning styles are of crucial importance in deep learning and thus efficacy of education.

A better understanding of the students' learning characteristics requires revision of the teaching strategies. Given the multimodal learning styles of the medical students, we need to adopt multi-modal active teaching strategies, such as using models, simulation, demonstrations, discussions, and plays, so that all the students with different learning style can be involved. Instead of focusing on lecturing, various teaching methods should be used. Even the lecturing session should be devised in a way that the learners are reminded of practical and visual sessions, reading/writing assignments, note-taking which all cover the students' learning styles

Limitations of the Study

All scientific studies are faced with some limitations and this study is not an exception. Since the present study was a cross-sectional one, we could not evaluate the cause/effect relationship between the variables. Also, self-reports were used to collect the data, which could affect the results. The other limitations were low sample size, lack of pre-test/post-test design. It is suggested that in future studies the researchers use pre-test/ post-test to collect the data and also focus on the relationship between learning styles in different majors. Moreover, it is recommended that the methods of adapting learning styles to different courses should be researched.

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