The effect of learning styles on the academic achievement of nursing students: a cross-sectional study

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Abstract

Background Learning in the academic setting is influenced by the dynamic interaction between students and teachers. Recognizing and adapting to diverse learning styles is essential for improving instruction, gaining knowledge, and drawing informed conclusions. Therefore, this study investigated learning styles and their effects on students' academic achievement.

Methods In a cross-sectional study in Iran's Mazandaran province, 238 nursing students were surveyed between October and December 2021 using random sampling. The questionnaire included socio-demographic data, Kolb's Experiential Learning Model, and students' academic performance (EPT). Statistical analysis with SPSS version 22 involved descriptive statistics, one-way ANOVA, chi-square tests, and linear regression with statistical significance set at $p < 0.05$.

Results The mean age of the nursing students was 20.95 ± 1.71 years. The most common student learning styles were convergent (75.2%) and accommodator (12.2%). According to the results, convergent (148.62 ± 16.28) and accommodator learning styles (147.72 ± 8.79) with the highest average played a role in students' academic achievement. The mean score of EPT was 147. 13 ± 15.48 (out of 240). A significant difference between the academic performance and different dimensions of learning style was found ($p = 0.002$).

Conclusion Findings indicated that adopting a convergent and accommodator learning style can affect students' academic achievement. Therefore, learning environments appropriate to this style, such as simulation and laboratory activities, are suggested to emphasize practical work and make students think an scrutinize.

Keywords Academic achievement, Learning styles, Action Learning, Nursing students

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Introduction

Learning is influenced by the interaction between students and teachers in an academic setting [1]. Understanding and utilizing different learning styles is important for effective instruction, knowledge acquisition, and drawing conclusions [2, 3]. Learning styles are personal approaches to receiving and processing information, influenced by an individual's genetics, experiences, and expectations [4]. Creating a learning environment that aligns with students' preferred learning styles is crucial for supporting their learning journey. Tailoring teaching methods to their needs can greatly enhance their ability to learn and achieve academic success [5]. The teacher plays a critical role in recognizing each student's potential and planning for their balanced personal development [6]. This allows for the development of students' ability to manage their learning styles and provides them with more effective feedback on their needs.

Understanding and utilizing different learning styles is crucial for effective instruction and academic success. They provide insight into student learning and allow educators to tailor instruction to their needs [7]. Research has shown a significant relationship between critical thinking and academic performance. Professional competence can be enhanced by incorporating critical thinking into learning styles [8]. In addition, incorporating learning styles can greatly impact curricula design and ultimately lead to better academic performance [9].

Researchers have conducted many studies and created various assessment tools to identify learning styles. The Kolb Learning Style Inventory (LSI) is widely used in the medical field and is considered one of the most popular measurement tools for determining learning styles [10]. According to Kolb, adult learning is a procedure of knowledge creation through transforming experiences [11, 12]. Kolb's Learning Style Inventory identifies four primary learning styles: Divergent (characterized by creativity and observation), Convergent (focused on problem-solving and practical application), Assimilative (logical thinking and abstract concepts), and Accomodative (hands on experience and adaptability). These styles reflect the ways individuals approach learning and processing information. Additionally, the Kolb Learning Style Inventory identifies four stages of experience: (i) concrete experience, (ii) reflective observation, (iii) abstract conceptualization, and (iv) active experimentation (Fig. 1). These stages build upon each other, with concrete experiences leading to reflection and observation, forming abstract concepts tested through active experimentation [4, 10].

When considering nursing students as self-learners in medical education, it is important to understand their learning styles [10]. This includes knowing why students prefer certain styles, how well those styles align with teaching methods, and the impact of learning styles on academic achievement [10]. This information is crucial for instructors to plan instruction effectively and provide appropriate educational materials. Without knowledge of
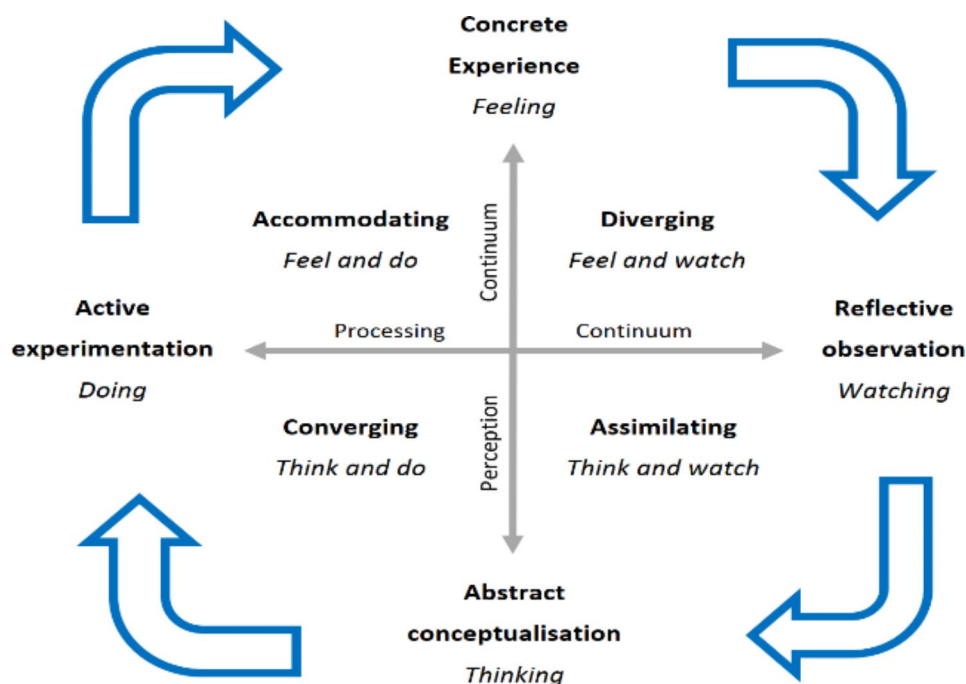
Fig. 1 Kolb's learning styles and experiential learning cycle

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individual learning styles, it becomes difficult to provide the right resources [13, 14]. Studies have been conducted on the success and satisfaction of various instructional methods, such as problem-based learning [15–18]. However, few studies have explored the relationship between learning styles and academic achievement. For example, a study in Oman examined self-directed learning readiness and its connection to socio-demographics and learning styles in nursing students. The study found significant relationships between learning styles such as solitary, competitive, imaginative, perceptive, and self-directed learning. On the other hand, the analytical learning style showed a negative association with self-directed learning [19]. Another study looked at the effects of the Covid-19 pandemic, including remote instruction styles and learning styles, on academic and professional confidence [20]. The present study examined the connection between learning style and academic achievement in an Iranian nursing sample. The research aims to address this knowledge gap and offer valuable insights on supporting nursing students. By understanding nursing students' individual learning styles and requirements, instructors can establish a more conducive learning environment, resulting in enhanced academic achievement and satisfaction for both students and teachers.

Main text

Methods
Study hypotheses
We sought to answer the following hypotheses:

1. There exists a notable correlation between learning style and academic performance among students at Mazandaran University of Medical Sciences.
2. There is a significant association between learning style and academic performance, and demographic factors (i.e., age, gender, and GPA) among students at Mazandaran University of Medical Sciences.

Study design
The present cross-sectional survey was conducted between October and December 2023 among nursing students at Mazandaran University of Medical Sciences. The total population of nursing students at the university during the time of study was 620. Participants were selected through a simple random sampling method. We included students from the second to eighth term to represent various stages of their academic journey. The students had not yet completed their training or obtained professional nursing licences (i.e., non-licensed students). This selection aimed to capture a wide range of perspectives without focusing on temporal changes between

periods. The survey questionnaire has been attached in the supplementary material.

Data collection procedure and sample size estimation
The sample size was estimated based on a previous study. Using the following formula, samples were selected by random sampling method among students, where $\alpha = 0.05$, $1-\beta = 0.95$, and $r = 0.3$. Considering 20% of the possible loss, the minimum sample size was calculated to be 174

$$ n = \frac{\left[Z_{1-\frac{\alpha}{2}} + Z_{1-\beta} \right]^2}{\left[\frac{1}{2} \ln \frac{1+r}{1-r} \right]^2} + 3 $$

Then, each participant was informed about the study goals, and an informed written consent was sent to them for signing. After returning the informed written consent form to the researchers through e-mail, the questionnaire was anonymously sent to the participants via the online survey for their completion. However, 2 incomplete responses were removed from the study. Thus, 238 responses remained for the final analysis.

Socio-demographic information
Participants' socio-demographic information related to age, gender, and grade point average (GPA) were collected in the study.

Learning style inventory
A 12-item Kolb's Learning Style Inventory was employed to evaluate the study participants' learning styles [21–24]. Each item had four components: reflective observation, concrete experience, active experimentation, and abstract conceptualization. The four scores derived from these four parts indicate four distinct learning styles. Two scores are obtained by subtracting two styles from one another, specifically by subtracting abstract conceptualization from concrete experience and active experimentation from reflective observation. These two scores are plotted on a coordinate axis, forming the four quadrants of a square, which are identified as diverging, converging, assimilating, and accommodating [23]. The reliability of Kolb's questionnaire has been established in various studies around the world, with a Cronbach's coefficient ranging from 0.73 to 0.78 [25]. In the Iranian version, Emamipour et al. found that the alpha coefficients of abstract conceptualization, concrete experience, active experimentation, and reflective observation were 0.49, 0.51, 0.47, and 0.53, respectively [26]. In this study Cronbach's alpha was 0.81, 0.83, 0.84, and 0.86 for abstract conceptualization, concrete experience, active experimentation, and reflective observation, respectively.

Educational performance test

The Educational Performance Test was employed to evaluate the participants' academic performance. This questionnaire has been used in various studies. The number of questions in this questionnaire is 48 [27], and it consists of 5 areas: self-efficacy (15 items), emotional effects (8 items), planning (10 items), lack of consequence control (5 items), and motivation (10 items) related to academic performance. Items are responded to on a five-point Likert scale (1=none to 5=very high) with a minimum score of 48 and a maximum of 240 [28]. In the Iranian version, Goltash et al. confirmed the validity of the questionnaire and its reliability by Cronbach's alpha of 0.84 [29]. Cronbach's alpha coefficient was 0.86 in the present study.

Data analysis

In this study, the variables were described using mean, standard deviation, median, frequency, and percentage statistics. The normality hypothesis was checked using the Kolmogorov-Smirnov test ($p=0.369$), and the results indicated that this hypothesis is valid for the academic performance score. To assess significant differences, a one-way analysis of variance (ANOVA) and chi-square test were employed. Linear regression was conducted to identify significant predictors of academic performance. The analysis was conducted using the Statistical Package for Social Science (SPSS) version 22 software, and a significance level of less than 0.05 was used.

Ethical considerations

The study followed human participating ethical guidelines as suggested by the Helsinki Declaration, and formal ethical approval was obtained from the Mazandaran University of Medical Sciences. While collecting the data, participants were informed about the study objectives and other ethical issues associated with the study. They were also assured of their right to withdraw from the survey at any stage. A written Informed consent was required to participate in this study. The study was approved by the Ethics Committee of Mazandaran University of Medical Sciences (Approval No. IR.MAZUMS. REC.1399.9075).

Results

A total of 238 nurse students participated in the study, 134 of whom were female (56.3%). The mean age of the participants was 20.95 (±1.71) years, where 55.9% belonged to the age group of <17 years.

In terms of learning style, 75.2% were converging, 12.2% accommodating, 6.3% diverging, and 5.9% assimilating. Figure 2 shows the number of persons in each style.

In Table 1, descriptive information about learning styles according to demographic variables was reported and compared. The results showed that male and female nurse students learning styles are not different ($\chi^2=5.31$, $p=0.151$). Also, the student's grade point average was not significantly related to the learning style ($\chi^2=0.85$, $p=0.837$). Learning style significantly differed with the mean age of the participants (F=3.15, $p=0.026$), with the assimilator having the highest mean score (21.50 ± 0.52) and the accommodator having the lowest (20.14 ± 1.06) (Table 1).

The average score of students' academic performance was 147.13 ± 15.48, and according to the range of the academic performance questionnaire (48 to 240), the average is almost in the center of this range and indicates the average performance of students. Table 2 provides
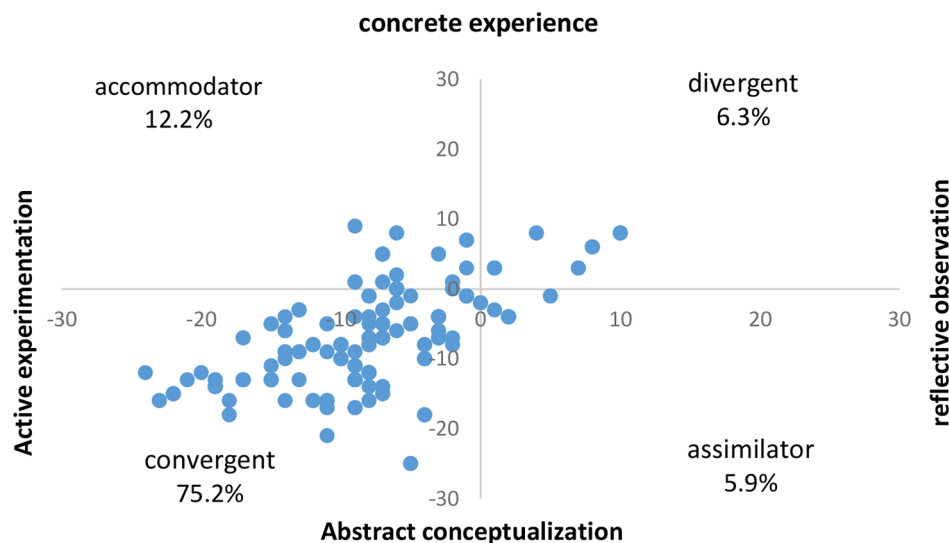
Fig. 2 Distribution of nurse students based on club learning style

Table 1 Comparison between learning styles and socio-demographic variables

Variables	Divergent	Accommodator	Convergent	Assimilator	χ^2/F	*p*-value
Gender						
Male	4 (26.7)	10 (34.5)	81 (45.0)	9 (64.3)	5.31	0.151*
Female	11 (73.3)	19 (65.5)	99 (55.0)	5 (35.7)		
Age (mean ± SD)	21.40 ± 1.30	20.14 ± 1.06	21.00 ± 1.84	21.50 ± 0.52	3.15	0.026+
Grade Point Average						
< 17	7 (46.7)	16 (55.2)	103 (57.2)	7 (50.0)	0.85	0.837*
> 17	8 (53.3)	13 (44.8)	77 (42.8)	7 (50.0)		

*: chi-square test +: analysis of variance test

Table 2 Descriptive statistics of academic performance questionnaire

Dimensions	Mean	Standard deviation	Median	Minimum-Maximum
Self-Efficacy	35.83	6.35	35	24–50
Emotional effects	44.40	5.85	45	33–65
Planning	15.61	2.24	15	9–22
Lack of consequence control	27.61	6.82	27	16–45
Motivation	23.66	3.31	24	17–36
Total	147.11	15.48	147	119–199

Table 4 Linear regression of academic performance

Variable		B	Std. Error	95% CI	*p*-value
Gender	Male	-			
	Female	-1.84	2.08	-5.91, 2.23	0.377
Age		0.04	0.59	-1.12, 1.19	0.952
Age group	< 17	-			
	> 17	-1.21	2.05	-5.22, 2.81	0.557
Learning style	Divergent	-			
	Accommodator	6.79	4.80	-2.62, 16.20	0.157
	Convergent	7.44	4.03	-0.46, 15.33	0.065
	Assimilator	-7.90	5.59	-18.86, 3.06	0.158

descriptive information about the dimensions of the Academic Performance Questionnaire (Table 2).

Table 3 shows the average academic performance, and dimensions were reported and compared on a style basis. There were significant differences in the total score of the entire questionnaire and all dimensions except self-efficacy in terms of different academic performance styles ($p < 0.05$). The converging style significantly obtained the highest score in terms of planning (F = 4.58, $p = 0.004$) and total score of academic performance (F = 5.28, $p = 0.002$). The divergent style had significantly the highest score in terms of lack of consequence control (F = 3.47, $p = 0.017$), and the accommodative style had the highest score in terms of motivation (F = 2.82, $p = 0.040$) and emotional effects (F = 3.26, $p = 0.022$). Students with converging and accommodating learning styles have better academic performance than participants with divergent and assimilative styles (Table 3).

In Table 4, the linear regression information of academic performance was reported. None of the variables and learning styles had a significant relationship with the academic performance score. The academic performance score in accommodator and convergent styles was higher than the divergent and assimilator styles, which got the lowest score (Table 4).

Discussion
The educational learning style has been linked to academic achievement and professional satisfaction. The present study found that most nursing students utilized a convergent learning style, which was associated with better academic performance. This aligns with previous research indicating that students with converging learning styles outperformed other groups [8, 30–33]. Nursing students are required to apply their knowledge and deliver appropriate services to patients in clinical settings, which may explain the preference for convergent learning. However, other studies have reported divergent learning styles as the most common among students [22, 34, 35]. This difference could be attributed to varying educational settings and methods. It is important to note that nursing students often exhibit a combination of divergent, convergent, and assimilative learning styles,

Table 3 Comparison between learning styles and academic performance

Dimensions	Divergent	Accommodator	Convergent	Assimilator	F	*p*-value*
Self-Efficacy	42.47 ± 4.02	45.48 ± 3.11	44.65 ± 6.30	41.07 ± 4.27	2.55	**0.057**
Emotional effects	23.67 ± 2.32	24.59 ± 1.72	23.70 ± 3.58	21.29 ± 1.82	3.26	**0.022**
Planning	32.87 ± 3.66	33.93 ± 5.14	36.53 ± 5.29	33.93 ± 5.90	4.58	**0.004**
Lack of consequence control	16.13 ± 1.19	15.07 ± 2.15	15.78 ± 2.31	14.07 ± 1.64	3.47	**0.017**
Motivation	25.60 ± 2.32	28.65 ± 2.84	27.96 ± 7.43	23.21 ± 5.82	2.82	**0.040**
Total	140.73 ± 7.58	147.72 ± 8.79	148.62 ± 16.28	133.57 ± 14.57	5.28	**0.002**

*: One-way ANOVA test

rather than a single dominant style. Individuals who prefer a distinct learning method often possess introverted and emotional traits, and are drawn to artistic and social service roles. These characteristics make them well-suited for professions like nursing. Kolb suggests that learners should be able to adapt their learning styles based on the situation, as each style has its own strengths and weaknesses. If a language learner relies solely on one style, they may become limited in their abilities [21].

Previous research demonstrated a significant relationship between learning styles and academic performance among participants [36, 37]. Similar findings have been reported in studies conducted in Iran, highlighting the importance of learning styles in relation to academic achievement [8, 22, 38]. The positive relationship between learners' academic success and learning styles suggests that the more exposed learners are, the higher their academic achievement is. Therefore, these styles must be strengthened to ensure that learners achieve laudable success. Nursing students understand their unique learning styles and can actively participate in the learning process. Therefore, teachers can contribute to their success by providing helpful and accurate advice to students in adopting a learning style. However, opposite findings have been reported, saying that learning styles and teaching methods do not affect academic progress and that learning styles are not a good predictor of academic performance [39, 40], which is consistent with the present study results.

As nursing curricula evolve, educators should consider employing a mix of teaching strategies that accommodate different learning styles, thereby promoting a more inclusive learning environment. This may include incorporating technology, such as e-learning platforms and face-to-face instruction, can influence the adoption of different learning styles. E-learning environments, for example, often promote self-directed learning styles, while face-to-face learning may facilitate more collaborative and auditory learning styles [41, 42].

In addition, further research is warranted to explore the impacts of contextual factors, such as cultural influences and institutional support systems, on learning styles and academic success. A deeper understanding of these dynamics could inform the development of targeted interventions that enhance nursing education and foster the academic success of nursing students.

Limitations
The study is limited by the online data collection technique, which reduced the number of questionnaire completions. Additionally, the cross-sectional nature of the study cannot establish a cause-effect relationship. The study population was limited to nursing students, which limits the generalizability of the findings to other population groups, such as medical students.

Conclusion
According to the results of this study and the predominance of students with convergent and assimilator learning styles, it is suggested that learning environments suitable for these styles, such as simulation, laboratory activities, practical work emphasis, and encouraging students to think and scrutinize, should be used in teaching and learning. This will facilitate better learning and help students acquire the necessary capabilities in educational environments.

Supplementary Information
The online version contains supplementary material available at https://doi.org/10.1186/s13104-024-06949-8.

Supplementary Material 1

Declarations

Ethics approval and consent to participate
The study was approved by the Ethics Committee of Mazandaran University of Medical Sciences, IRAN (Approval No. IR.MAZUMS.REC.1399.9075). Informed written consent to participate in the study was obtained.

Consent for publication
Not applicable.

Competing interests
The authors declare no competing interests.

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