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Learning styles vs. virtual education preferences: a cross-sectional study on medical sciences e-students

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E-students sometimes feel isolated due to the lack of face-to-face communication with teachers. It is important to pay attention to students' learning styles and the virtual education methods used by teachers. This study aimed to investigate the preferences of students at Shiraz University of Medical Sciences (SUMS) regarding virtual education and their learning styles. A descriptive survey research was conducted on postgraduate e-students in 2019-2020. A stratified random sampling was performed among 300 students from four virtual master's programs at SUMS. A total of 180 questionnaires were distributed, and 155 samples completed the questions. The VEPQ questionnaire was used to measure the participants' virtual education preferences, while the VARK standard questionnaire was utilized to determine their learning styles. The data were analyzed using SPSS 24 software via one-sample T-tests, independent T-tests, and ANOVA tests. All students exhibited a unimodal learning style, with their dominant style being reading/writing ($P < 0.05$). All educational methods received scores higher than the cut-off point ($P < 0.01$). Students' virtual education preferences were as follows: e-content (5.26 ± 0.74), self-directed projects (4.70 ± 0.90), face-to-face modules (4.67 ± 1.14), online presentations (4.32 ± 0.94), and text interaction (3.98 ± 1.18). There was no significant difference in students' virtual education preferences based on their learning styles ($P > 0.05$). E-students have different learning styles, but their educational preferences are more influenced by their circumstances. Therefore, the use of multimedia and independent learning is essential for them. It can be stated that "flexibility," "personalization," and "independence" are the three main preferences of e-students that should be considered in educational planning.

KEYWORDS

teaching methods, learning style, VARK, e-studentd, e-learning, educational preference

Introduction

The emergence and development of new technologies have facilitated the implementation of various e-learning methods in classrooms. Over the past few decades, the number of virtual courses and e-students has increased. However, e-students often feel isolated due to the lack of face-to-face communication with their instructors. Therefore,

it is essential to consider students' learning styles and the virtual education methods employed by teachers.

Learning Style: Students have different learning styles (Bokhari and Zafar, 2019). Learning styles are defined as the individual and preferred methods through which students understand, process, and retain information (Caulley et al., 2012). Several studies have shown that learners use different methods in the process of acquiring and adopting information processing, and this difference has resulted from their different learning styles (Caulley et al., 2012; Günes, 2018; Kharb et al., 2013). Many believe that recognizing the diversity of learning styles is a key factor in achieving educational success (Bokhari and Zafar, 2019; Koohestani et al., 2019; Rezaei et al., 2010). There are various learning methods, including visual, auditory, and textual approaches, among others (Vizeshfar and Torabizadeh, 2018). Knowledge of students toward their learning styles can provide a basis for instructors to optimize their teaching method (Bokhari and Zafar, 2019). Learning styles are inherent skills and are closely related to the method of acquiring or understanding new information or knowledge. It also can be used to strengthen knowledge, skills, and attitudes (Mangold et al., 2018).

Students' awareness of their learning styles is an important factor in improving the quality of medical education, and if the method of presenting information to them matches their learning style, they will learn better (Bokhari and Zafar, 2019; Nejat et al., 2011). Research results have shown that awareness of learning styles can be useful for both students and teachers (Romanelli et al., 2009). Recognizing differences in learning styles allows teachers to adjust their methods to align with students' preferences, thereby improving learning outcomes and increasing student satisfaction with the educational process (Koohestani et al., 2019).

Educational preferences: Essentially, the interaction between teachers and students is one of the most important and influential factors affecting students' engagement in the learning process (Hafen et al., 2015). The most important aspect of this influence is the conscious selection of an appropriate teaching style by teachers (Shuster et al., 2003). Teaching preferences refer to the behaviors that teachers show while interacting with learners and play an important role in various aspects of teaching (Bokhari and Zafar, 2019; Mafyan et al., 2014).

Researchers have introduced various categories of teaching and learning styles. Benzie identifies a range of educational styles that lie on a spectrum from teacher-centered to learner-centered approaches (Benzie, 1998). Learner-centered approaches focus on developing students' capacity for independence and responsibility. In these approaches, learners actively participate in designing their learning, conducting research, and evaluating their progress (Gardner and Holmes, 2006). In contrast, in teacher-centered styles, the teacher primarily acts as the transmitter of knowledge, providing predetermined content to students (Matsuyama et al., 2019). When there is a lack of alignment between the teaching style and students' learning styles, learners may become bored, inattentive, discouraged, and exhibit poor performance. However, if teachers can adapt their teaching styles to match their students' learning preferences, learners are likely to achieve better academic outcomes (Bates, 2005; Sener and Çokçaliskan, 2018), and the motivation of learners will increase (Davids et al., 2011). Norman also believes that a learner's success is influenced by the method of information transmission (Norman, 2009). Also, Bertolmi believes

that one of the main reasons for learners' frustration is the contradiction between the content of learning and the forms of teaching. He believes that the reason why some learners do not learn well, despite having the best teachers, is their different learning preferences (Bertolami, 2001). In other words, learners receive and process information in various ways based on individual differences, which can manifest in their approaches to reading, listening, acting, reacting, thinking, analyzing, and imagining (Alkhasawneh et al., 2008).

Siyami et al. reported that recognizing students' preferred teaching styles can help predict their academic engagement. Their findings indicated that female students favored a student-centered teaching style, while male students preferred a teacher-centered approach (Siyami et al., 2014). Furthermore, Sohrabi et al. found that students of health management and economics preferred active experimental learning and abstract thinking (Sohrabi and Keshmiri, 2013). Yasini Ardakani et al. reported that most students at Yazd University of Medical Sciences preferred team-based teaching methods (Reid et al., 2013).

New e-Teaching and Learning Methods: With the emergence of new technologies, the range of teaching and learning methods is increasing every day. Virtual education and e-learning, utilizing both synchronous and asynchronous online methods as well as multimedia resources, are new approaches that have gradually been adopted in teaching to facilitate education without dependence on time and place (Esichaikul et al., 2013). Another feature of e-learning is its ability to provide a unique experience through the simultaneous use of three teaching modes: visual, auditory, and textual (Saberi et al., 2018). In virtual education, learners actively participate in the learning process, shifting the focus from a teacher-centered approach to a learner-centered one. This model eliminates location constraints, allowing students to access education anytime and anywhere (Huynh, 2017). Virtual education can be delivered to learners in various formats, including individually or collaboratively, online or offline, synchronously or asynchronously, as well as through blended learning approaches (McKimm et al., 2003). The online method can be presented both synchronously or asynchronously. Synchronous instruction is a type of online teaching in which the learner and the instructor are connected to the Internet or intranet at the same time and learners can share their questions and comments live via sharing text, audio or video format with the instructor and other learners. Webinars, virtual classes, and video conferences are examples of this method (Idhalama et al., 2021). Asynchronous methods are online learning approaches that allow teachers and learners to be active at different times. In this format, instructors upload educational content to web-based platforms, enabling learners to access materials, complete assignments, and submit responses at their convenience. Additionally, learners can engage in discussions, leave comments, and receive feedback in forums while reading their peers' opinions (Greaves, 2017), and often require one of the electronic platforms including Learning Management System (LMS), or Moodle (Idhalama et al., 2021). The use of visual, textual, and audio e-content, especially interactive multimedia, is very popular in virtual education since learners can select one of the based on their preferences (Mafyan et al., 2014) (Kim et al., 2008; Rouse, 2000). E-content can be created as single media formats, such as textbooks, podcasts, and images, or as multimedia that combines various visual and audio elements interactively.

A key approach in e-learning and virtual education is blended learning, which aims to enhance educational quality by integrating the strengths of both face-to-face teaching and virtual methods (Bertolami, 2001; Van der Velden, 2013).

Challenges: Identifying learning styles is essential for selecting the appropriate technology and media in education (Kharb et al., 2013). Today, there is a growing tendency to adopt teaching methods that cater to learners' diverse learning styles (Nuzhat et al., 2011). Teachers should adapt their teaching methods to accommodate different learning styles. In recent decades, the integration of new technologies in medical sciences has significantly advanced, enhancing educational practices and improving learning outcomes (Bediang et al., 2013), and many courses are presented online. Many individuals prefer virtual courses to avoid the constraints of time and location. However, the absence of direct access to teachers and face-to-face interaction can leave e-students feeling isolated or concerned about receiving a comprehensive education. Therefore, understanding the educational preferences of this group is crucial. As virtual academic disciplines continue to expand, identifying e-students' learning styles and preferences in these new environments becomes increasingly important. In this context, we aimed to investigate three main questions:

- Q1 What are the learning styles of e-students?
- Q2 What are the virtual education preferences of e-students?
- Q3 How do the virtual education preferences of e-students differ based on their learning styles?

Methods

Study design

In this cross-sectional research, all e-students at Shiraz University of Medical Sciences (SUMS), IRAN, who were enrolled in four virtual fields of study during 2019 were studied.

Sampling

The included students were students of MSc of Medical Education, MSc of e-Learning in medical sciences, MSc of Community health education and MPH of Health policy. At the time of the study, about 300 e-students were studying at the SUMS. According to Cochran's formula for a limited statistical population ($N = 300$); The sample size required for this study was calculated. In this formula, acceptable error (d = 0.05) and Z = 1.96, the ratio of P and q was considered to be relatively (0.5). Based on the Cochran formula for calculating the sample size, finally the desired sample size was estimated at 168 people.

$$n = \frac{NZ^2pq}{Nd^2 + Z^2pq} = \frac{300*1.96^2*0.5*0.5}{300*0.05*0.05 + 1.96^2*0.5*0.5} = 168$$

To account for the possibility of missing samples, 180 students were randomly selected from the list of student IDs provided by the Education Deputy. After obtaining the ethics code and permission from the educational deputy, a questionnaire was designed electronically and sent to the students' email addresses due to their unavailability. Of the questionnaires sent, 155 were completed in full, resulting in an 86% response rate.

The inclusion criteria required participants to be e-students at Shiraz University who had studied in a virtual field for at least two semesters and participated in the study with informed consent. The exclusion criteria included not completing the questionnaire or leaving more than 20% of the questions unanswered.

Tools/Instruments

In this research, two main questionnaires were used:

1. Virtual Education Preferences Questionnaire (VEPQ): The first part of the questionnaire included demographic data such as gender, age, field of study, employment status, and marital status. The main body of the questionnaire was based on the VEPQ developed by Karimian et al. (2023) (Karimian et al., 2023), with 17 Items on a six-point Likert scale, included 5 teaching methods or components: Text interactions (3 Items), e-Content (2 Items), Online presentation (3 Items), Self-Directed Projects (6 Items) and Face-to-face interactions (3 Items). The values of the options were: very high = 6, high = 5, relatively high = 4, relatively low = 3, low = 2, and very low = 1. The validity was confirmed via 10 e-learning and medical education experts via Content Validity Index (CVI) included relevance (0.882), clarity (0.924), and simplicity (0.953). The Content Validity Ratio (CVR) was reported 0.805. The reliability of the questionnaire was confirmed by internal consistency with Cronbach's alpha of 0.824%.

2. Learning styles Questionnaire: The VARK Questionnaire version 8.01, developed by Fleming and Mills in 1992, was used to measure the participants' learning styles (Fleming and Mills, 1992), it describes four modalities of student learning including 14 questions in four categories: (visual, auditory, reading/writing, or kinesthetic). Each question is aimed at placing respondents in a "learning" situation. The respondents were permitted to choose two or more options if appropriate. Accordingly, learning styles were categorized as unimodal (V, A, R, or K), bimodal (VA, VR, AR, VK, AK, and RK), trimodal (VAR, ARK, VRK, and VAK), or quad modal (VARK).

Data collection

Initially, the list of e-students in the fields of study under investigation was obtained from the educational department with official permission. Both questionnaires were designed electronically and their's link was sent via email to 180 students who were randomly selected from four e-disciplines. Questionnaires were completed by the students simultaneously. Also, a reminder message was sent three times to all participants. A total of 155 completed questionnaires were returned.
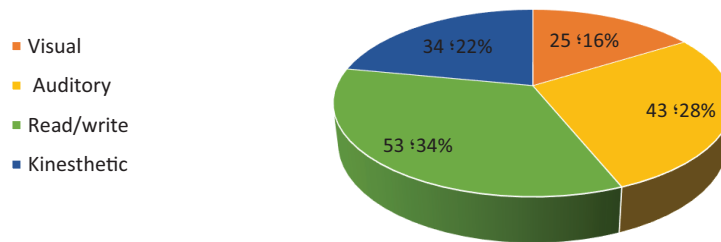
FIGURE 1
Learning styles (frequency, percentage) of e-students.

Data analysis

Data were analyzed using SPSS 24. We used one-sample *t*-test, independent t-test, and ANOVA to determine the status of students' learning styles, educational preferences, and their relationship with contextual components. The confidence level of the tests was considered 95% and the amount of acceptable error (α) in all tests was 0.05.

Ethical considerations: The questionnaires were completed anonymously with the informed consent of all the students. This project has been approved as a part of the MSc thesis on e-learning in medical sciences by the Vice Chancellor for Research of SUMS and has been confirmed by the ethics committee of Shiraz University of Medical Sciences with the code of IR.SUMS.REC.1398.413.

Results

Demographic characteristics

A total of 155 completed questionnaires were returned out of 180 distributed (86%). Among the 155 participating students, 45 (29%) were male and 110 (71%) were female. The distribution of fields of study was as follows: 61 (39.4%) in Medical Education, 27 (17.4%) in e-Learning in Medical Sciences, 24 (15.5%) in Community Health Education, and 43 (27.7%) in MPH with a focus on Health Policy. The average age of participants was 38.2 ± 8.2 years. The majority had previous majors in Medicine and Paramedical Studies, and 136 (87.7%) of them were employed. Participants were also asked, "What was the reason for choosing virtual education?" In response, 104 (67.1%) reported that the flexibility of virtual education allowed them to adapt to their circumstances. Sixteen (10.4%) stated that they entered the new field because they had been tested several times in their previous field and were not accepted. Additionally, 16 (10.4%) cited their interest in new technologies and fields as the main reason, while 19 (12.3%) chose both flexibility and adaptability as well as interest in new technologies.

Analysis of research questions

Q1. Learning styles of e-students: Based on the Chi-Square test, learning styles were different among e-students (Chi-Square = 11.168, $P = 0.01$). All the students were unimodal, and the highest frequency was related to the reading/writing style, auditory, kinesthetic and visual style (Figure 1).

In the study examining the differences in participants' learning styles based on contextual variables, no significant differences were observed according to gender ($P = 0.571$) and age ($P = 0.489$). However, learning styles varied significantly according to the field of study (Table 1).

Q2. Virtual Educational Preferences: In the first research question, e-students were asked about their preference of e-learning method. The average of student viewpoints is shown in Table 2.

The range of scores was between 1 and 6 and the cut-off-point (minimum expected level) was considered equal to 60% = 4. According to the research findings, the most preferred among the questionnaire items were related to "receiving multimedia and educational videos before the class", and also receiving the "e-book and handouts" was the most preferred type of multimedia for students

Also, a comparison of components of virtual education preferences from the perspective of SUMS e-students indicated that all components (teaching methods) are required from the students' viewpoints, considering that the average cut-off-point with minimum expectation is 60%, all educational methods scores were more than 4, but the average score of e-content (5.26 ± 0.74) and Self-Directed Projects (4.70 ± 0.90) were higher. Text interactions methods were the least preferred by students (Table 3).

Effect of Gender: the results showed that female students significantly prefer e-content compared to males ($P = 0.001$). In other areas, the educational preferences of males and females were not different ($P > 0.05$).

Effect of Field of Study: The results of the ANOVA test revealed that students from different disciplines had varying preferences ($P = 0.01$). Additionally, the Tukey *post-hoc* test indicated significant differences between the two fields of e-learning in Medical Sciences ($P = 0.007$) and Medical Education ($P = 0.031$) compared to Health Policy regarding the perceived need for short face-to-face module courses. In other words, students in the e-learning and Medical Education disciplines expressed a greater need for more face-to-face training.

Effect of Age: The age of the participants was first divided into three categories: 22 to 35 years, 36 to 45 years, and > 46 years. The group differences were assessed using the ANOVA test. The results showed significant differences in the total mean ($P = 0.007$) and the preference for face-to-face interaction ($P = 000$). The results of

TABLE 1 Differences in learning styles based on the field of study.

Field of study	Index	V	A	R	K	Total
MSc/ E-Learning in Medical Sciences	• Frequency	1	10	13	3	27
	• %within Field of study	3.7	37.0	48.1	11.1	100
	• %within Learning style	4.0%	23.3	24.5	8.8	17.4
	• %of Total	0.6	6.5	8.4	1.9	17.4
MSc/ Medical. Education	• Frequency	13	23	12	13	61
	• %within Field of study	21.3	37.7	19.7	21.3	100.0
	• %within Learning style	52.0	53.5	22.6	38.2	39.4
	• %of Total	8.4	14.8	7.7	8.4	39.4
MPH/ Policy-making	• Frequency	7	8	16	12	43
	• %within Field of study	16.3	18.6	37.2	27.9	100
	• %within Learning style	28.0	18.6	30.2	35.3	27.7
	• %of Total	4.5	5.2	10.3	7.7	27.7
MSc/ Community based Education	• Frequency	4	2	12	6	24
	• %within Field of study	16.7	8.3	50.0	25.0	100
	• %within Learning style	16.0	4.7	22.6	17.6	15.5
	• %of Total	2.6	1.3	7.7	3.9	15.5
Total	• Frequency	25	43	53	34	155
	• %within Field of study	16.1	27.7	34.2	21.9	100

N = 155 Likelihood Ratio = 0.005 P = 0.015. ■ Visual, ■ Auditory, ■ Read/write, ■ Kinesthetic.

TABLE 2 The average score of educational preferences items from the students' viewpoints.

Components	Items	Mean	SD
Text interactions	• Discussions boards and forum environment increase my ability to criticize and analyze	3.95	1.39
	• feel that I learn better by sharing contents and ideas through wiki and forum	3.93	1.24
	• I prefer to ask my questions in text chat form in online environments	4.06	1.53
Online presentation	• I learn better when the professor teaches online in a virtual class	4.37	1.12
	• I learn better when my classmates present the webinars and conferences	4.01	1.30
	• I prefer to question and answer in the virtual class	4.57	1.23
e-Content	•I prefer to have multimedia and educational videos before the class	5.38	0.79
	• I prefer to have the e-books and handout of the course (Pdf handout).	5.15	1.01
Self-Directed Projects	• I prefer to read and translate scientific texts as part of my homework	4.27	1.35
	• I learn better when I do a practical project (e-Content and App development, etc.)	4.81	1.27
	• Writing a scientific article is more effective and informative in my learning	4.66	1.29
	• Analyzing, criticizing and evaluating articles or different situations is an effective method	4.79	1.04
	• I learn better in assignments that are based on planning, problem solving and presenting a solution	4.99	0.95
	• I prefer to review and integrate several articles/models and create a new article/model	4.74	1.15
Face-to-face interactions	• It is necessary to hold face-to-face meetings at the beginning of the semester to introduction and clarification	4.82	1.46
	• I prefer to have some intensive face-to-face meetings during the semester to provide a summary	4.24	1.49
	• I prefer to participate in face-to-face troubleshooting sessions before the exams	4.95	1.37

SD, Standard deviation.

the Tukey *post hoc* test showed that the group of 36 to 45 years old ($P = 0.000$) was significantly higher compared to Groups of 22 to 35 years. In other words, with age, the desire for face-to-face training ($P = 004$) increased (Table 4).

Q3. Virtual education preferences according to learning styles: The ANOVA test showed that none of the educational preferences (teaching methods) differed significantly according to students' learning styles ($P > 0.05$). The score range of virtual education

TABLE 3 Educational preferences from the perspective of SUMS e-students.

Teaching preferences	Mean	SD	t	P-value
Text interactions	3.98	1.18	5.07	< 0.001
Online presentation	4.32	0.94	10.76	< 0.001
e-Content	5.26	0.74	29.37	< 0.001
Self-Directed Projects	4.70	0.90	16.72	< 0.001
Face-to-face interactions	4.67	1.14	12.73	< 0.001
Total Mean	4.58	0.61	22.01	< 0.001

SD, Standard Deviation N = 155.

TABLE 4 Determining the differences in face-to-face training preferences by age groups.

Group1	Group2	Mean difference	P-value
$22 \leq$ Year ≤ 35	$36 \leq$ Year ≤ 45	−0.632*	0.004
	≥ 46	−1.120*	0.000
$36 \leq$ Year ≤ 45	$22 \leq$ Year ≤ 35	0.632*	0.004
	≥ 46	−0.488	0.112
≥ 46	$22 \leq$ Year ≤ 35	1.120*	0.000
	$36 \leq$ Year ≤ 45	0.488	0.112

preferences by learning style is presented in Figure 2. Although there was no significant difference between students' preferences and their learning styles, the score ranges of preferences among the VARK learning styles were different (Figure 2).

Also, the profile of the learning style according to the virtual education preferences showed that the e-content method had a higher share of the score than each of the learning styles, and the text interaction method had the least (Figure 3).
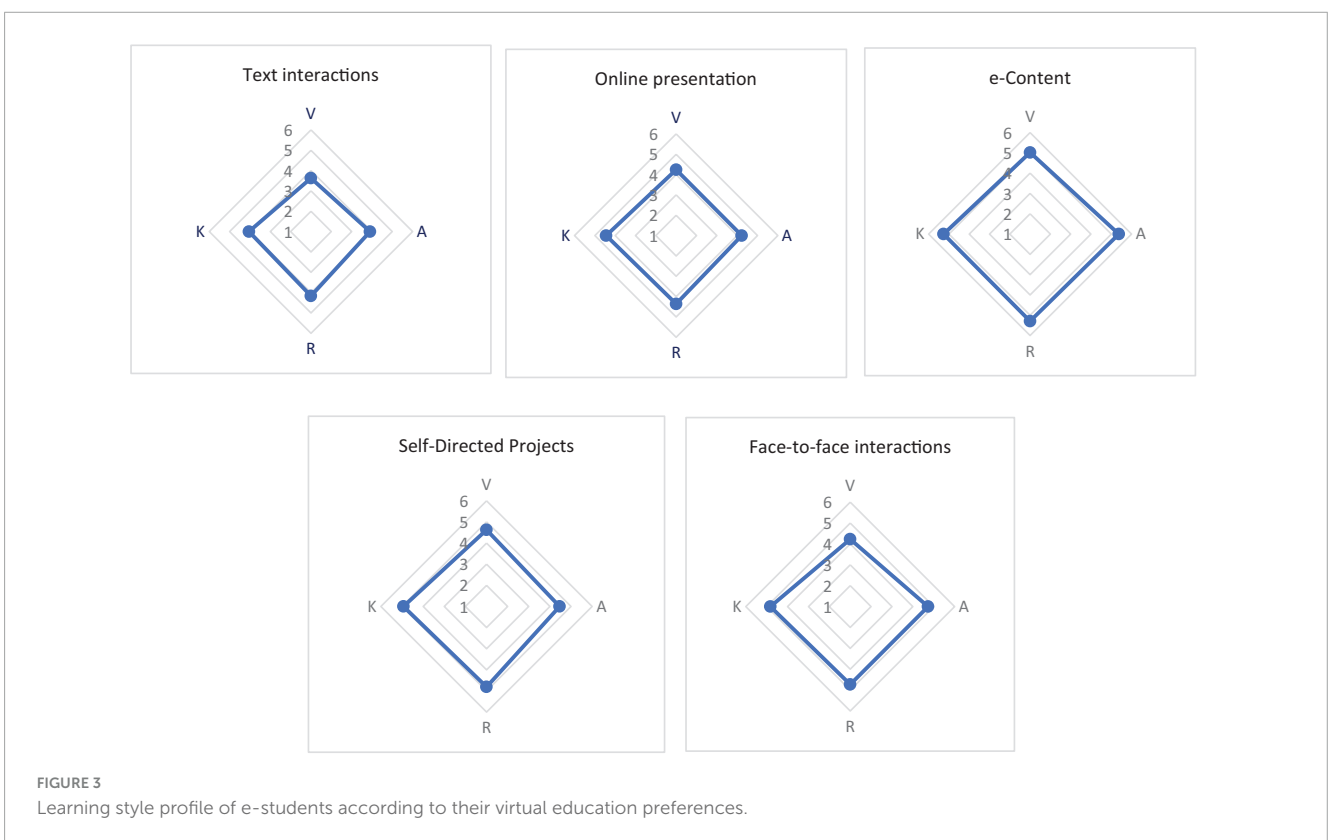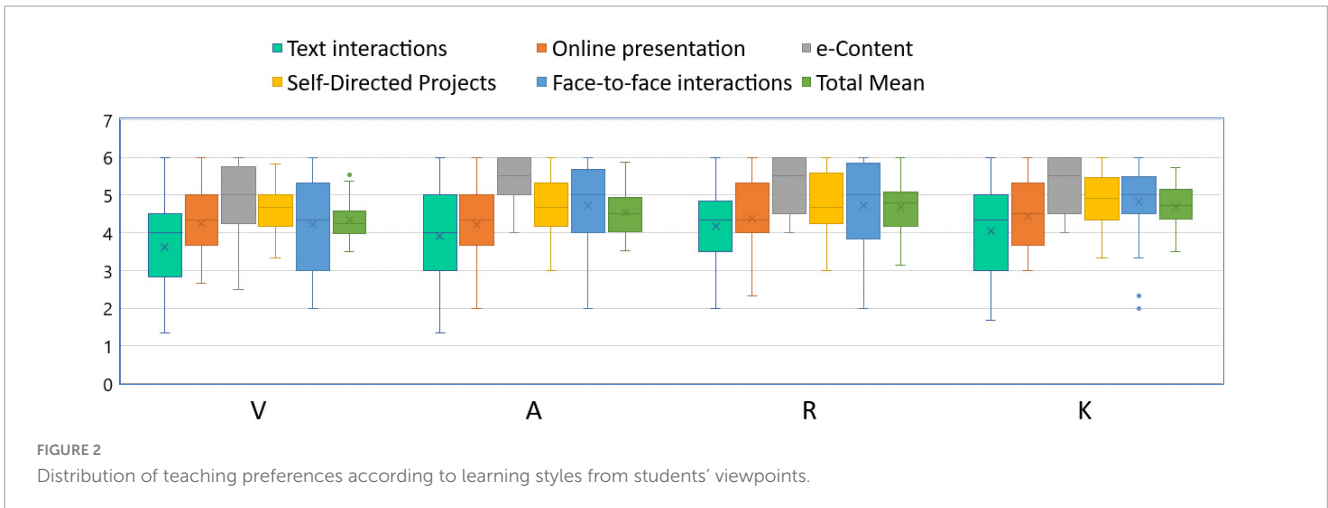
Discussion

In this research, two concepts of learning style and virtual education preferences of e-students and their relationship were investigated. The results indicated that based on the VARK model, most of the students of the virtual fields in this research had a reading and writing style. Also, the students' most preferred virtual education were e-content and self-directed project-based methods.

Learning Styles: Participants of this study were postgraduate students of interdisciplinary medical sciences including medical education, E-learning in medical sciences, Community-oriented health education, and health policy. The present study revealed that all participants had a single learning style also we found that the dominant learning style in students of SUMS virtual fields was reading-writing style. This finding is consistent with the results of Moghadam et al.'s study (2013) regarding the comparison of the learning style of nursing and midwifery students based on the VARK model. Moghadam et al., 2015). Peyman et al. (2012) conducted a study on nursing students to determine their learning style. They found out that the dominant style among the students

was the reading-writing style, which is also consistent with the present study (Peyman et al., 2012). Ojeh et al.'s study (2017) also conducted a study on learning style preferences using the VARK questionnaire among master's degree clinical students. The results showed that the participant's dominant style was reading-writing style (Ojeh et al., 2017). Several other studies on learning styles based on the VARK model among medical students revealed that most nursing students have a reading-writing style which was consistent with the results of the present study (Ahmadi and Allami, 2014; Hejazi et al., 2015; Mooneghi et al., 2009). On the other hand, there are some studies with contradictory results, a study by Amini et al on medical students using the VARK questionnaire found that medical students prefer multi learning styles but among mono style students they were principally visual (Amini et al., 2010).

In a descriptive cross-sectional study conducted by Kharb et al. (2013) on medical students, the most prevalent learning style was found to be the multiple styles, followed by the dual and then the sequential styles. Furthermore, the majority of the individuals who had a singular learning style were kinesthetic learners, followed by visual, auditory, and finally read/write learners (Kharb et al., 2013). In another study conducted by Panambur et al. (2014) on learning styles of pre-internship medical students in Oman, only one third of the students had a singular learning style, while two thirds of the students had combination and multiple learning styles (Panambur et al., 2014). Moreover, a study conducted by Hedayati et al. (2015) on the learning styles of medical and dentistry students revealed that the most common learning style was visual, while the least common was auditory (Hedayati et al., 2015).

The results of a study by Liew et al. (2015) on the learning styles of 419 pre-clinical medical students using the VARK questionnaire showed that most students had a dominant learning style, and among students with a single learning style, the dominant style was kinesthetic (Liew et al., 2015). In a study by Akhlaghi et al. (2018) on the impact of learning styles on the performance of first to sixth-year dental students at Isfahan University of Medical Sciences, results indicated that more than 50% of students had a dominant multiple learning style. Among students with a single learning style, the auditory and kinesthetic styles had the highest frequency, but students with the read/write style had higher academic success (Akhlaghi et al., 2018). However, Khanal et al. (2019), in a study on learning styles of medical and dental students using the VARK questionnaire, showed that most students had multiple learning styles, followed by dual styles. Among individuals with a singular learning style, the kinesthetic style had the highest contribution. Students with a singular learning style had better grades than those with multiple learning styles, but the results did not show any significant differences based on gender or ethnicity (Khanal et al., 2019). In a study by Rezigalla and Ahmed (2019) conducted on the learning styles of medical students in Saudi Arabia, more than 86% of students had a single learning style, with the majority being auditory and the least being read/write learners. Additionally, the most common learning style across all levels of students was the visual style (Rezigalla and Ahmed, 2019). Also, in a study by Stanley et al. (2020) on the learning styles of pharmacy technicians and their impact on their education, the dominant learning style was found to be a singular learning style, with kinesthetic being the preferred style (Stanley et al., 2020). Furthermore, in a review analysis by Childs-Kean et al. (2020) on relevant articles regarding learning

FIGURE 2
Distribution of teaching preferences according to learning styles from students' viewpoints.

FIGURE 3
Learning style profile of e-students according to their virtual education preferences.

styles in the fields of medical and health sciences, it was found that based on the VARK model, students in medicine, dentistry, and nursing mostly have multiple learning styles (combination style), with kinesthetic being the dominant style. However, students in pharmacy mostly have a visual learning style (Childs-Kean et al., 2020).

It should be noted that the difference in results from previous studies may be due to the fact that although the previous studies mainly focused on medical and paramedical students, now many of these students are studying in interdisciplinary fields. The mean age of the study participants was approximately 39 years, whereas most studies on learning styles have been conducted at the undergraduate level and among younger age groups. Additionally,

mature and working individuals may prefer more traditional and less technology-dependent methods, such as reading and writing, for self-study or specialized professional training. In a general summary of studies on learning styles in various fields, it is evident that learning styles do not adhere to a specific pattern, and the results are highly diverse. This variation can be influenced by various factors, such as the learning environment and previous learning experiences, the nature of the field of study, gender differences, assessment methods, teaching styles and presentation, the amount of course content, and the orientation of the teaching (student-centered or teacher-centered).

Virtual education preference: In this study, e-learning methods including text interaction, online presentation (synchronous),

e-Content, student-centered projects, and face-to-face module were categorized. The findings of the study showed that the preferred teaching method from students' viewpoints for all five methods is above average and its symmetrical shape shows that e-students prefer a balanced blended approach of all educational methods. But the highest average was for e-Content, and student-centered projects. In other words, students were most concerned about having pre-course e-content, and this may help them to have more flexibility in their educational time and place. As the second priority was the student-centered projects, it can be inferred that be due to the fact that most of the e-students in this study were often employed and they do not have enough time to attend online classes (with time constraints), so despite the synchronous methods were one of the students' preference. However, they were more interested in having e-content and engaging in project-based assignments. In Salehi's study, teaching with the help of audio-visual media in theoretical courses, and discussion and feedback in practical courses were found as the preferred teaching methods. The first part of Salehi and colleagues' study was somewhat aligned with the results of our research. However, since e-students do not have much in-person contact with each other, the second preference of face-to-face students—based on questions, answers, and group discussions—was not consistent with our research findings (Salehi et al., 2000). In the study of Yassini Ardakani et al. the preferential teaching methods of 354 medical students in Yazd University of Medical Sciences were studied. The results showed that students in theoretical courses prefer the lecture and deductive method, and in practical courses, they prefer the team training method. This result is different from the results of the present study, and this difference may be due to the fact that students in face-to-face classes are able to work better in team working projects while having interactions, but in virtual fields, students interact less with each other. Of course, the teamwork method was not a clear component in our research, but in the two items of the educational preferences questionnaire, which specifically aimed at sharing opinions and experiences with other peers, as well as sharing scientific conferences between students and presenting by peers, the score was higher than cut-off-point but e-content and student-center methods were preferred. This preference may be due to the occupations and personal life of the participants. Because they have less time for group coordination (Reid et al., 2013). Kharb et al in a cross-sectional descriptive study found that undergraduate medical students in a medical school in India preferred the most practical teaching methods. This result is somewhat in line with the results of our research in terms of preferring practical methods, but students in our research preferred the e-content method. This may be due to the fact that medical students do not feel much need for access to content and resources due to face-to-face interactions and direct access to professors, and the nature of the medical field is more about practical work in real environments. However, in virtual fields, due to the lack of face to face access to professors, there is always concern about access to content (Kharb et al., 2013). Stanley et al. in a study on the educational preferences of pharmaceutical technicians found that students preferred team work, online methods, self-directed and student-centered methods, simulation and experimental training, and empirical on-the-job training methods (Stanley et al., 2020). In another cross-sectional descriptive study, Al-Maghraby et al. studied 53 physiotherapy students and found that more than

85% of students preferred the practical teaching methods, pre-organizing teaching, demonstration, and multimedia. The result of this research is in line with the results of the present study in terms of priority of practical methods and student involvement in their learning, but contrary to the results of the present study, since physiotherapy students expressed methods based on multimedia and electronic content in the last priorities (Al Maghraby and Alshami, 2013). Liu in an interventional study found that they prefer peer learning method, intergroup competition, teacher interaction, materials and resources, independent learning methods, and direct experience (Liu, 2007). Karimi et al. in a study of 167 students at Fasa University of Medical Sciences found that the highest frequency of teaching methods preferred by students were: group discussion, question-answer method, demonstration, project-based method, and simulation. Differences in the results of this research can also be due to differences in the nature and conditions of face-to-face and virtual disciplines as well as the type of field of study. This study was performed in 2009, when multimedia and online learning were not yet common in universities (Karimi and Jamshidi, 2010).

Virtual education preference and Learning style: In this research, the virtual education preferences of students based on learning style were not significantly different. This indicates that, although students may prefer different learning styles, the most important factor determining their educational preferences is likely their circumstances. Considering that the students who participated in this research were mostly employed, female, and married, they face challenges and responsibilities in both their professional and personal lives, which create limitations in terms of time and space. Therefore, e-content multimedia is more effective due to its flexibility and adaptability to spatial and temporal conditions. Additionally, multimedia is suitable for all learning styles. The second preference of the participants was the self-directed and project-oriented method. According to adult education theories, participants' work experience leads them to prefer independence in learning (Subedi and Pandey, 2021).

In examining the effect of contextual factors on students' educational preferences, based on the research findings, female significantly preferred e-content compared to male. In other areas, the educational preferences were not different by gender. The research of Siyami et al. showed that female students preferred student-centered teaching style and male students preferred teacher-centered style (Siyami et al., 2014). However, Parashar et al in 2016 and Saleh Moghadam et al in 2013 found no significant relationship between gender and educational preferences of students, which was not consistent with the present study (Parashar et al., 2018; Salehmoghaddam et al., 2013). These differences may be due to the fact that in previous research, the age group of undergraduate students was younger than students in our research. The e-students in our study were Postgraduate and their age range was more than 38 years. Most of our students are employed and have professional and personal businesses. Also, most of our research students were married female who had less time due to family responsibilities and child care, so e-content provided more flexibility with their living situation. Part of this difference is due to the nature of face-to-face and virtual disciplines. In virtual disciplines e-students have less access to the teacher and therefore the teacher-approved e-content gives the student more

confidence and support. Another important point is that the four disciplines studied in this research are interdisciplinary in nature. the previous field of study of students was medical sciences while their current discipline was interdisciplinary field of educational sciences. Therefore, due to the fact that the background of students was not compatible with the new field, they feel the need for more e-content to improve their theoretical knowledge.

Conclusion

Students in virtual education seem to prefer a blended approach that combines various teaching methods. However, due to limited access to face-to-face interactions and communication with professors, e-content serves as an effective educational support for these students. Additionally, considering the postgraduate level of the students and their employment situations, they predominantly prefer practical and problem-solving methods that engage them with real-world issues. The elements of *flexibility*, *personalization*, and *independence* are the main preferences of e-students, particularly because many of them are women who are employed or married. Consequently, methods that provide e-content can be more suitable for their personal circumstances. Furthermore, holding short, intensive modular courses can effectively establish communication between teachers and students.

Limitations of the research: This research was conducted only with students in the fields of medical education, e-learning, community-based education, and health policy, and they were asked solely about the teaching methods they had experienced. Consequently, among the educational preferences, there were no items such as simulation, augmented reality, or virtual reality. It seems advisable that, when re-examining this questionnaire, other educational methods should be considered.

Suggestion for the future research: We investigated the relationship between the variables of gender, field of study, and the main components of the research. However, other variables such as job, place of residence, etc. may also be effective in this regard, which is suggested to be investigated in future research. Additionally, this research was only conducted on students of virtual courses before the pandemic. Considering that after the pandemic, almost all majors have been designed in the form of extended learning, this research can be examined from the perspective of students of all majors.

Educational relevance statement

- E-students have different learning styles, but their educational preferences are more influenced by their conditions.
- E-students have less access to face-to-face interactions and communication with professors, the
- e-content as a e-student educational support can be effective.
- Also, according to the students at the postgraduate level and employment situation, they mostly preferred practical and problem solving methods while engaging with real problems.

- The element of "Flexibility", "Personalization" and "independence" was the main preference of e-students because most of them were women, employed or married, so methods including providing e-content for students can be more appropriate for their personal living conditions.
- Also, holding short intensive modular courses can be effective in establishing communication between the teacher and the student.

Data availability statement

The datasets used and/or analyzed during the current study are available from the corresponding author on reasonable request.

Ethics statement

The studies involving humans were approved by the Iranian National Committee Ethics in Biomedical Research with the code of IR.SUMS.REC.1398.413. The studies were conducted in accordance with the local legislation and institutional requirements. Written informed consent for participation in this study was provided by the participants. Written informed consent was obtained from the individual(s) for the publication of any potentially identifiable images or data included in this article.

Author contributions

ZK: Conceptualization, Data curation, Formal analysis, Funding acquisition, Investigation, Methodology, Project administration, Resources, Software, Supervision, Validation, Visualization, Writing – original draft, Writing – review and editing. ZZ: Data curation, Investigation, Writing – review and editing.

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Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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