

Predicting Academic Students' Achievement: a Kolb's Learning Styles Approach

Majid Hamdani

Department of educational sciences, Farhangian University,
Tehran, Iran

hamdani.majid@gmail.com

Abstract

Considering that the courses of study are different in universities, students' academic achievement, which is often measured in terms of their academic grade point average, has close relationship with the students' various learning styles. In this research, the relationship between learning styles of the students of Farhangian University of Khuzestan Province and Kolb's learning styles was investigated and their future successes were predicted. The sample were 234 pre-service teachers who randomly collected. The standard questionnaire of Kolb's learning styles with 12 questions in the form of 4 components was used. The Cronbach's alpha was 0.88. the data analysis with Pearson correlation coefficient showed that there was a direct and significant relationship between pre-service teachers' learning style and pre-service teachers' academic achievement with grade point average criterion. On the other hand, using concurrent regression test, it was specified that both assimilating and divergent learning styles had the prediction capability for academic achievement of the pre-service teachers with the average grade point criterion.

Keywords: Learning Style, Farhangian University, Academic Success, Prediction, Kolb, pre service teachers

Received 18 August 2021/Accepted 13 October 2021 ©Author all rights reserved

Introduction

The process of selecting students in Islamic Republic of Iran is based on the national entrance examination (Ashouri et al, 2021), and afterwards individuals are selected on the basis of scientific requirements such as raw score, scientific balance, scientific quality of other competitors, as well as individuals' interest in selecting the course (Meraji, 2019). This process sometimes leads to the wrong selection of students or their academic decline during the years of their academic courses. For this reason, some students give up their studying or with little effort and eventually with minimum grades end up their study (Pourmohammadi et al, 2020; Kamali & Rezaei, 2020). This point creates important issues in the educational and planning processes of universities.

This becomes even more important when pre-service teachers are selected in the same process as other students. practically, pre-service teachers have been chosen in these fields, based on this crucial fact that no other scientific criterion is considered. While in the future, they are responsible for public education at the school levels.

On the other hand, learning styles have always been proposed as one of the most important factors in education and considered by researchers ((Demirtas & Egilmez, 2018; Aubrey and Reilly, 2015). The processes learning have a bilateral relationship with teaching in different aspects of educational systems including public and higher education, formal or informal, (Izadi and Mohammadzadeh, 2007) and refer to the alteration of behaviour as a result of individual experience (Encyclopedia Britanica, 2021; Shang, 2016), although these experiences or performed learning can also be the result of relation of learners with the physical or social environment and make their cognitive, attitude or skill structures (Hamdani, 2017). In this regard, organizing the educational environment, defining the interaction method of teachers with students, as well as the way of teaching to learn without awareness and recognition of the learners' method and style of learning will not almost be possible (Aubrey and Reilly, 2015) or will include many mistakes that ultimately leads to the waste of resources and time. Undoubtedly, the point that what kind of learning style the students use in their learning process has a significant impact on the outcome and result of educational activities. The important point regarding curriculum designers and instructors is the awareness of these studying approaches and the factors affecting students' learning styles (Dawn et al., 2013). In other words, the learning skills of individuals or their learning styles are different from their preferences and tendencies. These learning styles are proposed as a proper indicator for understanding and knowing people (Fleming et al., 2011; Antelm-Lanzat et al, 2020).

In general, learning styles are divided into three, namely cognitive, emotional, and physiological categories that explain, in a relative stable way, how to perceive, act, and respond to the learning environment (Rahiminia, 2017; Amin Khandaghi and Rajaie, 2013). In cognitive learning styles, the type of one's perception of the subjects is emphasized. In addition, one remembers information, contemplates the points and solves the problems. Another type of learning style that includes the emotional characteristics of the learner, are said to the emotional learning styles that include individuals' emotions related to the subject matters, educational activities, and so on. The third type of learning styles is physiological learning styles. These types of

learning styles have biological aspect and include one's reactions to the physical environment affecting his/her learning, such as the way of designing the spaces, used colors, physical activities in training and so on (Zhang et al., 2012). But among the mentioned styles, the cognitive learning styles compared with other learning styles such as emotional and physiological learning styles have wider applications, because they are cognitive manifestation of individuals in information processing.

Cognitive Learning Styles

The topic of learning style is a complex topic about which many studies have been performed over the past several decades that the result of these studies is to obtain seventy various models of learning styles (Coffield, 2004; Warning and Evans, 2013), among which five models of the learning styles of Dawn and Dawn, Felder and Silverman, Vark, Kolb, Gregoric are important and considerable, and the Kolb's learning style is almost the most common and the most valid classification of learning styles used that has been used in the present research to predict academic achievements of the students of Farhangian University.

David Kolb has compiled his learning theory based on empirical learning. He therefore considers experience as a very important factor in learning (Hawk and King, 2007). According to the Kolb's Learning Style Model, learners should go through a two-step process in dealing with data and information. The first step is data acquisition and understanding and the second one is data processing and conversion (Vega Román & Hugo Ruiz, 2018). While data acquisition will be possible through two methods of objective experience learning and abstract conceptualization, information processing will be possible by the use of contemplative observation learning and active experimentation (Sarchami and Hosseini, 2006).

People who are in the process of objective experience learning often learn through specific experiences and examples proposed in interpersonal and group discussions and are sensitive towards their own and others' feelings to the proposed concepts. It should be considered that this learning stage has application in the informal setting and the role of professor, teacher, or trainer in connection to this form of learning is empathy and facilitating (Evans, 2006).

Contemplative observation style involves people who, before performing any action, carefully observe situations and see affairs from various angles. Learners in this style prefer to use visual

and lecture methods in learning. In relation to the learners in this style, the professor, teacher or trainer is expected to play the role of a guide. Doing action on a systematic, pre-prediction designing basis and having a logical analytical process in thoughts are the characteristics of those who have an abstract conceptualization style. The mission of professors and teachers at this stage is to transfer information (Petersen and Kolb, 2017).

The last style of learning in Kolb's learning style is active experimentation method. People who use this style have a relatively high ability to do affairs and are risk taking. These people tend to influence others and generally prefer individual activity-based learning situations over group activities. Professors and teachers in this style specify for the learner how to do work (Kolb, 2014).

According to the Kolb's theory, through combining these four styles, four divergent, convergent, assimilating, and adaptive learning styles are formed to determine the individual's learning style. By combining the learning styles of objective experience learning and contemplative observation, the divergent learning style is obtained. People with this learning style are more successful in investigating objective situations from various angles and organizing some relationships. The convergent style is the result of the combination of abstract conceptualization and active experimentation learning styles. Since people who have this learning style apply thoughts in practice, they are more successful in specialized jobs and technological tasks, and in fact have the ability of solving problems and decide based on existing solutions. Through combining contemplative observation learning and abstract conceptualization, the assimilating learning style emerges. The ability to organize information and understand situations through abstract concepts is the properties of individuals of this learning style. And finally is the adaptive learning style that results from a combination of the two learning styles of objective experience learning and active experimentation. Among the characteristics of those with this learning style, the following cases can be mentioned: enjoyment from doing practical works, project execution and engaging oneself with new experiences and performing thoughts instead of logically analyzing them (Rahiminia et al., 2016; Aala et al., 2015). The general features of these styles can be observed in Table I.

Table I
General Characteristics of Learning Styles, Summarized from Kolb (2014)

	Divergent Learning Style	Convergent Learning Style	Assimilating Learning Style	Adaptive Learning Style
Characteristics	<ul style="list-style-type: none"> • Learning through emotion and observation • High creativity and imagination power • Seeing situations from various angles • Emotional • Interested in creating relationship • Interested in art and humanities courses • The consultants, experts of the organizations and managers 	<ul style="list-style-type: none"> • Learning through thinking and action • High ability to apply ideas and theories practically • Better performance in situations that there is only one solution for the problem • Non-emotional and non-exciting • Individualistic (lack of creating many relationships) • Physics, Engineering and Computer Sciences, and so on 	<ul style="list-style-type: none"> • Learning through thinking and observation • Understanding and generating inductive theories and reasoning • Combining various approaches and observing them in a general context • Individualistic (lack of creating many relationships) • Accurate, thoughtful and logical • Not paying attention to the practical application of theories and thoughts • Basic Sciences and Mathematics • Researchers, planners and philosophers 	<ul style="list-style-type: none"> • Learning through emotion and action • High ability to perform programs and experiments • Interested in new experiences • Risk taking, fast-paced, and hasty • Interested in the applicability of the issues • Relying on acquiring information from others • Solving problems intuitively and by try and error method • Interested in creating relationship • Occupations such as nursing, teaching, marketing and salesman

Researchers believe that if professors and planners pay attention to learning styles at various educational levels, it facilitates learning and educational processes and helps learners to become more efficient in choosing the course and occupational situations (Sudira et al., 2018; Aydin, 2016).

Villanueva (2020) believes that cognitive styles are used to enhance learning and there are use recommended to be used in educational circumstance.

On the other hand, Alemdag (2020) in examining the impact of learning styles on physical education concluded that the academic achievement of physical education students does not differ based on their learning style preferences, although in higher semesters the relative impact of learning styles on students' academic achievement has been observed. Karatas & Yalin (2021) have achieved similar results and state that there is no significant difference between students in different learning styles.

In this study, this question has been addressed that is it possible to achieve the prediction of future academic achievements of students by the aid of recognizing the learning styles of the students of Farhangian University in various courses.

Method

Respondents

statistical population of present research included all the male and female students of Farhangian University of Khuzestan province numbered about 600 people who have been studying in the campuses and educational centers of this university in the academic year of 2018-2019. According to the Krejcie Morgan table, a sample of 234 people was selected from the mentioned population by random sampling method.

Study design

To design the research, first the Kolbs' Learning Styles Questionnaire was used to assess the students' learning style and then the students' educational grade point average was obtained. After this stage, the relationship between these two variables was investigated by statistical methods. Then, students' academic achievement was predicted based on the Kolbs' Learning Styles Questionnaire.

According to the collected data, out of 234 statistical samples, 141 male and 93 female have responded. The table of people's distribution in terms of course of study was also according to Table 2.

Table 2
Distribution of Students of Farhangian University of Khuzestan Province in Terms of Their Course of Study

Course	Number of People
Educational Sciences (Elementary)	54
English	21
Teaching Persian Language	31
Theology and Islamic Sciences	31
Geography	13
Consultation	21
Arabic Language and Literature	35
Mathematics	28
Total	234

Measurement

The students who selected as research sample have been justifying about the standard questionnaire version 3 of Kolb's learning styles, necessary guidance was provided Attached to this questionnaire, the participants' characteristics such as academic year, field of study, gender and grade point average (as a predictor variable in the academic achievement) have also been presented.

This questionnaire measures four learning methods of individuals in two objective experience- abstract thinking, and contemplative observation - active experimentation dimensions by Kolb's questionnaire. After combining these dimensions, four convergent, divergent, adaptive and assimilating learning styles are created. Each sentence of this questionnaire consists of four parts and each part represents a learning style including objective experience, contemplative observation, abstract conceptualization and active experimentation. Of the all 12 options, the first option gives a score that represents the objective experience score. The second option belongs to the contemplative observation learning; the third option belongs to the abstract conceptualization style and

the fourth option belongs to the active experimentation learning style. In sum, these four scores represent four learning styles. By the two by two subtraction of these styles, that is the subtraction of abstract conceptualization from objective experience and the subtraction of active experimentation from contemplative observation, two scores are obtained; these two scores are located on the coordinate axis, and on the intersection of the two axes, that is, the vertical axis (objective experience, abstract conceptualization) and horizontal axis (contemplative observation, active experimentation) four quadrants are created, that in each quadrant, one convergent, divergent, adaptive, and assimilating learning style is located. The reliability coefficient of Kolb's questionnaire was calculated between 0.73 and 0.82 in 1985 by himself through Cronbach's alpha coefficient method for the four components. This questionnaire has obtained coefficients between 0.79 and 0.94 in other researches such as Joy and Kolb (2009). Reliability coefficient in the research of Gheibiet al. (2012) was calculated between 0.62 and 0.75, and in the research of Qasemi et al. (2012) it was calculated between 0.71 and 0.90. In this research, the reliability of the mentioned questionnaire was also calculated by Cronbach's alpha for the adaptive component as 0.78, divergence component as 0.75, convergence component as 0.86 and convergence component as 0.91 and in general, it was calculated equal to 0.88.

Data analysis

After data collection, the data were analyzed by SPSS software. For data analysis, at the level of descriptive statistics, mean, frequency and standard deviation and at the level of inferential statistics, statistical methods such as regression and Pearson test were used.

Results

As it has been specified in Tables 3 and 4, for each learning style, central and dispersal indicators have been presented. According to T 3, in general, the mean scores of male and female students' learning styles had structural similarities, and both sexes have had higher scores in the assimilating and convergent. Totally, the mean and standard deviation of students in adaptive were (27.58) and (6.57), in divergent were (32.2) and

(7.44), in assimilating were (34.8) and (8.42), in convergent were (34.39) and (7.6). Moreover, the academic grade point's averages were (16.36) and (1.74) respectively.

Table 3
Central and Dispersion Indicators of Learning Style of the Students of Farhangian University of Khuzestan in Terms of Gender

Variable	Group	Male		Female		Total	
		Mean	Standard Deviation	Mean	Standard Deviation	Mean	Standard Deviation
Adaptive		26.78	6.55	28.96	6.403	27.58	6.57
Divergent		32.8	6.9	31.15	8.24	32.2	7.44
Assimilating		34.34	8.67	35.61	7.952	34.8	8.426
Convergent		34.23	7.6	34.67	8.276	34.39	7.84
Grade Point Average		16.62	1.57	15.89	1.931	16.36	1.74

Table 4 has mentioned the central and dispersion indicators of the students of Farhangian University of Khuzestan province in terms of courses. Based on the presented data, the highest mean of learning styles in all courses except geography and mathematics, has been the assimilating learning style.

Table 4
Central and Dispersion Indicators of the Students of Farhangian University of Khuzestan Province in Terms of Courses

Variable Group	Adaptive		Divergent		Assimilating		Convergent		Grade Point Average	
	Mean	Standard Deviation	Mean	Standard Deviation	Mean	Standard Deviation	Mean	Standard Deviation	Mean	Standard Deviation
Educational Sciences (Elementary)	28.03	8.27	30.935	7.567	36.35	9.18	35.09	8.25	16.98	1.45
English	26.46	6.97	34.066	5.723	34.4	5.27	34.06	5.8	17.75	1.12
Teaching Persian Language	28.32	7.18	32.354	8.55	35.7	10.3	34.7	7.92	15.97	1.98
Theology and Islamic Sciences	23.56	6.3	26.866	8.05	28.26	10.5	26.76	9.91	15.45	1.7
Geography	26.4	5.69	33.533	8.232	35.16	7.9	35.93	4.96	16.09	2.02
Consultation	28.28	3.4	35.87	3.159	40.09	3.56	36.34	3.66	16.3	1.7
Arabic Language and Literature	30.73	6.97	33.466	7.938	36.3	7.59	36.23	9.66	16.35	1.67
Mathematics	28.76	4.82	30.33	5.86	34.83	6.53	35.86	6.46	15.97	1.21

The presupposition of data normality was investigated before testing hypothesis. The results of Kolmogorov-Smirnov test for learning styles and academic grade point average of the subjects showed that none of the Z values were statistically significant, thus the hypothesis of scores distribution normality was confirmed.

After investigating the normality of data, as it is observed in Table 5, it was specified that in the educational sciences` (elementary) course, there was a positive and significant relationship between the assimilating learning style, in the English teaching between the divergent style, in the Persian language teaching course between the adaptive, divergent and converging styles, in the Theology and Islamic Sciences among all styles, in the

geography course among all learning styles, in the consultation course only between assimilating learning style, in the Arabic language and literature course only between divergent learning style, as well as in the mathematics course only between assimilating learning style and the academic grade point average of students. On the other hand, there was a positive and significant relationship between all learning styles and the total academic grade point average of students ($p < 0.05$).

Table 5
Pearson Correlation Coefficient Results between Learning Styles and Grade Point Average in Terms of Courses

Group	Adaptive		Divergent		Assimilating		Convergent	
	R	P	R	P	R	P	R	P
Variable								
Educational Sciences (Elementary)	0.077	0.67	0.078	0.67	0.476	0.04	0.123	0.5
English	0.047	0.8	0.442	0.015	0.088	0.64	0.228	0.2
Teaching Persian Language	0.523	0.003	0.418	0.019	0.28	0.12	0.341	0.049
Theology and Islamic Sciences	0.731	0.001	0.661	0.001	0.654	0.001	0.625	0.001
Geography	0.350	0.048	0.657	0.001	0.565	0.001	0.612	0.001
Consultation	0.150	0.413	0.075	0.68	0.330	0.05	0.178	0.33
Arabic Language and Literature	0.319	0.061	0.386	0.035	0.321	0.051	0.3	0.09
Mathematics	0.062	0.74	0.064	0.81	0.504	0.005	0.314	0.091
Total	0.299	0.001	0.304	0.001	0.389	0.001	0.275	0.001

In order to predict the academic achievement of the students of various courses, as Table 6 shows, the prediction regression of the academic grade point's average of Persian language students on the learning styles (adaptive, divergent and convergent) was

significant ($p < 0.05$ and $F = 3.53$). And with respect to the beta coefficients, only the adaptive learning style with a beta coefficient of 0.68 could predict positively and significantly the academic grade point's average of Persian language students. Also, the R^2 value indicated that 53% of the variance of the grade point average of Persian language students was explained by the adaptive learning style.

Table 6
Concurrent Regression Test Results for Predicting the Grade Point Average of Persian Language Students Based on Learning Styles

Test Name	Statistical Indicator						
	R	R^2	F Test	P-Value	Beta	T	P-Value
Adaptive					0.683	2.019	0.049
Divergent	0.531	0.28	3.53	0.028	0.126	0.302	0.76
Convergent					0.067	0.228	0.8

As table 7 shows, the prediction regression of the grade point average of the students of Theology and Islamic Sciences on learning styles (adaptive, divergent, assimilating and convergent) was significant ($p < 0.01$, $F = 9.105$). And with respect to the beta coefficients, only the adaptive learning style with the beta coefficient of 0.62 and the assimilating with the beta coefficient of 0.55 could positively and significantly predict the academic grade point average of the students of theology and Islamic sciences. Also, the R^2 value indicated that 77% of the variance of the grade point average of the students of theology and Islamic sciences was explained by the adaptive and assimilating learning style.

Table 7

Concurrent Regression Test Results for Predicting Academic Grade Point Average of the Students of Theology and Islamic Sciences Based on Learning Styles

Statistical Indicator Test Name	R	R ²	F Test	P-Value	Beta	T	P-Value
	Adaptive					0.62	2.102
Divergent					0.39	0.912	0.37
Assimilating	0.77	0.59	9.105	0.001	0.552	2.23	0.018
Convergent					0.41	1.34	0.19

As Table 8 shows, the prediction regression of the grade point`s average of the students of geography on learning styles (adaptive, divergent, assimilating, and convergent) was significant ($p < 0.01$, $F = 14.51$). And considering the beta coefficients of adaptive learning style with the beta coefficient of 0.71, divergent with the beta coefficient of 0.52, and assimilating with the beta coefficient of 0.45, it could positively and significantly predict the grade point average of the students of geography. Also, R² indicated that 83% of the grade point average variance of the students of geography was explained by adaptive, divergent and assimilating learning styles.

Table 8

Concurrent Regression Test Results for Predicting the Grade Point Average of the Students of Geography Based on Learning Styles

Statistical Indicator Test Name	R	R ²	F Test	P-Value	Beta	T	P-Value
	Adaptive					0.71	3.59
Divergent					0.52	4	0.001
Assimilating	0.83	0.69	14.516	0.001	0.45	3.09	0.005
Convergent					0.181	0.95	0.35

As Table 9 shows, the prediction regression of the grade point average of the students of educational sciences course on assimilating learning style was significant ($F = 14.51$, $p < 0.01$). And considering the beta coefficients of adaptive learning style with the beta coefficient of 0.71, divergent with the beta coefficient of 0.52, and assimilating with the beta coefficient of 0.45, it could positively and significantly predict the academic grade point average of the students of educational sciences. Also, R^2 indicated that 83% of the grade point average variance of the students of educational sciences was explained by adaptive, divergent and assimilating learning styles.

Table 9
Concurrent Regression Test Results for Predicting the Grade Point Average of the Students of Educational Sciences Based on Learning Styles

Statistical Indicator Test Name	R	R ²	F Test	P-Value	Beta	T	P-Value
	Adaptive					0.058	0.331
Divergent	0.75	0.39	12.21	0.001	0.56	0.311	0.23
Assimilating					0.421	2.652	0.031
Convergent					0.098	0.18	0.17

As Table 10 shows, the prediction regression of the academic grade point's average of all students on learning styles (adaptive, divergent, assimilating, and convergent) was significant ($F = 11.01$, $p < 0.01$). And considering the beta coefficients of divergent learning style with the beta coefficient of 0.35, assimilating with the beta coefficient of 0.32, it could positively and significantly predict the academic grade point average of all students. Also, R^2 value indicated that 5% of the grade point average variance of all students was explained by the divergent and assimilating learning styles.

Table 10

Concurrent Regression Test Results for Predicting the Grade Point Average of all Students Based on Learning Styles

Statistical Indicator Test Name	R	R ²	F Test	P-Value	Beta	T	P-Value
	Adaptive					0.048	0.398
Divergent					0.356	3.615	0.001
Assimilating	0.5	0.25	11.01	0.001	0.324	3.012	0.005
Convergent					0.088	0.88	0.37

Discussion

Among the most important factors of the professional development and growth of the human resources of the community, their academic education and receiving job trainings can be considered. On the one hand, in the University of Farhangian, in addition to offering conventional academic trainings, professional trainings tailored to the educational courses are also provided, so that based on the presented trainings and performed learning, the students try for the development of education and training system as an effective factor in future. Based on the assumptions proposed in this research, students' learning style influences their learning process and academic achievements. Thus, assuming that there is a relationship between the students' learning styles and academic achievement, and even the prediction of their academic achievement can be done based on their preferred learning style, the research data have been collected and analyzed.

As it was specified while analyzing the data, the preferred learning styles of the students of various courses of Farhangian University of Khuzestan province has had a significant relationship with their academic achievement. According to the data obtained for all

students, there has been a significant relationship between their learning style and their grade point average as a criterion of academic achievement. This relationship has also been greater for the divergent and assimilating styles than other styles. These results showed that in general, students with learning styles corresponding with the theoretical learning such as different theoretical models as well as theories supported by two divergent and assimilating styles have acted more successfully than other students. This point itself can be a sign that the courses are paying attention to more theoretical foundations and also the educational system of the country, which has ultimately regarded it more important to raise people with this learning style so that people with this style have had a better academic achievement than other students, and the relationship between their learning style and their grade point average has been stronger. The results of current study is consistent with the results of Sudira et al (2018) on the impact of Kolbs' learning styles for academic achievement of pre-service teachers, although in this study, learning styles had differences impacts based on the field of students. Besides, results of Aydin (2016) shows similar results to the current research. The results of Villanueva's (2020) research are similar to this research in the sense that some of the learning styles are effective in the learning progress of students in certain disciplines. The recommended manner of this study, which is based on the use of learning styles in the academic achievement of Farhangian University students, is also consistent with the results that he has obtained from his research.

The abovementioned results are inconsistent with the results of Alemdag (2020) & Karatas & Yalin (2021) researches on the impact of learning styles on academic achievement. In fact, the results of present study indicate the impact of these learning styles on students' academic achievement and even predict their future academic achievement, while in this regard, the results of the above researches did not agree with the results of current research.

More interestingly, these two learning styles in general also have the capability to predict the students' academic achievements. Thus, based on the made explanations, it is suggested that, provided that according to the educational experts, students with divergent and assimilating learning styles will be better teachers, learning styles should

be used for screening incoming students. Otherwise, and in case that the learning styles are not important in future academic and occupational success of the students, it is necessary to perform modifications in university curricula, teaching methods of university professors, methods and tool applied, educational sources, methods of holding examination and so on, so that the students with convergent and adaptive styles can also achieve success.

Conclusion

Students' academic achievement is of great importance in educational systems. This issue becomes more important when the career future of students is determined based on their academic level and the field they choose. In this research, the study of students' academic achievement based on club learning styles has been considered. The results showed that learning styles affect the academic achievement of students of Farhangian University of Iran and can even predict their academic success.

As a result, among the Kolbs' learning styles, it can be said that assimilating and divergent learning styles are better for the academic success of Farhangian University students'. It is recommended that in the process of selecting preservice teachers, candidates be admitted who have these learning styles or these two learning style are stronger among their learning style.

References

- Aala, M., Sanjari, M., Peymanie, M., Mirzabygi, M., & Salemi, S. (2015). Nursing students' learning styles in Iran University of Medical Sciences. *Journal of Medical Education Development*, 7(16), 19-27.
- Alemdağ, C. (2020). Changes in learning style preferences of physical education students. *Educational Policy Studies Journal*, 10(4), 207-220.
- Amin khandagi, & M., Rajaie, M. (2013). The effect of students' learning style on their preferred teaching style. *Journal of Educational Psychology*, 9(28), 16-40.
- Antelm-Lanzat, A. M., Gil, Alfonso J., Cacheiro-González, M. L., Pérez-Navío, E., & Fonseca-Pedrero, E. (2020). Learning styles and vocational guidance in secondary education. *Educational Sciences: Theory & Practice*, 20(3), 1-15.
- Ashouri, M., Vahedi, S., Adib, Y., & Badri, R. (2021). Discovering the experience of failing university entrance exam among applicants: A grounded theory study. *Journal of Psychological Science*, 19(96), 205-227.
- Aubrey, K., & Riley, A. (2015). *Understanding and using educational theories*: SAGE Publications.

- Aydin, B. (2016). Examination of the relationship between eighth grade students' learning styles and attitudes towards mathematics. *Journal of Education and Training Studies*, 4(2), 124-130.
- Coffield, F. (2004). *Learning styles and pedagogy in post-16 learning: a Systematic and critical review*. London: Learning and Skills Research Centre.
- Dawn, T., Harkin, J., & Turner, G. (2013). *Teaching young adults: a Handbook for teachers in post-compulsory education*: Taylor & Francis.
- Demirtas, S., & Egilmez, H. O. (2018). The relationship between learning styles of pre-services music teachers and academic achievement. *European Journal of Educational Research*, 7(3), 615- 629.
- Encyclopedia Britannica. (2021). *Learning & learning styles*. Retrived 22 july 2021 from <https://www.britannica.com/science/learning>.
- Evans, C. (2006). *Learning styles in education and training*: Emerald Group Publishing.
- Fleming, S., McKee, G., & Huntley-Moore, S. (2011). Undergraduate nursing students' learning styles: A longitudinal study. *Nurse Education Today*: 31(5), 44-49.
- Gheibi, M., Arefi, M., & Danesh, E. (2012). The relationship between learning styles and self-efficacy of college students, *Practical Psychology*, 6(1). 35-69.
- Hamdani, M. (2017). *Learning unit design (practice guide)*. Tabriz: University Research Publications.
- Hawk F. T, J. & Shah A. (2007) .Using learning style instruments to enhance student learning. *Decision Sciences Journal of Innovative Education*; 5(1):1-19.
- Izadi, S., Mohammadzadeh, & Edmalei, R. (2007). Investigating the relationship between learning styles, personality characteristics and academic performance of students. *Teaching and Learning Research*, 1(27), 15-28.
- Kamali, F., & Rezaei, P. (2020). Academic failure in medical students as an effective factor in community health. *Journal of Preventive Medicine*, 7(1), 73-79.
- Karatas, E., & Yalin, H. I. (2021). The impact of matching learning-teaching styles on students' academic achievement. *Eurasian Journal of Educational Research*. 92, 377-402.
- Kolb, D.A. (2014). *Experiential Learning: Experience as the Source of Learning and Development*: Pearson Education.
- Meraji, M., Safaei, f., Shojaee, S., Mousavi Poor, R., & Mahmoodian, S. (2019). Health information technology students' satisfaction for their field of study and career prospect. *Journal of Modern Medical Information Sciences*, 4(2), 8-17.
- Peterson, K., & Kolb, D.A. (2017). *How you learn is how you live: Using nine ways of learning to transform your life*: Berrett-Koehler Publishers.
- Pourmohammadi, B., Gohar, K., & Rahimi Pordanjani, S. (2020). Academic failure in health students of Semnan university of medical sciences. *Journal of Development Strategies in Medical Education*, 7(1), 78-91.
- Qasemi, N., Rabie, M., Kalantari, N., & Abdi, H. (2012). Psychometric properties (factor analysis, reliability and validity) of modified kolb learning styles scale in iranian students. *Teaching Strategies*, 6(28), 361-367.
- Rahimi Nia, E., Rahimi Nia Hoorie, & Sharifi Rad, G. (2017). Evaluation of the learning styles and styles based on Kolb theory in students of Qom University of Medical Sciences. *Journal of Medical Education Development*, 9(24), 24-32.
- Sarchami, R., & Hosseini, S. M. (2006). The relationship between learning styles and academic achievement of qazvin nursing students. *Journal of Qazvin University of Medical Sciences*, 8(1), 64-67.

- Sudria, I. B. N., Redhana, I. W., Kirna, I. M., & Aini, D. (2018). Effect of kolb's learning styles under inductive guided-inquiry learning on learning outcomes. *International Journal of Instruction*, 11(1), 89-102.
- Vega Román, E., & Hugo Ruiz, V. (2018). Estilos de aprendizaje y su relación con el rendimiento académico de estudiantes de segundo año de educación general básica. [In french] *Journal of Learning Styles*, 11(22), 166-178.
- Villanueva, F. (2020). The use of Kolb's learning styles inventory (LSI) in school settings. *Journal of Graduate Studies in Education*, 12(1), 42-45.
- Waring, M., & Evans, C. (2014). *Understanding Pedagogy: Developing a critical approach to teaching and learning*: Taylor & Francis.
- Zhang, L., Sternberg, R.J., & Rayner, S. (2012). *Handbook of intellectual styles: Preferences in cognition, learning, and thinking*. Springer Publishing Company.