

Tracing the Relationship Between Pre-service Teachers' Learning Styles and Attitudes Toward Online Learning¹

Serkan Düzgün² Alper Kaşkaya³

Article History:

Received 19.08.2022

Received in revised form

19.02.2023

Accepted

Available online 13.03.2023

The present study attempted to uncover pre-service teachers' attitudes toward online learning and investigate the relationship between these attitudes and their learning styles, year of study, gender, enrolled program, and grade points average (GPA). In this descriptive survey study, we recruited 337 pre-service teachers enrolled in a state university in Türkiye and having had to attend the emergency remote learning process during the COVID-19 pandemic in the spring semester of the 2020-2021 academic year. The findings revealed the participating pre-service teachers overall held positive attitudes toward online learning. Besides, while they had a high general acceptance of online learning, their attitudes toward its usefulness were relatively low. Most of the participants often adopted a multimodal learning style, and the kinesthetic learning style was highly preferred among unimodal learners. Those adopting the kinesthetic learning style had a more positive view of online learning than their peers adopting the visual and read/write learning styles. In addition, the male participants had more positive attitudes toward online learning than their female counterparts. However, the pre-service classroom teachers had lower attitudes toward online learning than their peers in the other programs. Finally, it is surprising that the participants with lower GPAs had higher attitudes toward online learning.

© IJERE. All rights reserved

Keywords: Pre-service teachers, online learning, learning styles, distance education.

INTRODUCTION

Online learning refers to a learning process through a learning management system on web-based information technology tools in line with the principles of distance education (Bates, 2001; Curtain, 2002). The concept of distance education, implying that the teacher and the learner are involved in a teaching process at a distance from each other, considers "distance" not only physically and temporally but also as the interactional distance between the learner and the teacher, that is, the cognitive distance (Moore, 2013; Simonson et al., 1999). Online learning offers learners and teachers remarkable opportunities to reduce interactional distance (Lee, 2017; Moore et al., 2011; Ryan et al., 2016). Online learning has been widely adopted at all levels of educational institutions in the period of emergency remote learning due to the COVID-19 pandemic. Besides, it should be noted that the rapid developments and changes in technology and the pandemic-specific experiences made it inevitable that online learning-oriented technologies would become widespread in education. While it seems important to use up-to-date technologies to eliminate time and space dependence in distance education, considering learning-teaching approaches, students' self-regulation, individual differences, and learning styles in the teaching process would contribute to the efficiency of online learning (Arslan & Babadoğan, 2005; Ömeroğlu & Onan, 2021; Zapalska & Brozik, 2006).

It is now an accepted fact that every single student is diverse, and their differences highly affect the teaching process (Schmeck, 1988). A perspective emphasizing individual differences is one's learning style. Keefe (1989) (quoted by Logan & Thomas, 2002) denoted a learning style as a combination of cognitive, affective, and psychological factors linking with how a student perceives, interacts, and reacts to a particular learning environment. Therefore, it can be asserted that a learning style covers a number of factors reflecting one's preferences in a learning situation and includes their cognitive styles (Logan & Thomas, 2002). Considering learning styles, defined as the ways people prefer to learn, contributes to the efficiency of the learning process. Previous research documented that teaching processes promoted by diverse learning processes with characteristics specific to individual differences positively affect students' academic achievement and attitudes toward subjects (Vaishnav & Chirayu, 2013; Arslan & Babadoğan, 2005; Terrell & Dringus, 2000). So far, many approaches have been proposed to evaluate learning styles (Dunn et al., 1981), and some of the most prominent ones are based on learning styles research by Dunn and Dunn, Kolb, Gregorc, Felder-Silverman, and Grasha-Reichmann (Gülbahar & Alper, 2014). One among these approaches relies on the perceptual approach, where four basic learning styles are defined as visual, auditory, read/write, and kinesthetic/tactile (Fleming, 1995; Fleming & Bonwell, 2001; Leite, Svinicki, & Shi, 2010). In this approach, students' learning styles are steered by which of their senses receives the stimuli in the activities carried out during the learning process. In other words, considering them regarding a particular learning process, perceptual learning styles are grounded on one's senses with which information is received, processed, and

¹ Part of this work was presented orally at the Turkish World Educational Sciences International Congress-II - 2022

² Gazi University, serkanduzgun@gazi.edu.tr, orcid.org/0000-0001-8635-4181

³ Erzincan Binali Yıldırım University, akaskaya@erzincan.edu.tr, orcid.org/0000-0002-6695-6422

expressed (Erden & Altun, 2006). Yet, what should be remembered in this context is that people are often inclined to adopt more than one perceptual learning style (Boydak, 2014; Erden & Altun, 2006; Fleming, 1995; Fleming & Bonwell, 2001; Karataş et al., 2015; Leite, Svinicki, & Shi, 2010; Şimşek, 2002).

The relevant literature puts a significant emphasis on considering students' learning styles in distance education (Gülbahar & Alper, 2014; Zapalska & Brozik, 2006). Teachers realizing the differences in their students' learning styles are thought to be able to better adapt their teaching strategies and techniques in the distance education process (Manochehr, 2006). Besides, distance education offers many teaching methods, such as self-directed learning, cooperative learning, small group work, project-based learning, adaptive learning environments, lecturing, independent research, and discussion groups (Düzgün, 2022). Moreover, teachers who can adapt teaching methods, materials, and resources to their students' learning styles are also believed to be able to create an environment maximizing their learning potential (Tu & McIsaac, 2002). Therefore, it is deemed essential that learners and teachers/instructors have prior knowledge about their own learning preferences in distance education and that learning processes are designed and performed with an approach appealing to more than one learning style thanks to the said awareness. While concept map tools and image-video editing tools can be preferred for visual learners, podcasts and audio editing tools can be deployed for auditory learners. Moreover, blogs, wikis, and e-books go well with read/write learners, while virtual and augmented reality tools can be preferred for kinesthetic learners (Düzgün, 2022).

The present study ultimately aimed to discover the effects of learning styles, year of study, gender, enrolled program, and grade points average (GPA) among pre-service teachers, who had to attend distance education during the COVID-19 pandemic, on their attitudes toward online learning. The sub-problems of the research are as follows:

1. What level do the pre-service teachers have attitudes toward online learning?
2. How are the pre-service teachers' learning styles distributed?
3. Do the pre-service teachers' attitudes toward online learning differ by their learning styles?

Do the pre-service teachers' attitudes toward online learning differ by their year of study, gender, enrolled program, and GPA?

METHOD

Research Design

We employed a descriptive survey design in this research to reveal the association between online learning attitudes of Turkish pre-service teachers having had to attend distance education during the pandemic and some of their demographic characteristics. Survey research is often utilized to describe the characteristics of objects, communities, and institutions and the functioning of phenomena (Cohen et al., 2007). The type of survey research where the data are collected at once is called cross-sectional survey research (Fraenkel et al., 2011). In this study, we attempted to describe the current situation of the participants pertaining to the said variables using a cross-sectional survey design.

Population and Sample

The target population of the research consisted of pre-service teachers having received distance education at a state university in Türkiye in the spring semester of the 2020-2021 academic year. In sampling, we utilized the convenience sampling technique to be able to select the sample from easily accessible units (Büyüköztürk et al., 2009), considering the restrictions of the pandemic. Carrying out research with quantitative data requires keeping the sample size as big as possible; thus, we attempted to reach pre-service teachers from all possible programs in this study. Accordingly, the prominent programs the participants were enrolled in were discovered to be mathematics education (24%), social studies education (22.3%), early childhood education (16%), and classroom education (13.9%). The research data were collected only from voluntary students. Table 1 presents the distribution of the participants. Accordingly, 337 students participated in the research. The participants' GPAs varied between 1.00 and 3.95, and the mean GPA was found to be 2.89.

Table 1. Distribution of the participants

Category	Variable	n	%
Gender	Male	70	20.8
	Female	267	79.2
	Total	337	100.0
Year of Study	1	76	22.6
	2	96	28.5
	3	104	30.9
	4	61	18.1
	Total	337	100.0
Program	Mathematics Education	81	24.0
	Early Childhood Education	54	16.0
	Psychological Counseling and Guidance	24	7.1
	Visual Arts Education	23	6.8
	Classroom Education	47	13.9
	Social Studies Education	75	22.3
	Turkish Language Education	33	9.8
	Total	337	100.0

Data Collection Tools and Procedure

We collected the data using a demographic information form (gender, year of study, department/program, and GPA), the VARK Learning Styles Questionnaire (VARK-LSQ), and the Online Learning Attitude Scale (OLAS).

While the validity and reliability study of the VARK-LSQ, developed by Fleming (1995, 2001), was carried out by Leite, Svinicki, & Shi (2010), Düzgün (2018) adapted the questionnaire into Turkish and calculated its internal reliability coefficient to be 0.76. The item-total correlation in all subscales of the instrument ranged from 0.36 to 0.55. The first-order confirmatory factor analysis (CFA) resulted in the following fit indices $\chi^2/df = 2.07$, RMSEA = 0.06, SRMR = 0.07, NNFI = 0.41, CFI = 0.43, GFI = 0.73, and AGFI = 0.71, while the second-order CFA revealed $\chi^2/df = 2.08$, RMSEA = 0.06, SRMR = 0.07, NNFI = 0.41, CFI = 0.43, GFI = 0.73, and AGFI = 0.71. In this study, we calculated the internal reliability coefficient of the scale to be 0.82.

Usta et al. (2016) designed the 20-item 5-point Likert-type OLAS and found its internal reliability coefficient to be 0.90. Exploratory factor analysis (EFA) in the original study demonstrated the data within four sub-scales explained 63.82% of the total variance. Moreover, the authors calculated Cronbach's alpha coefficient to be 0.77 for the general acceptance subscale (GENACP), 0.85 for the individual awareness subscale (INDAWR), 0.79 for the usefulness subscale (USEFUL), and 0.68 for the application efficient sub-scale (APPEFF). In this study, we replicated the reliability analysis of the OLAS and found alpha values to be 0.92 for the total score, 0.69 for GENACP, 0.90 for INDAWR, 0.80 for USEFUL, and 0.71 for APPEFF. In addition, the CFA results yielded the following fit indices: $\chi^2/df = 2.88$, RMSEA = 0.07, CFI = 0.98, IFI = 0.98, PNFI = 0.83, NFI = 0.97, NNFI = 0.98, and SRMR = 0.05. Overall, the findings above indicated that the measurement tools deployed were suitable for collecting data from our sample (Hooper et al., 2008; Hu & Bentler, 1999; Mulaik et al., 1989; Steiger, 2007; Wheaton et al., 1977).

Moreover, we sought relevant permissions from the corresponding authors via e-mail to use the OLAS in this study. The Educational Sciences Ethics Committee of T.C. Erzincan Binali Yıldırım University granted ethical approval to our research (No.: E-88012460-050.01.04-150142 dated 02/23/2022).

Data Analysis

We used descriptive statistics to analyze the data on IBM SPSS 26.0 and LISREL 8.80. Descriptive data were arranged in line with the findings from the data collection tools. Table 2 shows the normality results of the data.

Table 2. Normality findings of the OLAS

Subscales	n	Max.	M	Median	Mode	Skewness	Kurtosis
GENACP	337	35	20.64	21.00	20	.066	-.524
INDAWR	337	30	14.94	13.00	6	.588	-.724
USEFUL	337	15	9.98	10.00	15	-.237	-.868
APPEFF	337	20	12.98	14.00	15	-.320	-.600
Total Score	337	100	58.53	57.00	51	.212	-.660

Considering that the skewness and kurtosis values in the table above ranged between +1 and -1, we can assert the data on the OLAS showed a normal distribution (Hair et al., 2013). Accordingly, we compared the data by gender, year of study, and program using independent samples t-test and one-way analysis variance (ANOVA). Since each participant distribution for the VARK-LSQ was less than 30, we performed Kruskal-Wallis H and Mann-Whitney *U* tests to analyze the participants' learning styles. In addition, we sought the relationship between GPA and attitudes toward online learning using Pearson correlation analysis. We accepted *p*-value < 0.05 as statistically significant.

FINDINGS

We carried out this study to discover the effects of learning styles, year of study, gender, academic program, and GPA among pre-service teachers attending distance education during the pandemic on their attitudes toward online learning and presented the findings below in order of sub-problems.

Regarding the first sub-problem of the research, the findings of the participants' attitudes toward online learning are shown in Table 3.

Table 3. Pre-service teachers' attitudes toward online learning

Subscales	n	Max.	M	SD
GENACP	337	35	20.64	5.74
INDAWR	337	30	14.94	7.16
USEFUL	337	15	9.98	3.55
APPEFF	337	20	12.98	4.10
Total Score	337	100	58.53	17.99

Considering attitudes toward online learning, the findings revealed that the participants scored highest on the GENACP subscale ($M = 20.64$) and the lowest on the USEFUL subscale ($M = 9.98$). Besides, we can mention high attitudes toward online learning among the participants based on their mean total OLAS score ($M = 58.53$), which implies that the participants had a greater attitude toward online learning. However, it seems that the participants thought that online learning offers less usefulness compared to its other aspects.

The learning styles distribution of the participants, the second sub-problem of the research, are shown in Tables 4, 5, and 6.

Table 4. Distribution of the participants' learning styles

Learning Style		n	%
Visual	V	20	5.9
Auditory	A	37	11.0
Read/Write	R	25	7.4
Kinesthetic	K	58	17.2
Visual-Auditory	VA	1	0.3
Visual-Kinesthetic	VK	8	2.4
Visual-Read/Write	VR	3	0.9
Auditory-Kinesthetic	AK	15	4.5
Auditory-Read/Write	AR	16	4.7
Read/Write-Kinesthetic	RK	20	5.9
Visual-Auditory-Kinesthetic	VAK	7	2.1
Visual-Auditory- Read/Write	VAR	3	0.9
Visual-Read/Write-Kinesthetic	VRK	9	2.7
Auditory-Read/Write-Kinesthetic	ARK	20	5.9
Visual-Auditory-Read/Write-Kinesthetic	VARK	95	28.2
Total		337	100.0

It was discovered that the majority of the participants adopted all of the learning styles (Audio-Visual-Read/Write-Kinesthetic; 28.2%), while the majority of unimodal learners preferred the Kinesthetic learning style (17.2%). Although visibility is prevalent in social domains, the number of visual learners remained relatively low in our sample (5.9%).

Table 5. Distribution of the learning style groups by the participants' learning style preferences

Group	Preferences	n	%
Unimodal	V-A-R-K	140	41.5
Bimodal	VA-VK-VR-AK-AR-RK	63	18.7
Trimodal	VAK-VRK-ARK	39	11.6
Quadrimodal	VARK	95	28.2
Total		337	100.0

We grouped the learning styles of the participants by the number of their learning style preferences. Accordingly, the majority of the participants (41.5%) were unimodal learners, while the least number of participants (11.6%) were discovered to be trimodal learners (Table 5). Unimodal learners seem to dominate the sample, urging the significance of diversifying learning environments. Content delivered in a single environment may influence the learning of those adopting other learning preferences.

Table 6. Distribution of the participants by their unimodal learning preferences

Learning Style		n	%
Visual	V	20	14.3
Auditory	A	37	26.4
Read/Write	R	25	17.9
Kinesthetic	K	58	41.4
Total		140	100.0

Table 6 shows the learning style preferences of unimodal learners. While most of the pre-service teachers (41.4%) adopted the kinesthetic learning style, the visual learning style was adopted the least (14.3%). The predominance of kinesthetic learners in our sample seems not to overlap with the overall structure of applications in online learning. Online learning is usually carried out on computers, tablets, and phones, which may then generate a limitation to instructional activities requiring physical movements. Regarding the third sub-problem of the research, Table 7 demonstrates the results of the Kruskal-Wallis H test to reveal any significant difference in the participants' attitudes toward online learning by their learning styles.

Table 7. Participants' attitudes toward online learning by their learning styles

Subscale	Learning Style	n	Mean Rank	χ^2	df	p	Significant difference*
GENACP	V	20	51.23	8.243	3	0.041	V-K*, V-R*
	A	37	65.04				
	R	25	82.38				
	K	58	75.51				
	Total	140					
INDAWR	V	20	45.93	10.060	3	0.018	V-K*, V-R*
	A	37	67.91				
	R	25	77.72				
	K	58	77.52				
	Total	140					
USEFUL	V	20	44.60	13.110	3	0.004	V-K*, V-R*
	A	37	65.08				
	R	25	83.16				
	K	58	77.43				
	Total	140					
Total Score	V	20	46.45	11.761	3	0.008	V-K*, V-R*
	A	37	64.97				
	R	25	83.98				
	K	58	76.51				
	Total	140					

*p < .05

As in Table 7, the pre-service teachers' GENACP scores ($X^2_{(3)} = 8.243; p < .05$), INDAWR scores ($X^2_{(3)} = 10.06; p < .05$), USEFUL scores ($X^2_{(3)} = 13.110; p < .05$), and total OLAS scores ($X^2_{(3)} = 11.761; p < .05$) significantly differed by their learning styles. Yet, it was not the case for their APPEFF scores. Then, we performed the Mann-Whitney U test to find out the source(s) of these significant differences.

Table 8. Mann-Whitney U test results of the participants' learning styles

Subscale	Learning Style	n	Mean Rank	Sum of Ranks	U	p
GENACP	V	20	30.00	600.00	390.000	0.029*
	K	58	42.78	2481.00		
	V	20	17.33	346.50		
	R	25	27.54	688.50		
INDAWR	V	20	26.98	539.50	329.500	0.004*
	K	58	43.82	2541.50		
	V	20	17.48	349.50		
	R	25	27.42	685.50		
USEFUL	V	20	25.93	518.50	308.500	0.002*
	K	58	44.18	2562.50		
	V	20	16.60	332.00		
	R	25	28.12	703.00		
Total Score	V	20	28.03	560.50	350.500	0.009*
	K	58	43.46	2520.50		
	V	20	16.15	323.00		
	R	25	28.48	712.00		

* $p < .05$

The findings showed that the participants' attitudes toward online learning significantly differed in favor of kinesthetic and read/write learners on the GENACP subscale ($U = 390; Z = -2.179; p = 0.029$ and $U = 136.500; Z = -2.601; p = 0.009$, respectively), INDAWR subscale ($U = 329.500; Z = -2.873; p = 0.004$ and $U = 139.500; Z = -2.533; p = 0.011$, respectively), USEFUL subscale ($U = 308.500; Z = -3.125; p = 0.002$ and $U = 122; Z = -2.945; p = 0.003$, respectively), and total OLAS score ($U = 350.500; Z = -2.627; p = 0.009$ and $U = 113; Z = -3.131; p = 0.002$, respectively). Considering that online learning activities are generally aided with visuals, sounds, and texts, it is not surprising the participants with a read/write preference adopted a positive attitude toward online learning. What is more striking is that the participants adopting the kinesthetic learning style also demonstrated a positive attitude toward online learning. In terms of the fourth sub-problem of the research, we investigated the pre-service teachers' attitudes toward online learning by their year of study, gender, program, and GPA. Accordingly, the one-way ANOVA revealed no significant difference in the participants' attitudes toward online learning by their year of study, which may be associated with the simultaneous transition to online learning at all grade levels due to the pandemic. The results of the independent samples *t*-test regarding their attitudes toward online learning by gender are shown in Table 9.

Table 9. Participants' attitudes toward online learning by gender

Subscale	Gender	n	M	SD	df	t	p
GENACP	Male	70	22.66	6.406	335	3.352	.001
	Female	267	20.11	5.441			
	Total	337					
INDAWR	Male	70	18.11	7.959	335	4.275	.000
	Female	267	14.11	6.700			
	Total	337					
Total Score	Male	70	63.83	20.966	335	2.795	.005
	Female	267	57.15	16.892			
	Total	337					

* $p < .05$

We found out significant differences between attitudes toward online learning in favor of the male participants on the GENACP subscale ($p = .001$), INDAWR subscale ($p = .000$), and the total OLAS score ($p = .005$). On the other hand, we could not conclude significant differences between the participants' attitudes toward online learning by gender on the USEFUL and APPEFF subscales (Table 10).

Table 10 presents the results of the one-way ANOVA analysis to explore the difference between the participants' attitudes toward online learning.

Table 10. Participants' attitudes toward online learning by enrolled program

Subscale		Sum of Squares	df	Mean Square	F	p	Significant difference (Tukey)
INDAWR	Between groups	1122.206	6	187.034	3.838	0.001*	2-5, 3-5, 6-5
	Within groups	16080.607	330	48.729			
	Total	17202.813	336				
Total Score	Between groups	3.855	6	857.905	2.734	0.013*	2-5, 6-5
	Within groups	273.478	330	313.832			
	Total	277.332	336				

* $p < .05$

Subscale	Program	N	X	Ss
INDAWR	1 Mathematics Education	81	15,20	6,875
	2 Early Childhood Education	54	16,65	8,819
	3 Psychological Counseling and Guidance	24	17,75	6,720
	4 Visual Arts Education	23	14,04	7,957
	5 Classroom Education	47	11,62	4,276
	6 Social Studies Education	75	15,88	7,232
	7 Turkish Language Education	33	12,70	5,687
	8 Total Score	337	14,94	7,155
Total Score	1 Mathematics Education	81	59,11	17,247
	2 Early Childhood Education	54	61,80	22,568
	3 Psychological Counseling and Guidance	24	63,13	17,045
	4 Visual Arts Education	23	58,35	17,755
	5 Classroom Education	47	50,26	11,957
	6 Social Studies Education	75	60,88	18,962
	7 Turkish Language Education	33	55,03	13,658
	8 Total Score	337	58,53	17,987

We could not find any significant differences between the participants' attitudes toward online learning by enrolled program, except for the INDAWR subscale ($p = .001$) and the total OLAS score ($p = .013$). The Tukey HSD test, performed to uncover the source(s) of significant differences, showed significant differences between the participants enrolled in early childhood education ($p = .006$) and psychological counseling and guidance ($p = .009$) and social studies education ($p = .019$) and those enrolled in classroom education on the INDAWR subscale ($F = 2.191$; $p < .05$). It was also the case between those enrolled in early childhood ($p = .020$) and social studies education ($p = .023$) and the participants enrolled in classroom education on the total OLAS score ($F = 2.734$; $p < .05$).

Table 11 summarizes the results of the correlation analysis to examine the relationship between the participants' attitudes toward online learning and their GPA.

Table 11. Relationship between the participants' attitudes toward online learning and their GPA

	<i>M</i>	<i>SD</i>	GPA	GENACP	INDAWR	USEFUL	APPEFF	Total Score
GPA	2.89	0.73	1	-.100	-.190**	-.087	-.070	-.140**
GENACP	20.64	5.74		1	.798**	.668**	.564**	.897**
INDAWR	14.94	7.16			1	.743**	.589**	.933**
USEFUL	9.98	3.55				1	.637**	.851**
APPEFF	12.98	4.10					1	.768**
Total Score	58.53	17.99						1

** $p < 0.01$

As summarized in the table above, we concluded significant, negative, and low correlations between GPA and the INDAWR subscale ($r = -.190$; $p = 0.00$; $p < 0.05$) and the total OLAS score ($r = -.140$; $p = 0.010$; $p < 0.01$). In addition, there were significant positive relationships between the OLAS subscales, including the total score, which may be because successful students may have thought online learning would adversely affect their own learning processes.

DISCUSSION and CONCLUSION

The present study explored the relationship between pre-service teachers' learning styles and their attitudes toward online learning. The findings revealed that the participants had high attitudes toward online learning. In this sense, it can be asserted that the participants adopted a perception of the necessity of an online learning process but experienced several problems in terms of the usefulness of the process. Overlapping with this finding, Düzgün and Sulak (2020) concluded that pre-service teachers adopted a positive attitude toward distance education and found it pragmatic but not effective. On the other hand, Hacıömeroğlu & Elmalı (2021) reported low attitudes toward online learning among university students. Besides, Yenilmez et al. (2017) discovered the above-moderate attitudes toward distance education among pre-service teachers. Such a perception may have emerged because the participating pre-service teachers had some issues in this process when they had to utilize but did not have sufficient experience with distance education tools mandated by compulsory developments with the COVID-19 pandemic. Moreover, the students were caught unprepared since switching to distance education immediately, which may have caused them to adopt some undesirable perceptions of distance education (Aras, 2019; Bayram et al., 2019; Gürleyik & Akdemir, 2018; Sarıbaşı & Meydan, 2020).

We concluded that the participating pre-service teachers were mostly multimodal learners regarding learning styles and that the unimodal learners preferred the kinesthetic learning style the most. In some studies, it seems the majority of the participants were multimodal learners (Yılmazel et al., 2015). Overlapping with our findings, the previous research also reported that the majority of unimodal learners adopted the kinesthetic learning style (Argut Karabörklü et al., 2017; Katırcı Kırmacı et al., 2019; Usta, 2019; Işıldar et al., 2016). However, the literature hosts some contradictory findings showing that the visual learning style was adopted more (Kanninen, 2008).

When it comes to learning styles, we discovered that the online learning attitudes of the pre-service teachers adopting kinesthetic and read/write learning styles significantly differed when compared to those of the participants with the visual learning style. Accordingly, we concluded that the students with the mentioned learning styles accepted and adapted to the online learning process more quickly and thought online learning to be more appealing and useful, considering their traits. While some studies documented that learning styles are likely to be influential in students' attitudes and achievement, supporting our finding (Bostrom, Olfman, & Sein, 1993; Ergün & Kurnaz, 2019; Lindsay, 1999), some others (Hajizainuddin, 1999; Desai, 1996) did not reach a significant relationship between learning styles and attitudes toward learning.

The findings showed no significant relationship between the pre-service teachers' attitudes toward online learning by their year of study. While some previous findings overlap with this finding (Başar et al., 2019; Baltacı et al., 2022), some others yielded that grade levels affect attitudes toward distance education (Düzgün & Sulak, 2020; Gündüz, 2013; Hacıömeroğlu & Elmalı, 2021). However, considering the curricula recommended by the Council of Higher Education (CHE), the practice-oriented nature of courses offered in the 3rd and 4th years could have created a differentiation between the students' attitudes toward online learning. Yet, it should be noted that the distance education process during the pandemic resulted in courses conducted with similar methods, leading the students to adopt overlapping perceptions of online learning by year of study.

Considering gender, we discovered that the male participants had more positive attitudes toward online learning. In this regard, the male students differed from their female counterparts, particularly in showing immediate acceptance and having a high awareness of the online learning process. Despite similar results in the literature (Başar et al., 2019; Yenilmez et al., 2017), the literature also hosts research concluding that gender is not associated with attitudes toward distance education (Baltacı et al., 2022; Düzgün & Sulak, 2020; Gündüz, 2013; Hacıömeroğlu & Elmalı, 2021).

Our findings documented that the students enrolled in the classroom education program adopted more negative perceptions of online learning compared to their counterparts in the other programs. They had lower individual awareness of online learning, but the students enrolled in early childhood education, social studies education, and psychological counseling and guidance had more positive perceptions of online learning. Although there are compatible findings in the literature (Başar et al., 2019; Gündüz, 2013; Yenilmez et al., 2017), some studies reported no relationship between pre-service teachers' programs and their attitudes toward distance education (Düzgün & Sulak, 2020). Such a difference between the students enrolled in different programs may be attributed to their diverse experiences in online learning. For example, Sarıbaşı & Meydan (2020) emphasized that online teaching of applied and observation-oriented courses adversely affected the online learning attitudes of students enrolled in an undergraduate geography program.

Finally, we concluded a negative association between the participants' attitudes toward online learning and their academic achievement. Accordingly, the students with higher academic achievement had more negative views of online learning. The shadow on the reliability of assessment and evaluation processes may be considered one big problem of distance education during the pandemic. The failure to overcome such a problem and the lack of assessment transparency may have led some students to resort to undesirable means and be granted undeserved exam scores from time to time. This situation, therefore, may have been perceived as totally negative, particularly by students with higher academic achievement.

It should be noted that learning styles are only one of the factors influencing pre-service teachers' attitudes toward online learning. Instructors' learning styles, attitudes toward online learning, favorite instructional methods, technology literacy, and knowledge and proficiency in online learning activities and course content may also be among the factors affecting pre-service teachers' attitudes toward online learning. Thus, further research is highly needed to uncover the impacts of the mentioned factors. In addition, qualitative research may help reveal the underlying causes and implications of the mentioned factors.

Declarations

Limitations

The nature of descriptive survey design does not allow for mentioning cause-effect relationships, creating a limitation in understanding the actual reasons for our findings. The causality can be mentioned with qualitative research on the impacts of learning styles in distance education.

Conflict of Interest

No potential conflicts of interest were disclosed by the authors with respect to the research, authorship, or publication of this article.

Ethics Approval

The formal ethics approval was granted by the Educational Sciences Ethics Committee of T.C. Erzincan Binali Yıldırım University. We conducted the study in accordance with the Helsinki Declaration in 1975.

Funding

No specific grant was given to this research by funding organizations in the public, commercial, or not-for-profit sectors.

Research and Publication Ethics Statement

The study was approved by ethics committee of the T.C. Erzincan Binali Yıldırım University (Approval Number/ID: E-88012460-050.01.04-150142 dated 02/23/2022). Hereby, we as the authors consciously assure that for the manuscript "Tracing the Relationship Between Pre-service Teachers' Learning Styles and Attitudes Toward Online Learning" the following is fulfilled:

- This material is the authors' own original work, which has not been previously published elsewhere.
- The paper reflects the authors' own research and analysis in a truthful and complete manner.
- The results are appropriately placed in the context of prior and existing research.
- All sources used are properly disclosed.

Contribution Rates of Authors to the Article

The authors provided equal contributions to this work.

REFERENCES

- Aras, E. (2019). *Opinions of academic staff who work at sport training institutions towards distance education: a qualitative study. [Spor eğitimi kurumlarında görev yapan akademik personel ve spor eğitimi gören öğrencilerin uzaktan eğitime yönelik görüşlerinin incelenmesi].* [Yüksek lisans tezi, Fırat Üniversitesi, Elazığ]. <https://doi.org/10.33689/spormetre.529611>
- Argut Karabörklü, S., Mustafaoğlu, R., Kuş, G., & Razak Özdinçler, A. (2017). Determination of learning style preferences in students at the faculty of health sciences. *Clinical and Experimental Health Sciences*, 7(4), 146-151. <https://doi.org/10.5152/clinexphealthsci.2017.299>
- Arslan, B., & Babadoğan, C. (2005). Relationships between learning style preferences and gender, age and success level at 7th and 8th Grade. *Eurasian Journal of Educational Research*, 21(14), 35-48. https://ejer.com.tr/wp-content/uploads/2021/01/ejer_2005_issue_21.pdf
- Baltacı, S., Bütüner, S.Ö., & Çalışkan, E. (2022). Investigation of primary school mathematics teacher candidates' self-efficacy levels for online learning in terms of various variables. [İlköğretim matematik öğretmen adaylarının çevrimiçi öğrenmeye yönelik öz-yeterlik düzeylerinin çeşitli değişkenler açısından incelenmesi]. *Ahi Evran Üniversitesi Kırşehir Eğitim Fakültesi Dergisi*, 23(Special Issue), 472-508. Doi: 10.29299/kefad.1054516 <https://dergipark.org.tr/en/pub/kefad/issue/69090/1054516>
- Başar, M., Arslan, S., Günsel, E., & Akpınar, M. (2019). Distance education perceptions of prospective teachers. [Öğretmen adaylarının uzaktan eğitim algısı]. *Journal of Multidisciplinary Studies in Education*, 3(2), 14-22. <https://dergipark.org.tr/en/pub/jmse/issue/45032/555407>
- Bates, A. W. (2001). Beyond button-pushing: Using technology to improve learning. In R. Epper & A. W. Bates (Eds.), *Teaching faculty how to use technology: Best practices from leading institutions* (pp. 141-152). Westport: American Council on Education/Oryx Press.
- Bayram, M., Peker, A. T., Aka, S. T., & Vural, M. (2019). Examination of attitudes of university students towards distance learning. [Üniversite öğrencilerinin uzaktan eğitim dersine karşı tutumlarının incelenmesi]. *Gaziantep Üniversitesi Spor Bilimleri Dergisi*, 4(3), 330-345. <https://doi.org/10.31680/gaunjss.586113>
- Bostrom, R. P., Olfman, L., & Sein, M. K. (1993). Learning styles and end-user training: A first step. *MIS Quarterly*, 17(3), 118-120. <https://doi.org/10.2307/249513>
- Boydak, A. (2014). *Learning styles. [Öğrenme stilleri].* İstanbul: Beyaz Yayınları.
- Büyüköztürk, Ş., Kılıç Çakmak, E., Akgün, Ö. E., Karadeniz, Ş., & Demirel, F. (2009). *Scientific research methods. [Bilimsel araştırma yöntemleri].* (4. Baskı). Ankara: Pegem Akademi Yayınları.
- Cohen, L., Manion, L., & Morrison, K. (2007). *Research methods in education.* (6th Edition). London: Routledge.
- Curtain, R. (2002). *Online delivery in the vocational education and training sector.* Australian National Training Authority. NCVER. https://www.ncver.edu.au/_data/assets/file/0027/9648/online-delivery-in-vet-sector-782.pdf
- Desai, M. S. (1996). *Longitudinal study to assess the impact of instructor-based training versus computer-based training on user performance: A field experiment* (Publication No. 9638463). [Doctoral dissertation, University of North Texas, Denton]. ProQuest Dissertations and Theses Global.
- Dunn, R., DeBello, T., Brennan, P., Krinsky, J., & Murrain, P. (1981). Learning style researchers define differences differently, *Educational Leadership*, 38(5), 372-375. https://files.ascd.org/staticfiles/ascd/pdf/journals/ed_lead/el_198102_dunn.pdf
- Düzgün, S., & Sulak, S. E. (2020). The opinions of the teacher candidates on distance learning practices in the Covid-19 pandemic process. [Öğretmen adaylarının Covid-19 pandemisi sürecinde uzaktan eğitim uygulamalarına ilişkin görüşleri]. *Milli Eğitim Dergisi, Salgın Sürecinde Türkiye'de ve Dünyada Eğitim*, 619-633. <https://doi.org/10.37669/milliegitim.787874>
- Düzgün, S. (2018). Verification of VARK learning styles inventory translated into Turkish with verified factor analysis models: Classroom teacher's example. [Türkçeye çevrilmiş VARK öğrenme stilleri envanterinin doğrulayıcı faktör analizi modeli ile doğrulanması: Öğretmenler örneği]. *Turkish Studies*, 13(11), 1619-1634. <http://dx.doi.org/10.7827/TurkishStudies.13442>

- Düzgün, S. (2022). *Learning styles in distance education. [Uzaktan eğitimde öğrenme stilleri]*. In Zahal O. & Tankız K.D. (Eds.), *Research and evaluations in education. [Eğitimde araştırma ve değerlendirmeler]* (pp. 339-369). Gece Kitaplığı.
- Erden, M., & Altun, S. (2006). *Learning styles. [Öğrenme stilleri]*. İstanbul: Morpa.
- Ergün, E., & Kurnaz, F. B. (2019). Investigation of the relations between e-learning style and academic achievement in e-learning environment. [E-öğrenme ortamlarında öğrenme stilleri ve akademik başarı arasındaki ilişkinin incelenmesi]. *Journal of Theoretical Educational Science*, 12(2), 532-549. <https://doi.org/10.30831/akukeg.407029>
- Fleming, N., & Bonwell, C.C. (2001). *How do I learn best, a students' guide to improved learning, Version 3,0*. New Zealand: Christchurch.
- Fleming, N.D; (1995). I'm different; not dumb. Modes of presentation (VARK) in the tertiary classroom, in Zelmer, A., (ed.) *Research and Development in Higher Education, Proceedings of the 1995 Annual Conference of the Higher Education and Research Development Society of Australasia, HERDSA*, 18, 308-313. https://fyi.extension.wisc.edu/wateroutreach/files/2016/03/Fleming_VARK_Im_Different_Not_Dumb.pdf
- Fraenkel, J.R., Wallen, N. E., & Hyun, H. H. (2011). *How to design and evaluate research in education*. (8th Edition). New York: McGraw-Hill.
- Gülbahar, Y., & Alper, A. (2014). Development of e-learning styles scale for electronic environments. [Elektronik ortamlar için e-öğrenme stilleri ölçeğinin geliştirilmesi]. *Eğitim ve Bilim*, 39(171), 421-435. <http://eb.ted.org.tr/index.php/EB/article/view/2078>
- Gündüz, A. Y. (2013). *Preservice teachers' perception of distance education [Öğretmen adaylarının uzaktan eğitim algısı]* (Publication No. 29179932). [Doctoral dissertation, Sakarya University]. ProQuest Dissertations and Theses Global.
- Gürleyik, S., & Akdemir, E. (2018). Guiding curriculum development: Student perceptions for the second language learning in technology-enhanced learning environments. *Journal of Education and Training Studies*, 6(4), 131-138. <https://doi.org/10.11114/jets.v6i4.2994>
- Hacıömeroğlu, G., & Elmalı, Ö. (2021). Pre-service teachers' attitude, self-efficacy, and perceptions of the learning environment regarding distance learning: A mixed method study. [Öğretmen adaylarının uzaktan öğrenmeye yönelik tutum, öz yeterlik ve öğrenme ortamı algıları: Bir karma yöntem çalışması]. *Journal of Multidisciplinary Studies in Education*, 5(3), 65-87. <https://dergipark.org.tr/en/pub/jmse/issue/65161/912347>
- Hair, J. F., Black, W. C., Babin, B. J., Anderson, R. E., & Tatham, R. L. (2013). *Multivariate data analysis*. Essex, England.
- Hajizainuddin, A. M. (1999). *A study of learning styles and hypermedia's organizational structures in a Web-based instructional program designed for trainee teachers at the international Islamic University Malaysia* (Publication No. 9928068). [Doctoral dissertation, University of Pittsburgh, Pittsburgh]. ProQuest Dissertations and Theses Global.
- Hooper, D., Coughlan, J., & Mullen, M. (2008). Structural equation modelling: Guidelines for determining model fit. *Electronic Journal of Business Research Methods*, 6(1), 53-60. <https://academic-publishing.org/index.php/ejbrm/article/view/1224>
- Hu, L. T., & Bentler, P. M. (1999). Cutoff criteria for fit indexes in covariance structure analysis: Conventional criteria versus new alternatives. *Structural Equation Modeling: A Multidisciplinary Journal*, 6(1), 1-55. <https://doi.org/10.1080/10705519909540118>
- Işıldar, P., Aktaş, E., & Kurgun, O. A. (2016). Determining of the learning style of tourism students according to VARK learning model: comparison of bachelor and associate degrees. [Turizm öğrencilerinin VARK öğrenme modeline göre öğrenme stillerinin belirlenmesi: lisans ve ön lisans karşılaştırması]. *Dokuz Eylül University Journal of Graduate School of Social Sciences*, 18(1), 91-113. <http://dx.doi.org/10.16953/deusbed.38293>
- Kanninen, E. (2008). *Learning styles and e-learning*. [Master of science dissertation, Tampere University of Technology]. <https://citeseerx.ist.psu.edu/document?repid=rep1&type=pdf&doi=794cf9624b5623557931756000f12b7e9eeb112c>

- Karataş, H., Sır, N. Ş., & Çeliköz, N. (2015). An investigation on the learning style preferences of pre-service teachers. [Öğretmen adaylarının öğrenme stili tercihlerine ilişkin bir inceleme]. *Education Sciences*, 10(4), 237-252. <http://dx.doi.org/10.12739/NWSA.2015.10.4.1C0645>
- Katırcı Kırmacı, Z. İ., Otay Lüle, N., Aktaş, B., Arı Yılmaz, D., Günel Karadeniz, P., Erel, S., Adıgüzel, H., Ergen, H. İ., Uzun, M., Yıldızlı, M., & Ergun, N. (2019). Determination of learning preferences of SANKO university faculty of medicine and faculty of health sciences students by VARK questionnaire. [SANKO üniversitesi tıp fakültesi ve sağlık bilimleri fakültesi öğrencilerinin öğrenme tercihlerinin VARK anketi ile belirlenmesi]. *Sağlık Bilimlerinde Eğitim Dergisi*, 2(1), 21-28. <https://dergipark.org.tr/en/pub/jedihe/issue/52054/628942>
- Lee, K. (2017). Rethinking the accessibility of online higher education: a historical review. *The Internet and Higher Education*, 33, 15–23. <https://doi.org/10.1016/j.iheduc.2017.01.001>
- Leite, W. L., Svinicki, M., & Shi, Y. (2010). Attempted validation of the scores of the VARK: Learning styles inventory with multitrait-multimethod confirmatory factor analysis models. *Educational and Psychological Measurement*, 70(2), 323-339. <https://doi.org/10.1177/0013164409344507>
- Lindsay, E. K. (1999). An analysis of matches of teaching styles learning styles and the uses of educational technology (Publication No. 9922694). [Doctoral dissertation, North Carolina State University]. ProQuest Dissertations and Theses Global.
- Logan, K., & Thomas, P. G. (2002 June). *Learning styles in distance education students learning to program* [pp. 29-44]. Proceedings of 14th Workshop of the Psychology of Programming Interest Group, Brunel University. <https://www.academia.edu/download/3544341/10.1.1.108.6143.pdf>
- Manochehr, N. N. (2006). The influence of learning styles on learners in e-learning environments: An empirical study. *Computers in Higher Education Economics Review*, 18(1), 10-14. <https://www.economicsnetwork.ac.uk/cheer/ch18/manochehr.pdf>
- Moore, J., Dickson-Deane, C., & Galyen, K. (2011). E-learning, online learning and distance learning environments: Are they the same?. *The Internet and Higher Education*, 14(2), 129-135. <https://doi.org/10.1016/j.iheduc.2010.10.001>
- Moore, M. G. (2013). The theory of transactional distance. In Moore, M.G. (Ed.), *Handbook of distance education* (pp. 66-85). New York: Routledge.
- Mulaik, S. A., James, L. R., Van Alstine, J., Bennett, N., Lind, S., & Stilwell, C. D. (1989). Evaluation of goodness-of-fit indices for structural equation models. *Psychological Bulletin*, 105(3), 430-445. <https://psycnet.apa.org/doi/10.1037/0033-2909.105.3.430>
- Ömeroğlu, A. F., & Onan, B. (2021). Effect of application of the VARK learning model on achievement, attitudes and retention in grammar teaching. [Dil bilgisi öğretiminde vark öğrenme modeline yönelik uygulamaların başarı, tutum ve kalıcı öğrenmeye etkisi]. *Uluslararası Türkçe Edebiyat Kültür Eğitim (TEKE) Dergisi*, 10(4), 1457-1476. <https://dergipark.org.tr/en/pub/teke/issue/67281/1049561>
- Ryan, S., Kaufman, J., Greenhouse, J., She, R., & Shi, J. (2016). The effectiveness of blended online learning courses at the Community College level. *Community College Journal of Research and Practice*, 40(4), 285–298. <https://doi.org/10.1080/10668926.2015.1044584>
- Sarıbaş, M., & Meydan, A. (2020). The attitudes of the students of the geography departments towards online learning. [Coğrafya bölümü öğrencilerinin çevrimiçi öğrenmeye karşı tutumları]. *Türk Coğrafya Dergisi*, (76), 95-106. <https://doi.org/10.17211/tcd.811297>
- Schmeck, R. R. (1988). Individual differences and learning strategies. In C.E. Weinstein, E.T. Goetz, P. A. Alexander (Eds), *Learning and Study Strategies*, Academic Press. <https://doi.org/10.1016/B978-0-12-742460-6.50016-5>
- Simonson, M., Schlosser, C., & Hanson, D. (1999). Theory and distance education: A new discussion. *American Journal of Distance Education*, 13(1), 60-75. <https://doi.org/10.1080/08923649909527014>
- Steiger, J. H. (2007). Understanding the limitations of global fit assessment in structural equation modeling. *Personality and Individual Differences*, 42(5), 893-898. <https://doi.org/10.1016/j.paid.2006.09.017>
- Şimşek, A., (2004). Learning styles. [Öğrenme biçimleri]. Y. Kuzgun ve D. Deryakulu (Editör), *Individual differences in education. [Eğitimde bireysel farklılıklar]*. Ankara: Nobel Yayın Dağıtım.
- Terrell, S. R., & Dringus, L. (2000). An investigation of the effect of learning style on student success in an online learning environment. *Journal of Educational Technology Systems*, 28(3), 231-238. <https://doi.org/10.2190/R53M-BVBD-UGV5-77EH>

- Tu, C. H., & McIsaac, M. S. (2002). The relationship of social presence and interaction in online classes. *The American Journal of Distance Education*, 16(3), 131-150. https://doi.org/10.1207/S15389286AJDE1603_2
- Usta, İ. (2019). Investigation of learning styles of distance learners. [Uzaktan öğrenenlerin öğrenme biçimlerinin incelenmesi]. *Bilecik Şeyh Edebali Üniversitesi Sosyal Bilimler Dergisi*, 4(1), 371-384. <https://doi.org/10.33905/bseusbed.551031>
- Usta, İ., Uysal, Ö., & Okur, M. R. (2016). Online learning attitude scale: development, validity and reliability. [Çevrimiçi öğrenme tutum ölçeği: geliştirilmesi, geçerliği ve güvenilirliği]. *Journal of International Social Research*, 9(43), 2215-2222. <https://www.sosyalarastirmalar.com/articles/online-learning-attitude-scale-development-validity-and-reliability.pdf>
- Vaishnav, R. S., & Chirayu, K. C. (2013). Learning style and academic achievement of secondary school students. *Voice of research*, 1(4), 1-4. http://www.voiceofresearch.org/doc/mar-2013/Mar-2013_1.pdf
- Wheaton, B., Muthen, B., Alwin, D. F., & Summers, G. F. (1977). Assessing reliability and stability in panel models. *Sociological Methodology*, 8(1), 84-136. <https://doi.org/10.2307/270754>
- Yenilmez, K., Turğut, M., & Balbağ, M. Z. (2017). Investigation of prospective teachers' perceptions on distance education with respect to certain variables. [Öğretmen adaylarının uzaktan eğitime yönelik tutumlarının bazı değişkenler açısından incelenmesi]. *Erzincan Üniversitesi Eğitim Fakültesi Dergisi*, 19(2), 91-107. <https://doi.org/10.17556/erziefd.305902>
- Yılmazel, G., Duman, N. B., & Başçı, A. (2015). Relation between learning styles, methods for obtaining information and academic achievements of Turkish university students. *Hitit Üniversitesi Sosyal Bilimler Enstitüsü Dergisi*, 8(1), 225-233. <https://www.ceeol.com/search/article-detail?id=642033>
- Zapalska, A., & Brozik, D. (2006). Learning styles and online education. *Campus-Wide Information Systems*, 23(5), 325-335. <https://doi.org/10.1108/10650740610714080>