



Research Article

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EXPLORING ELECTROPHYSIOLOGY STUDENTS' LEARNING STYLES AND ATTITUDES TOWARD ONLINE LEARNING

 **Ülkühan Düzgün¹**

¹University of Health Sciences, Gulhane Training and Research Hospital, Department of Neurology, Ankara, Turkey

Correspondence:

Ülkühan Düzgün (e-mail: ulkuhanduzgun@hotmail.com)

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Ankara Yıldırım Beyazıt University Faculty of Medicine
Department of Family Medicine

Abstract

Objectives: A learning style can be described as an individual difference in perceiving and processing information in one's mind. The previous research suggested that one may attain greater achievement when teaching is organized according to their learning style. Moreover, upon comparing online and traditional learning environments, learning styles may also need to be considered in distance education. The present study aimed to explore the attitudes of electrophysiology students toward online learning by their learning styles.

Materials and Methods: This cross-sectional study recruited 101 students, 20.79% (n=21) males and 79.21% (n=80) females, enrolled in the electrophysiology program in the 2021-2022 academic year. The data were collected using a demographic information form, the VARK Learning Styles Questionnaire, and the Online Learning Attitude Scale (OLAS).

Results: Almost all participants (93.07%; n=94) attended distance education during the pandemic. The findings revealed that the participants mostly adopted all of the Visual-Auditory-Read/Write-Kinesthetic (39.60%; n=40) learning styles, while kinesthetic learning style was adopted the most (13.86%; n=14) as a unimodal learning style. Besides, while having a high attitude toward online learning, the students scored the highest on the OLAS APPEFF subscale (3.54 ± 1.02). Finally, it was concluded that the students with bimodal and quadrimodal learning styles had significantly higher attitudes toward online learning than those adopting a unimodal learning style ($p=0.034$ and 0.011 , respectively).

Conclusion: Overall, the participating electrophysiology students had high attitudes toward online learning and often adopted a multimodal learning style.

Keywords: Learning styles, student attitudes towards online learning, distance learning, electrophysiology.

Introduction

The COVID-19 pandemic-led crisis mandated higher education institutions to switch to other learning modes, particularly distance education. However, the relevant research suggested that a significant part of the academic world was totally unprepared to satisfy students' educational demands during the pandemic. Traditional and online education platforms bear diverse structures, contexts, requirements, and demands.¹ In previous findings, learning styles were shown as an essential factor in setting distance learning environments.² ³ Beadles et al. investigated students' tendency to choose web-based degree programs based on their learning styles and found that learning styles may influence the choice of educational approach, that students choosing to enroll in traditional and web-based programs significantly differed learning styles, and that intuitive students might be more likely to favor web-based programs.³ Moreover, studies comparing the effects of online and traditional learning environments on student achievement concluded that learning style is effective in distance education. The previous research also suggested that one may attain greater motivation and academic achievement when teaching is organized according to their learning styles.^{2, 4} In addition, success in online learning can be directly associated with the learner's attitudes and approaches toward such environments. In this sense, it can be proposed that learners with adverse attitudes toward online learning environments may have poor adaptation and achievement.⁵ Therefore, it seems valuable to uncover distance learners' attitudes toward distance learning. However, to the best of our knowledge, the literature hosts no studies investigating electrophysiology students' learning styles and attitudes toward online learning. Thus, the present study attempted to uncover electrophysiology students' learning styles and attitudes toward online learning and to evaluate their attitudes by their learning styles. The findings are thought to contribute to generating novel strategies in electrophysiology programs to enhance teaching methods for theoretical and applied curricula.

Materials and Methods

Sample

The sample consisted of first and second-year students enrolled in an electrophysiology associate degree program in the 2021-2022 academic year and attending distance and/or face-to-face education. The sample was conveniently selected based on voluntary participation. Moreover, the sample size covered almost the entire number of students in both years of study (excluding those rejecting to answer the survey questions)

Data Collection

In line with the purpose of the study, a demographic information form was used to collect the students' demographic characteristics (gender, age, year of study, attendance in distance education during the pandemic,

and tools used in distance education). While their learning styles were assessed using the VARK Learning Styles Questionnaire (VARK-LSQ), and their attitudes toward online learning were evaluated using the Online Learning Attitude Scale (OLAS). Finally, the students' grade point averages (GPA) were obtained from their end-of-year transcripts.

VARK Learning Styles Questionnaire (VARK-LSQ)

The questions in the VARK-LSQ are aimed at uncovering how one exchanges information and which perceptual and sensory characteristics govern their learning or teaching preferences.⁶ Sixteen questions in the instrument offer 16 different scenarios and ask respondents what they would do in such scenarios. One's learning style is measured in four different groups according to the method proposed by Fleming: visual, auditory, read/write, and kinesthetic. Yet, it should be noted that one may adopt one, more, or all of these four different learning styles, implying multimodal learning style preferences.⁷ Düzgün carried out the validity and reliability study of the VARK-LSQ in the Turkish context.⁸ While he calculated the internal consistency coefficient for the total VARK-LSQ score to be 0.76, it was found to be 0.85 in this study.

Online Learning Attitude Scale (OLAS)

OLAS was developed by Usta, Uysal, and Okur (2016).⁵ The 20-item instrument is scored on a 5-point Likert-type scale ranging from 5 (True at all) to 1 (Not at all true). The reliability analysis of the scale was replicated in this study, and the internal consistency coefficient was found to be 0.94 for the total score, 0.68 for the general acceptance subscale (GENACP), 0.94 for the individual awareness subscale (INDAWR), 0.86 for the usefulness subscale (USEFUL), and 0.69 for the application efficiency subscale (APPEFF). Moreover, the confirmatory factor analysis (CFA) resulted in the following fit indices: $\chi^2/df = 1.55$, RMSEA = 0.07, CFI = 0.98, PNFI = 0.82, NNFI = 0.98, and SRMR = 0.05.

Ethical Considerations

The Ethics Committee of Health Sciences University granted ethical approval to this study (2022-113 dated 04.21.2022). All research procedures were executed in accordance with the principles of the revised Declaration of Helsinki. Besides, relevant permissions were obtained from the school director to carry out this study and from the authors via e-mail to utilize their instruments in this research.

Statistical Analysis

Descriptive statistics for continuous variables are shown as mean \pm standard deviation, minimum, and maximum values, while they are presented as percentages and numbers for categorical variables. The

Kolmogorov-Smirnov test, tables, and histograms were resorted to check the normality of distribution. Accordingly, pair-wise comparisons of the normally distributed data were performed using an independent samples *t*-test. However, the Mann Whitney-U and Kruskal-Wallis H tests were utilized in the analysis of learning styles since the group distribution for this variable was less than 30 participants. Moreover, the linear relationships between the relevant variables were sought using Pearson’s correlation analysis. All statistical analyses were performed on the IBM SPSS 26.0 and LISREL 8.80 software, and a *p*-value <0.05 was considered statistically significant.

Results

Participants’ characteristics

There were 21 (20.79%) male and 80 (79.21%) female participants in the study. While 47.52% (n=48) were first-year students, 52.48% (n=53) were second-year students. Almost all participants (93.07%; n=94) attended distance education during the pandemic. While 67.02% (n=63) of the participants used their personal computers in distance education, 56.38% (n=53) attended online classes with their smartphones (Table 1). The mean GPA of the students was found to be 3.22±0.33 (2.28-3.72).

Table 1. Tools used during distance education.

		<i>n</i>	%
Attendance in distance education during the pandemic	Yes	94	93.07
	No	7	6.93
	Total	101	100.00
Personal computer	Yes	63	67.02
	No	31	33.98
	Total	94	100.00
Smartphone	Yes	53	56.38
	No	41	43.62
	Total	94	100.00
Tablet	Yes	10	10.64
	No	84	89.36
	Total	94	100.00

Participants’ learning styles

Considering the distribution of learning styles, 39.60% (n=40) of the students adopted all of the visual-auditory-read/write-kinesthetic learning styles, and 13.86% (n=14) of those adopting a unimodal learning style preferred the kinesthetic learning style (Table 2). When grouping learning styles by the number of

preferences, it was found that the majority of the students (39.60%; n=40) were quadrimodal and that the trimodal style was the least adopted one (13.86%; n=14; Table 3). Finally, while most participants (70.30%) preferred the multimodal learning style, 29.70% were unimodal learners.

Table 2. Distribution of the participants' learning styles (n = 101)

Learning Style	n	%
V	4	3.96
A	7	6.93
R	5	4.95
K	14	13.86
VA	1	0.99
VK	1	0.99
VR	2	1.98
AK	5	4.95
AR	5	4.95
RK	3	2.97
VAK	2	1.98
VRK	4	3.96
ARK	8	7.92
VARK	40	39.60

(V: Visual, A: Auditory, R: Read/Write, K: Kinesthetic, VA: Visual-Auditory, VK: Visual-Kinesthetic, VR: Visual-Read/Write, AK: Auditory-Kinesthetic, AR: Auditory-Read/Write, RK: Read/Write-Kinesthetic, VAK: Visual-Auditory-Kinesthetic, VRK: Visual-Read/Write-Kinesthetic, ARK: Auditory-Read/Write-Kinesthetic, VARK: Visual-Auditory-Read/Write-Kinesthetic.)

Table 3. Distribution of the participants by learning style groups (n = 101).

Group	Preference	n	%
Unimodal	V-A-R-K	30	29.70
Bimodal	VA-VK-VR-AK-AR-RK	17	16.83
Trimodal	VAK-VRK-ARK	14	13.86
Quadrimodal	VARK	40	39.60

(V: Visual, A: Auditory, R: Read/Write, K: Kinesthetic, VA: Visual-Auditory, VK: Visual-Kinesthetic, VR: Visual-Read/Write, AK: Auditory-Kinesthetic, AR: Auditory-Read/Write, RK: Read/Write-Kinesthetic, VAK: Visual-Auditory-Kinesthetic, VRK: Visual-Read/Write-Kinesthetic, ARK: Auditory-Read/Write-Kinesthetic, VARK: Visual-Auditory-Read/Write-Kinesthetic.)

Participants' attitudes toward online learning

When it comes to attitudes toward online learning, it was discovered that the participants scored the highest and the lowest on the APPEFF subscale ($M=3.54$, $SD=1.02$) and INDAWR subscale ($M=2.48$, $SD=1.36$). Besides, the students were found to have high total OLAS scores ($M=3.50$, $SD=0.87$) (Table 4).

The findings revealed no significant differences between the students' attitudes toward online learning by year of study. It was also the case regarding the total OLAS score by gender, but the male participants had significantly higher scores on the usefulness subscale than their female counterparts ($p=0.037$) (Table 5). Moreover, it was concluded that the bimodal and quadrimodal learners had significantly higher attitudes toward online learning than the unimodal participants ($p=0.034$ and 0.011 , respectively) (Table 6). Finally, there was no significant association between the students' attitudes toward online learning and their GPAs.

Table 4. The participants' attitudes toward online learning ($n = 101$).

Subscale	<i>M</i>	<i>SD</i>
GENACP	3.40	1.02
INDAWR	2.48	1.36
USEFUL	3.28	1.25
APPEFF	3.54	1.02
Total Score	3.50	0.87

(SD: Standard deviation, M: Mean, GENACP: General Acceptance, INDAWR: Individual Awareness, USEFUL: Usefulness, APPEFF: Application Efficiency.)

Table 5. The participants' attitudes toward online learning by gender ($n = 101$).

Subscale	Gender	<i>n</i>	<i>M</i>	<i>SD</i>	<i>p</i> *
GENACP	Male	21	3.50	1.27	-
	Female	80	3.37	0.94	
INDAWR	Male	21	3.02	1.43	-
	Female	80	2.33	1.31	
USEFUL	Male	21	3.45	1.54	0.037
	Female	80	3.24	1.17	
APPEFF	Male	21	3.60	1.21	-
	Female	80	3.53	0.98	
Total Score	Male	21	3.50	1.06	-
	Female	80	3.50	0.82	

* Independent samples *t*-test; a *p*-value < 0.05 was accepted as significant.

(SD: Standard deviation, M: Mean, GENACP: General Acceptance, INDAWR: Individual Awareness, USEFUL: Usefulness, APPEFF: Application Efficiency.)

Table 6. The relationship between the participants' learning style preferences and their attitudes toward online learning (n = 101)

Group	n	Mean Rank	Sum of Ranks	U	p*
1-Unimodal	30	28.50	855.00	390.000	0.011
4-Quadrimodal	40	40.75	1630.00		
1-Unimodal	30	20.88	626.50	161.500	0.034
2-Bimodal	17	29.50	501.50		

*Mann Whitney-U test; a p-value < 0.05 was accepted as significant.

Discussion

A learning style is often defined as one's distinctive and consistent approaches to perceiving, processing, organizing, and interpreting information.⁹ The VARK-LSQ, developed by Fleming and Mills, is also widely adopted thanks to its ease of administration, robust validity, and enhanced learning materials and can also be adapted to healthcare settings.¹⁰⁻¹²

Visual (V) learners learn best from the information presented through images (e.g., pictures, illustrations, charts, diagrams, and mind maps). Hearing or listening to information may be the best way of learning for auditory (A) learners. Such learners acquire much in lectures, prefer group discussions or listening to audio tapes and enjoy talking about examples. Besides, the read/write (R) learners grab information best when presented with words. They are often more successful in classes offering well-prepared slides or an appropriate writing outline. Finally, a kinesthetic (K) learner learns best by practice or simulation.^{10, 13}

Students may also adopt different learning styles in unimodal or multimodal patterns.¹⁴ While a multimodal learning style was previously reported to be more prevalent in studies involving medical and dentistry students,¹⁵⁻¹⁷ some other studies mentioned the common adoption of a unimodal learning style.^{14, 18} Students with a multimodal learning style have the ability to process information in any learning style and can adjust themselves to diverse teaching styles for a certain period of time.¹⁴ In this study, it was discovered that the multimodal learning style was adopted more than the unimodal learning style (70.30% vs. 29.70%), implying that electrophysiology students may enjoy a curriculum including theoretical and practical courses enriched with teaching with the mentioned perceptual styles.

As mentioned, learning styles can be considered key to deciding upon distance learning environments. Thus, further studies may consider scrutinizing learning preferences and learning styles in online learning environments using instruments to measure online learning styles.²

Attitudes toward online learning are thought to be influential in distance learning, as well as learning styles.⁵ It was found that the participants had the highest and lowest scores on the APPEFF and INDAWR subscales, respectively. Besides, the participants had high attitudes toward online learning. While various studies indicated moderate attitudes toward online learning among nursing students, some studies concluded that the participants exhibited 'indecisive' or negative attitudes.¹⁹⁻²² Mubayrik et al. reported that 67.9% of the participating medical students attended distance education and exhibited positive attitudes toward the "efficiency" of distance education. The top themes from the participants' views on distance education were 'accessibility,' 'ability to attend classes from anywhere,' and 'the ability to teach from anywhere.' Most respondents also appreciated the convenience of online learning regarding flexibility. In addition, the author reported a significant positive association between attending online classes and attitudes toward distance education.²³ In this study, the majority of the participants had attended distance education programs before; that is, they had experienced online classes. The hypothesis that students with the opportunity to experience online classes may adopt more positive attitudes toward online learning was confirmed in other studies as well as in this study.²² In other words, a previous experience with online learning may have contributed to their positive attitudes toward online learning.

Considering the students' attitudes toward online learning by gender, while they did not significantly differ in total OLAS scores, the male students had significantly higher scores on the USEFUL subscale than the female students. In their study investigating nursing students' attitudes toward online learning, Kabasakal et al. found no significant difference in total OLAS scores by gender, similar to this study.²⁰ The higher scores of the male students on the USEFUL subscale in this study may be attributed to an advantage of distance education: independent learning.²⁴ In the same study,²⁰ the authors concluded different mean attitude scores between the juniors and seniors. In this study, however, there was no significant difference in the attitude scores of the first-year and second-year students, which may be because the participants were at almost similar years of their study.

In their study exploring the effects of learning styles on the attitudes toward e-learning, Brown et al.²⁵ concluded that health science students' learning styles (measured with the Index of Learning Styles) could be considered to a limited extent as a predictor of their attitudes toward e-learning (measured with the Online Learning Environment Survey). In that study, the authors highlighted that the lecturers of health science students may consider the students' learning styles, particularly when utilizing technology or other aspects of e-learning. In another study using Kolb's Learning Style Inventory, students adopting 'assimilative' and 'accommodative' learning styles demonstrated significantly more welcoming attitudes toward various aspects of network-based teaching than those adopting 'convergent' and 'divergent' learning styles.²⁶ In their study with medical students, Yurdal et al. showed that learning styles were significant predictors of attitudes toward online education and determined that the visual-auditory learning style had the highest predictive power for

such attitudes.²⁷ The findings in this study showed that the participants adopting bimodal and quadrimodal styles had higher attitudes toward online learning than their counterparts with a unimodal style, implying that planning and executing learning processes covering all four learning styles may bring substantial advantages for teaching electrophysiology.

In summary, the findings revealed that the participating electrophysiology students mostly adopted a multimodal learning style, that they showed higher attitudes toward online learning, which did not significantly differ by year of study and gender, and that the students adopting a multimodal style had higher attitudes toward online learning than the unimodal learners.

The only limitation of the present research may be the relatively low sample size due to the single-center design.

Overall, the participating electrophysiology students' high attitudes toward online learning may document that online learning can be utilized as an efficient method in electrophysiology education. In addition, designing online teaching processes based on electrophysiology students' favorable learning styles may contribute to their productivity.

Ethical Considerations: The Ethics Committee of Health Sciences University granted ethical approval to this study (2022-113 dated 04.21.2022).

Conflict of Interest: None declared.

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