The Relationship of Satisfaction and Usage of Virtual Learning Facilities with Learning Style in Medical, Health and Operating Room Students

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Abstract

Background: Nowadays, several studies have been performed on the factors affecting the effectiveness of virtual education. One of the characteristics of learners is their different learning styles.

Objectives: The purpose of this study was to investigate the relationship between learning style and the level of satisfaction and usage of e-learning facilities in medical students.

Methods: This cross-sectional and retrospective (ex post facto) study was performed among medical, public health and operating room students of Shahrekord University of Medical Sciences in 2017. We redesigned their courses to be delivered in the blended method, so that teachers used a Learning Management System (LMS) in addition to traditional teaching. Information about learning styles was collected using Kolb's questionnaire, satisfaction level evaluated with a researcher made questionnaire and use of e-learning was examined by checking system loggings. Data were analyzed using one-way ANOVA, Tukey's post hoc, Welch's ANOVA and X^2 tests in SPSS software.

Results: Students' satisfaction with e-content in diverging learning style was higher (P = 0.032), but there was no significant relationship between learning style and demographic characteristics and total average mark. Also, there was no significant difference in the amount of using e-learning facilities between different learning style groups (P = 0.256).

Conclusion: It seems that using virtual learning facilities and considering the type of learning style in students can increase their satisfaction.

Keywords: Personal Satisfaction, e-Learning, Learning, Students, Education

Background

From a philosophical perspective, e-learning is based on constructivist and participatory learning approaches and empowers learners to change from being passive learners to active, exploratory and creative ones. Social and fundamental changes in epistemology and cognitive psychology approaches along with advances in hardware and software have increased the ability of educational planners in e-learning (1).

Learning management systems (LMS) are a viable solution to meet the different needs for virtual education in medical universities and have made it possible for individuals to teach easily and at low cost (2-4) regardless of time and space constraints. However, factors such as content security, emphasis on knowledge rather than performance and assurance of participant identity are among the disadvantages of this type of learning (5).

The results of studies show that e-learning has promising effects on the learning of some skills and their application by staff or students (6-8). Research shows that countries such as the US, Canada, UK, Australia and China are leading the way in the implementation of e-learning in medical education. Medical courses (mostly basic sciences) are available online at US medical colleges, including Harvard, Columbia, Boston, and Michigan (9).

Effective efforts have also been made at the universities

of Manchester and Sheffield in the United Kingdom and the medical schools of China (9). In a study, the impact of blended learning was investigated at the University of Munster Hospital in Germany, using a web-based e-learning tool (patient video clips). Results showed satisfaction and increased knowledge of students (10). On the other hand, Shahwardi et al. concluded that students were not satisfied with the quality of e-learning services (11).

Learning styles are one of the topics that can lead to optimal e-learning effectiveness. These styles refer to students' selective ways of learning (12), and are a set of cognitive, emotional, and physiological traits that deal with how the learner collects, organizes, and thinks about information. Awareness of learning style helps learners to improve their learning (13).

In recent years, many scientists have presented their theories on learning styles, and so far, around 21 types of learning styles have been mentioned. One of the most common learning styles that has been the focus of this study is Kolb's learning style (14). By identifying different learning styles, e-learning systems can provide appropriate suggestions and recommendations for teachers and students that can improve the learning process of students (12).

For medical students, knowledge and performance-based learning styles can bring about more success (15). One of the most important benefits of e-learning is the provision of educational services based on the needs of students, which makes it easy for individuals to teach without regard to time and space constraints (16). Therefore, considering the student's central role in the virtual education system, their satisfaction as end customers is one of the top priorities of the system designers and executives and one of the most important factors for its success (17).

Objectives

Due to the increasing trend of using virtual education and the existence of ambiguous aspects as to the effectiveness of learning in medical sciences, we aimed to investigate the relationship of satisfaction and utilization of virtual learning facilities with learning style in medical students in 2017.

Methods

This was a cross-sectional and retrospective (ex post facto) study, and the study participants consisted of 140 students of Shahrekord University of Medical Sciences including undergraduate medical students who entered the university in 2015 and 2016, undergraduate health students who entered the university in 2015, and undergraduate operating room students who entered the university in 2015. The participants were chosen using the census sampling method.

The inclusion criteria included all the students whose instructors had consented to the use of e-learning in the course. The exclusion criteria were absence, not completing the questionnaire at the time of collection of questionnaires and not logging into the Learning Management System (LMS).

Based on the possibility of delivering courses in a blended method and courses instructors being volunteer to do so, courses of Health 1 and 2 from medical curriculum, Common illnesses of children from General Health curriculum and Acquaintance with operating room equipment course from Operating Room curriculum were selected. The blended instructional design was used for the lessons. In the instructional design, we analyzed and set educational goals, instructional context, content, teaching method and the evaluation system. The blended learning lessons were specifically tailored for this project for one semester and information was collected after the end of the semester.

Workshops were held for the faculty members using the LMS and the lecturers were briefed on features of the system and how to use different modules. Students were provided with their usernames and passwords to log in to the LMS. All the sessions were held in person and the instructors only used the LMS as an elective complementary instruction during the semester.

During the semester, the instructors uploaded contents to the LMS, including PowerPoint, PDF and Word files and multimedia e-contents. As there was no obligation to use e-learning part of the course, students' scores were not affected by not participating in this part. The LMS used in this project was a specialized e-learning software for the delivery of asynchronous e-learning at http://lms.skums.ac.ir. Students' personal information such as age, gender, total mean marks, field of study, being local residence of the region, place of residence, marital status, access to appropriate computer and internet and experience in virtual learning were collected using a questionnaire.

Information about learning styles was collected using Kolb's questionnaire and satisfaction data was collected by a researcher-made questionnaire. The LMS report was used to investigate the use of virtual learning environment.

The Kolb Learning Style Questionnaire consists of 12 sentences with four options for each sentence (18, 19). Each option represents one of the four learning modes, namely objective experience, reflective observation, abstract conceptualization and active experimentation. Participants rated their suggested options from a 4 to 1 score (completely, to some extent, slightly and very low) given their learning style.

The sum of the scores of these options is four scores, representing four learning styles, with the first option in each question being the objective learning experience method, the second reflective observation learning, the third abstract conceptualization learning method, and the fourth active experimenter learning method. The pairwise subtraction of these methods (the difference between abstract conceptualization and objective experience as well as the difference between active experimentation and reflective observation) yields two scores on two coordinate axes (considering the final result being negative or positive).

The vertical axis includes objective experience at the top and abstract conceptualization at the bottom and

the horizontal axis includes reflective observation on the right and active experimentation on the left. These two axes form the coordinates of the four quadrants, and the four learning styles in each quadrant are diverging, converging, assimilating and accommodating (18, 19). The reliability of the Kolb Cognitive Styles Questionnaire has been investigated using Cronbach's alpha coefficient in previous studies. Accordingly, the coefficients of objective experience, reflective observation, abstract conceptualization and active experimentation were reported to be 0.65, 0.64, 0.67 and 0.74, respectively (19). In the present study, Cronbach's alpha coefficient of the questionnaire was obtained between 0.71 and 0.82.

Diverging learning style stems from a combination of objective experience and reflective observation. In fact, people with this type of learning style are more likely to see objective situations from different angles. They often prefer to see situations rather than act on them. They like situations that require diverse ideas, and are interested in diverse cultural attractions and information gathering.

Assimilating style is derived from the combination of abstract concept and reflective observation. People with this style of learning have a great deal of accuracy and ability to acquire and understand extensive information and to summarize it. In general, these people are less likely to pay attention to people and are more interested in abstract ideas and concepts.

Converging learning style is derived from a combination of abstract conceptualization and active experimentation. Individuals with this learning style are most capable of practicing ideas and theories. A person with this type of learning style can solve problems and make decisions based on the solutions they find.

Accommodating style also comes from a combination of objective experimentation and active experimentation. People with this style mostly learn through first-hand experiences and enjoy executing plans and engaging in challenging tasks. These people often prefer practical and tangible things to logical analysis (20).

Satisfaction questionnaire consisted of 16 questions rated on a five-point Likert scale (very high, high, medium, low, very low). Exploratory factor analysis was used to examine the construct validity of this questionnaire. At first, Bartlett's sphericity test was performed ($P = 0.001$) and Kaiser-Mayer-Olkin (KMO) value of 0.812 was calculated, confirming the suitability and adequacy of sample size. Then, using the scree test and examining the amount loaded on each question after using varimax rotation of the samples, only three factors with eigenvalues greater than 1 were determined and finally, 16 questions of the questionnaire were converted into three main factors. The first factor consisted of 8 items on satisfaction and interest in using virtual education, the second factor consisted of 4 items on satisfaction with the LMS and the third factor consisted of 4 items on satisfaction with electronic content, which explained 67% of the variance in total. The reliability of the questionnaire was reported to be 0.92 by examining

the degree of internal consistency based on a 20-person pilot study. The content validity of the questionnaire was evaluated by the opinions of 10 experts.

After identifying the three factors of interest in using virtual education, satisfaction with LMS and e-content satisfaction, the relationships between them and students' learning styles were analyzed using One-way ANOVA test. After performing the test and identifying significant relationships, Tukey's post hoc test was used to detect and investigate the significant satisfaction and Chi-square test was used to investigate the differences in qualitative variables in learning styles. The data were analyzed in SPSS software version 23 (IBM Corporation version, Armonk, NY). LMS logs were used to collect information on the number of students using virtual learning facilities, including number of logins, number of text and multimedia content readings, and number of downloads. The present study was approved by the Ethics Committee of Tehran University of Medical Sciences (Ethical codes: R.TUMS.VCR.REC.1396.3408).

Results

The participating students' age ranged from 18 to 25 years. Their mean age was 20.04 ±1.17 years and their total mean score was 15.67 ± 4.20 years.

Frequency distributions of field of study, gender, nativity status, residence status, marital status, computer and Internet access, computer and Internet use (personal or university), experience in virtual courses, and use of university LMS by learning styles are presented in Table 1. The relationship between each style and demographic variable was assessed by the Chi-square test. The findings showed that there was no significant relationship between learning style and field of study, gender, nativity status, residence status, marital status, access to appropriate computer and internet, computer and internet use (personal or university), virtual course experience and use of university LMS (Table 1).

The highest and lowest means of satisfaction and interest in using e-learning were in diverging and assimilating learning styles, respectively. The LMS satisfaction score was the highest in the accommodating learning style, while it was the lowest in the assimilating learning style. Satisfaction with e-content was also highest in the diverging learning style and lowest in the converging learning style (Table 2).

Table 1. Comparison of frequency of learning styles by the participants' demographic variables

Variable		Converging No. (percentage)	Diverging No. (percentage)	Assimilating No. (percentage)	Accommodating No. (percentage)	Pearson (Chi-square)	P-value
Field of study	Medicine	6 (12.0)	4 (8.0)	21 (40.0)	21 (40.4)	3.796	0.704
	Health	1 (6.0)	0 (0)	8 (47.0)	8 (47.1)		
	Operating room	1 (10.0)	2 (18.0)	4 (36.0)	4 (36.4)		
Sex	Female	6 (11.1)	4 (7.4)	21 (38.9)	23 (42.6)	0.504	0.918
	Male	2 (7.7)	2 (7.7)	12 (46.2)	10 (38.5)		
Being the local residence of the region	Native	6 (15.4)	1 (2.6)	17 (43.6)	15 (38.5)	4.198	0.241
	Non-native	2 (5.1)	4 (10.3)	15 (38/5)	18 (46.2)		
Place of residence	Dormitory	(0.7) 4	4 (7.0)	21 (36.8)	28 (49.1)	5.946	0.114
	Non-dormitory	4 (18.2)	(4.5) 1	12 (54.5)	5 (22.7)		
Marital status	Single	8 (10.4)	5 (6.5)	32 (41.6)	32 (41.6)	0.404	0.939
	Married	0 (0)	0 (0)	1 (50.0)	1 (50.0)		
Access to computer and the Internet	Yes	7 (9.6)	5 (6.8)	31 (42.5)	30 (41.1)	0.901	0.825
	No	1 (17.7)	0 (0)	2 (33.3)	3 (50.0)		
Use of computer and the Internet	University	3 (13.6)	2 (9.1)	6 (27.3)	11 (50.0)	3.092	0.378
	Personal	5 (9.1)	2 (3.6)	26 (47.3)	22 (40.0)		
Experience of enrollment in virtual training	Yes	3 (9.7)	2 (6.5)	13 (41.9)	13 (41.9)	0.196	0.978
	No	5 (10.6)	2 (4.3)	20 (42.6)	20 (42.6)		
History of LMS use	Yes	7 (16.3)	3 (7.0)	16 (37.2)	17 (39.5)	3.951	0.267
	No	1 (2.9)	2 (5.7)	16 (47.7)	16 (47.7)		

LMS: Learning management system

Table 2. Comparison of mean scores of satisfaction factors and use of virtual education facilitiesby learning style

Satisfaction factors	Learning style (mean±SD)				F-test*	P-value
	Converging	Diverging	Assimilating	Accommodating		
Interest in e-learning	3.50 ± 0.88	4.12 ± 0.69	2.70 ± 1.01	1.30 ± 3.07	2.126	0.114
Satisfaction with LMS	2.62 ± 0.93	2.66 ± 0.14	2.18 ± 0.75	3.50 ± 0.88	0.817	0.492
Satisfaction with e-content	2.37 ± 1.04	3.33 ± 0.80	2.01 ± 0.63	2.28 ± 0.76	3.580	0.022
Amount of use	18.16 ± 16.50	9.33 ± 2.10	15.23 ± 12.80	8.00 ± 7.10	**1.560	0.256

*test One-Way ANOVA, **test Welch's ANOVA   LMS: Learning management system

Satisfaction factors (satisfaction with virtual education, satisfaction with LMS and satisfaction with electronic content) were compared between the four learning style groups using ANOVA test. There was no significant difference in satisfaction with virtual learning and LMS among the learning styles, but there was a significant relationship between e-content satisfaction and students' learning styles (P = 0.02; Table 2).

Significant differences in e-content satisfaction in different learning styles were investigated using Tukey's post hoc test. Accordingly, there was a significant difference in satisfaction with electronic content between the diverging and assimilating styles (P = 0.032) as well as

the diverging and accommodating styles (P = 0.018).

The total mean score of students in the converging learning style (15.96 ± 4.90) was higher than other styles. This value was 15.62± 4.70, 15.74 ± 5.83, and 15.70 ±5.30 in the diverging, assimilating and accommodating learning styles, which were not significantly different (P = 0.979).

In order to check the system usage, the number of logins, the number of electronic content readings and the number of downloaded documents were evaluated. ANOVA was also used to determine the amount of system usage difference between students with diverse learning styles. Levene's test was used to test the homogeneity of variances. Welch's ANOVA test was used as the variance

of the distribution of usage value was not homogeneous in different styles (P = 0.036). The results showed that there was no significant difference in the amount of usage of virtual learning facilities in LMS between different learning styles (Table 2).

Discussion

The purpose of this study was to investigate the relationship between students' learning styles (converging, diverging, assimilating and accommodating) and their satisfaction with virtual facilities and the relationship between these styles with the amount of LMS usage in Shahrekord University of Medical Sciences students. The results showed no significant difference in satisfaction with virtual learning and LMS between different learning styles, but there was a significant difference in satisfaction with e-content among students with different learning styles.

Previous research has shown that the use of LMS as a non-synchronous e-learning tool has a significant role in student satisfaction and helps them focus on content (21). It should be noted that in an e-learning environment, many factors affect user satisfaction. These factors can be subdivided into inclusive dimensions, lecturers, courses, technology, system design and learning environments (22). For example, research results show that while content is appropriate, factors such as frequent technical problems, problematic use, and lack of access to electronic equipment can be considered as a cause of students' dissatisfaction with virtual education services (23).

The results of the study by Di Marco et al. showed a moderate relationship between the strategy of using deep learning techniques and the acceptance of the learning model and its satisfaction (24). Another study has demonstrated that the content of an LMS is better suited to support efficient and dynamic learning, and integrating the use of tools with face-to-face learning is crucial for students (25). Al-Neklawy concluded in his research that most students were very satisfied with the impact of blended teaching methods (26). In practical and skill-based discussions, it should be noted that training should be both virtual and in-person in order to achieve student satisfaction and optimal performance (27). On the other hand, learning styles have become a notable educational concept and the number of learners and the variety of educational content must be determined based on the learning style (28).

The results of the study by Ahadi et al. indicated that converging and diverging learning styles were prevalent among nursing students (29). In a study by Pouratashi et al. (30) to investigate the learning styles of agricultural students, the learning styles of female students were identified as converging and assimilating. In the present study, the percentages of accommodating and assimilating learning styles were higher in medical, health and operating room students, but there was no significant difference between different learning styles and each of these fields of study. The results of another study showed that participating in a virtual education course can improve attending students' attitudes towards virtual education in people with different learning styles (31). In the present study, there was no difference in the use of virtual education between learning styles, which was not unexpected as e-learning aims at covering all learning styles.

The present study had some limitations. Given that different lecturers and courses have been studied, teachers' teaching style, their ability to provide educational content, and the nature of the courses may also be confounding factors. On the other hand, sample selection and sample size were limited due to the choice of courses that could be offered in mixed mode, lecturers' cooperation with the use of cyberspace during the semester and training faculty and students on how to use the LMS. Also, due to the high cost of producing multimedia electronic content, the limited production of these contents was another drawback of the present study.

It seems that using e-content and presenting it to students can increase their satisfaction. It is recommended that this study be performed in other environments with larger sample sizes.

Supplementary Material

Supplementary material(s) is available here [To read supplementary materials, please refer to the journal website and open PDF/HTML].

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