



Relationship between Kolb's Learning Styles and Readiness for E-learning: A Cross-sectional Study in the Covid-19 Pandemic

Sareh Mehni¹, PhD Candidate;  Farshid Chahartangi¹, PhD Candidate; Mahsa Tahergorabi², PhD; Neda Dastyar^{3*}, MSc;  Akbar Mehralizadeh⁴, PhD; Azimeh Amirmijani⁵, MSc

¹Student Research Committee, Shiraz University of Medical Sciences, Shiraz, Iran

²Department of Environmental Health Engineering, Jiroft University of Medical Sciences, Jiroft, Iran

³Department of Midwifery, Nursing and Midwifery School, Jiroft University of Medical Sciences, Jiroft, Iran

⁴Department of Statistics, School of Medicine, Jiroft University of Medical Sciences, Jiroft, Iran

⁵Jiroft University of Medical Sciences, Jiroft, Iran

ABSTRACT

Background: Significant changes have occurred in education, including the emergence of E-learning which appeared to be an alternative method of carrying out teaching and learning activities. This research seeks to examine the correlation between Kolb's learning styles and readiness for e-learning.

Methods: This cross-sectional study was conducted in Jiroft University of Medical Sciences (southern Iran) in 2021. 247 eligible medical students were selected using convenient sampling. Data were collected using the Watkins standard e-learning questionnaire and Kolb's learning styles questionnaire. Data were analyzed by SPSS version 23 using descriptive and inferential statistics (ANOVA and post hoc LSD tests) which were all used to find connections. A P-value<0.05 was considered statistically significant.

Results: The participants' mean age was 21.5 (SD: 1.69) years and average score in the e-learning readiness tests was 127.54 (SD: 27.05). According the findings of this study, the learning style of most students was divergent (104 (42.1%)). One-way analysis of variance, showed that there was a statistically significant difference between the average e-learning readiness ratings for various learning styles (F=3.20, P=0.024). Converging style is the top favored learning style among students who are ready for online learning, according to researchers.

Conclusion: According to the findings of the study, students' learning styles were statistically relevant to their readiness for e-learning. The study may be useful for a balanced pedagogical system in both pandemic and post-pandemic situations. University planners need to pay special attention to the students' learning styles because one of the ways to increase preparation for e-learning is to know the students' learning style.

Keywords: Learning, Education, Students, Medical, Distance, Covid-19, Readiness

*Corresponding author:
Neda Dastyar, MSc;
Department of Midwifery,
Nursing and Midwifery
School, Jiroft University of
Medical Sciences, P.O. Box:
78617-63730, Jiroft, Iran
Tel: +98 9193418943
Email: nedadastyar98@gmail.
com

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Introduction

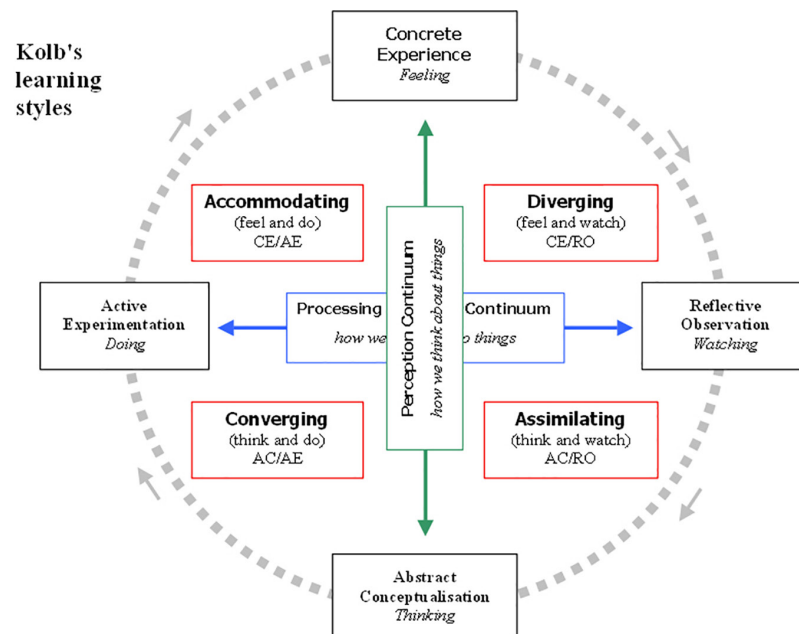
Before the school shutdown due to COVID-19, significant changes had occurred in education, including the emergence of E-learning (1). During this crisis, e-learning appeared to be an alternate method of carrying out teaching and learning activities (2). E-learning is the act of learning using electronic tools and procedures (3). Web-based learning, computer-based learning, virtual classrooms, and online collaboration are all examples of e-learning methods and applications. The Internet, intranet, extranet, satellite TV, and CD-ROM with multimedia capabilities are all used to provide content (4).

Adaptive and personalized e-learning systems, which meet the learners' variety and unique requirements, are essential nowadays in order to get the most out of these systems (5). The majority of the current studies employ learner/user modelling to accomplish adaptive personalization (6). The combination of personality traits, behavioural factors, and knowledge factors is known as the learner model (7, 8). Additionally, as a result of personality traits, learners have a variety of styles or methods to learn (9). According to Felder and Silverman (1988), students learn more efficiently and make better progress

when they have learning material that suits their learning styles (10).

Learner modelling based on learning styles has gained a great deal of attention in the literature as a result of these findings (11, 12). Learner attributes and needs play a crucial role in the educational domain. As a result, learning styles are given a lot of attention in the literature for a long time (13). A person's innate preferred methods of acquiring, processing, and remembering new knowledge, and remembering new knowledge and abilities are referred to as their learning style (14).

Kolb's learning style model and the experiential learning theory are based on the research of Dewey who views the experience as the foundation of learning, Lewin who emphasizes the value of individuals' active participation in the learning process, and Piaget who views intelligence as more than just an innate quality, but also as the result of interactions between people and their surroundings. The comprehension and transformation aspects that Kolb shows about learning styles are represented by the four-step cycle represented in Figure 1 as Concrete Experience (CE), Reflective Observation (RO), Abstract Conceptualization (AC), and



© concept david kolb, adaptation and design alan chapman 2005-06, based on Kolb's learning styles, 1984
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Figure 1: Kolb's learning styles (17)

Active Experimentation (AE) (15).

In general, concrete experience calls for complete individual engagement in an activity, reflective observation calls for the development of various viewpoints, abstract conceptualization calls for the acquisition of theoretical information, and AE calls for the application of knowledge. Learners may be classified as Diverger, Assimilator, Converger, or Accommodator based on a visual profile that is displayed on the Learning-Style Type Grid. The mix of Concrete Experience (CE) and Reflective Observation (RO) creates the diverging learning style (16).

Divergers may see certain events from different angles and, in any case, prefer to watch rather than take immediate action. Students with this learning style are characterized as imaginative and emotive, and they like generating ideas by the use of their imagination, perception, identification of problems, analysis from many angles, and adaptation (18).

Weak points are expressed as difficulties in making judgments, selecting among options, and even failing to evaluate learning possibilities. Both Active Experimentation (AE) and Reflective Observation (RO) fall under the assimilating learning style. The assimilators are very good at combining large amounts of information into a logical whole (16).

It has been shown that students who learn by assimilation are able to plan and recognize issues, but frequently struggle to implement a systematic strategy in practical settings. They are told that they need to get better at gathering data, building conceptual models, testing ideas and hypotheses, and taking probabilities into account rather than just current circumstances. Assimilating learners typically concentrate on abstract concepts and ideas, learn by listening and observing, and consider their teachers as the most reliable sources of information (18).

Combining Abstract Conceptualization (AC) and Active Experimentation (AE) results in converging learning style. They are the idea practitioners. It is highlighted

that these people are capable of advanced logical analysis and deductive reasoning, have suitable decision-making and problem-solving abilities, and prefer dealing with technical difficulties over social and interpersonal interactions. Combining AE and Concrete Experience (CE) results in accommodating learning style. The accommodators can use their previous experiences to their advantage. These students possess leadership qualities, favor interpersonal interactions, and seek out other people's personal knowledge above technical answers. They are regarded as inquisitive and investigative, and they are notable for their initiative, adaptability, and open-mindedness (16).

Overcoming the obstacles of e-learning is crucial for its successful adoption, particularly in developing and disaster-stricken nations like Iran. The preparation for e-learning is a timely strategy to recover from the problem brought on by pandemic illnesses (such as COVID-19) in the education industry. Yet, it is essential to look at the aspects that are connected to e-learning, including learning styles, in order to make e-learning more viable as a qualified substitute for conventional face-to-face learning. Nevertheless, to the best of our knowledge, no research has been done on the relationship between learning styles and e-learning preparedness in Iran during the COVID-19 pandemic.

Methods

Study Design

This cross-sectional descriptive study was conducted from the beginning of October to the end of November 2021 on 247 medical students of Jiroft University of Medical Sciences.

Research Environment, Sampling and Participants

The study population included all medical students of Jiroft University of Medical Sciences who met the inclusion criteria. They were selected using convenience sampling based on the inclusion criteria.

The criteria for entering the study

included having a history of studying at Jiroft University of Medical Sciences for at least 2 years and being willing to participate in the study.

The exclusion criteria were unwillingness to continue participating in the study and failure to complete all questionnaire items.

In order to determine the sample size, we used the correlation sample size formula ($N = [(Z_{\alpha} + Z_{\beta})/C]^2 / r^2$). Based on the correlation sample size formula ($Z_{\alpha} = 1.96$, $Z_{\beta} = 1.03$, $\alpha = 0.05$, $\beta = 0.15$, and $r = 0.20$) with 10% increase, 270 questionnaires were distributed, but only 247 of them filled out the questionnaire. The response rate was 92%.

Data Collection Tools

The data collection tool included three questionnaires:

1- Demographic information, which collected information on age, gender and marital status.

2- Kolb's learning styles inventory - version III (KLSI-III): There are 12 items and 4 sections on the scale. The four options in each item are scored between 1 and 4. The lowest score on the scale is 12, and the highest score is 48. After scoring, unified scores are calculated, which are obtained in the form of Abstract Conceptualization (AC), Concrete Experience (SC) and Active Experimentation (AE), and Reflective Observation (RO); the scores obtained as a result of this process range from -36 to +36. Positive score obtained by AC-SC indicates that the learning is abstract, whereas the negative score is concrete; similarly scores obtained by AE-RO indicate that the learning is active or reflective. Unified scores are plotted on the coordinate system. The score obtained by AE-RO is plotted on the horizontal axis, and that obtained by AC-SC is plotted on the vertical axis and the intersection of these two scores represents the individual's learning style (19, 20). The validity and dependability of the translated version of this questionnaire have been demonstrated by Hejazi et al. (21) in Iran. The questionnaire is scored in accordance with its instructions and the total

scores received for each of its sections; then, the dominant learning style of each individual is identified as a nominal variable. In the present study, the reliability of this tool was checked by calculating Cronbach's alpha as 0.82. Also, to determine the content validity of this questionnaire, the researchers checked the Content Validity Ratio (CVR) and the Content Validity Index (CVI). It was found that $CVI = 0.91$ and $CVR = 0.74$.

3- The Watkins et al.'s (22) standard e-learning questionnaire: This 27-item questionnaire includes questions about the students' readiness to participate in e-learning, which are categorized into six factors (access to technology, motivation, ability to learn through the media, Internet group discussions, and important issues for success in e-learning). Also, a 5-point Likert scale was used for scoring, i.e. the students were asked to choose one of the options according to their readiness: strongly disagree (score=1), disagree (score=2), have no opinion (score=3), agree (score=4), and completely agree (score=5). The minimum possible score was 27, and the maximum score was 135. Also, a score between 27 and 45 was considered as low level of e-learning; a score between 45 and 90 was considered as moderate level of e-learning, and if the score was above 90, the level of e-learning was considered high. The reliability of the questionnaire in the study of Ahangar Seleh Bani (2014) was obtained 84% with Cronbach's alpha for the whole questionnaire, which indicates that the test has acceptable reliability (23). In the present study, the reliability of this tool was checked by calculating Cronbach's alpha as 0.75. Also, to determine the content validity of this questionnaire, the researchers checked the Content Validity Ratio (CVR) and the Content Validity Index (CVI). It was found that $CVI = 0.84$ and $CVR = 0.69$.

Data Collection

After obtaining permission from the ethics committee of Jiroft University of Medical Sciences and obtaining permission from the authorities, the researcher referred to the

education department of the medical school and prepared a list of eligible students and their contact information. The main researcher contacted the medical students by telephone, invited them to enroll in the program, and fully explained the objectives, research methodology, and voluntary participation to the students. Then, we obtained their verbal informed consent. The address of a questionnaire link, which was created and prepared using the Porsline service, was sent to students via the WhatsApp platform by the main researcher in order to conduct the study. The link included personal information, the Kolb Learning Style Inventory (KLSI), and the Standard e-learning questionnaire of Watkins et al. The questionnaire link was personally completed. The approximate time to complete the questionnaire link was 25 minutes.

Data Analysis

The data obtained from the questionnaires were entered into the computer after coding. Then, it was analysed through SPSS version 23 using descriptive and analytical statistics. The students' overall SDL preparedness and its subscales were determined using mean scores. Items that fit into a particular style were grouped for LS, and cumulative mean scores were computed. ANOVA and post hoc LSD

Table 1: Gender, e-readiness, and learning style of the students

Variable	Number (%)
Gender:	
Male	78 (31.6)
Female	169 (68.4)
Learning style:	
Diverger	104 (42.1)
Accommodator	84 (34)
Converger	35 (14.2)
Assimilator	24 (9.7)
E-readiness:	
Low	19 (7.7)
Moderate	190 (76.9)
High	38 (15.4)
Total	247 (100)

tests were all used to find the connections.

Results

Among the 247 participants, 78 (31.6%) were male and 169 (68.4%) were female. The mean age was 21.5 years±1.69 months (range: 17-28 years). The average score on the e-learning readiness tests was 127.54. (SD: 27.05). Gender, e-readiness, and learning style of the students are shown in Table 1.

According to the findings of a one-way analysis of variance, there was a statistically significant difference between learning styles in terms of the average e-learning readiness values (F=3.20, P=0.024) (Table 2).

Table 2: Comparison of learning styles in terms of e-readiness rate

Learning style	Mean(SD)	F	P value
Diverger	86.60 (24.7)	3.20	0.024*
Converger	80.42 (23.1)		
Accommodator	78.32 (17.3)		
Assimilator	75.04 (20.5)		
Total	81.78 (22.12)		

*ANOVA

Table 3: Two-by-two comparison of learning styles in terms of e-readiness rate

Learning style(i)	Learning style(j)	Mean Difference(i-j)	Std.Error	P value
Accommodator	Converger	-2.10	4.39	0.632**
	Assimilator	3.27	5.05	0.517**
	Diverger	-8.28	3.20	0.01**
Converger	Assimilator	5.38	5.78	0.353**
	Diverger	-6.17	4.26	0.149**
Assimilator	Diverger	-11.56	4.94	0.02**

**Post hoc LSD

The findings of the post hoc LSD test revealed that the divergent learning style had considerably lower average scores than the absorbing and adaptive learning styles in terms of e-learning preparedness. (Table 3)

Discussion

According to the findings, there was a strong correlation between learning styles and e-readiness. The majority of Jiroft University of Medical Sciences students (42.1%) had divergent learning style, while just 9.7% of them had assimilator learning style.

Similar to the current study, Bayrak (2017) (24) and Yavuzalp et al. (2017) (25) stated the dominant style of Turkish students was the divergent style, while El-Gilany et al. (2013) (26) found that the least style among Saudi students was divergent. In other studies such as those of Ata et al. (2019) (20), Tuncer et al. (2018) (27), and Senyuva (2017) (28) in Turkey, and Manouchehr (2006) (29) in Qatar, it was found that the most common learning style is assimilator style. This goes against the results of the current study. The varying learning styles of students in different studies appear normal since learning styles can vary for a variety of reasons. Such causes include personality traits, learning settings, subjects, and teaching techniques.

The capacity to observe carefully and the desire to interact with others are the biggest strengths of the pupils with divergent learning style. Researchers found a substantial difference in students' learning styles and readiness for online learning based on comparisons and analysis they did within these two categories. The differences in learning styles between normal and online learners were studied by Nick Zacharis in 2011 (30). Results showed that there was no impact on chosen modes of learning, such as online and traditional, and the capacity to successfully finish courses. Converging style is the top favoured learning style among students who were ready for online learning, according to researchers. Diverging and accommodating learning styles came next.

According to Kolb (2009) (19), students

who utilize abstract conceptualization prioritize scientific methods for problem-solving above creative approaches, which are representative of the concrete experience dimension. Therefore, choosing an abstract way of thinking is a step toward giving meaning to the content that is important to converging learning styles. Converging style is best at making ideas and theories work in the real world.

E-learning prefers to solve difficulties and discover solutions for issues, problems, and make decisions about them in the decision-making phase. They favour working on technical problems over interpersonal and social ones. Some preferred and appropriate methods of learning among asynchronous e-learners include doing individual assignments, online laboratories, and listserv. This latter would serve to distribute various types of information including text, video, graphic, and sound, experimenting with new ideas, simulations, labs, and practical applications, and doing individual assignments. The two primary learning capacities for a person who prefers the assimilation approach are Abstract Conceptualization and Reflective Observation (RO).

Limitations and Suggestions

There are two significant limitations to the present research. First, these results need to be considered from the perspective of Jiroft medical students because medical education can differ widely around the globe depending on a number of different factors. Also, its generalizability is restricted because it was conducted at a single medical college. It is advised to do interventions, qualitative investigations, and longitudinal studies, as well as research in settings with diverse cultures and a larger statistical population.

Conclusion

According to the study findings, the students' learning styles were statistically relevant to their readiness for e-learning. The study may contribute to a balanced pedagogical system in both pandemic and

post-pandemic situations. University planners need to pay special attention to the students' learning styles because one of the ways to increase preparation for e-learning is to know the learners' learning style.

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Author Contribution

All authors (S M, M TG, N D, A MAZ, A AMJ, and F CH) conceptualized the study, and all were major contributors to writing the manuscript. All authors approved the final manuscript.

Conflict of Interest: None declared.

Ethical Considerations and Participants Consent

The Jiroft University of Medical Sciences Ethics Committee approved this study (IR. JMU.RCE.1399.05). Students were reassured that their participation was voluntary and that their information would remain confidential. Due to the Covid-19 pandemic and the nature of the study, obtaining verbal informed consent was approved by the ethics committee of Jiroft University of Medical Sciences.

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