

# LEARNING STYLES OF TALENTED PRE-SERVICE TEACHERS

**Üstün Türker**

Gümüşhane University, Türkiye  
E-mail: [ustunturker@gumushane.edu.tr](mailto:ustunturker@gumushane.edu.tr)

**Özgür Bostancı**

Ondokuz Mayıs University, Türkiye  
E-mail: [bostanci@omu.edu.tr](mailto:bostanci@omu.edu.tr)

## Abstract

*The learning styles of students vary both among individuals and across different disciplines they choose to study. In higher education, academic discipline appears to be a key factor influencing students' distinctive learning styles. This study, which aims to determine the dominant learning styles and models of talented pre-service teachers, was designed with the survey model. The study group research consisted of 1019 volunteer pre-service teachers who continued their education in Physical Education and Sports, Music, and Arts & Craft Teaching departments. In the study, the VARK Learning Style Inventory was used as a data collection tool; students were asked to answer questions in a digital environment through Google Forms. According to the research results, kinesthetic style is the dominant learning preference for pre-service teachers in the visual arts and sports sciences, and both kinesthetic and aural styles are the dominant learning preferences for pre-service teachers in music education. Although talented pre-service teachers tend to learn predominantly kinesthetic and aural styles when evaluated, 61.2% of pre-service teachers prefer to learn with a Multiple Learning Model, which covers the entire instructional diversity, rather than sticking to just one learning style.*

**Keywords:** learning styles, learning preference, talented teacher, VARK

## Introduction

Learning style makes cognitive, affective, physical, or kinetic behavioral changes according to individual differences and human learning experiences. In other words, it is the way of realizing the learning skill by activating one or more sense organs of the human being. Many definitions of learning styles have been made in the literature (Diaz & Ryan, 1999; Dunn & Dunn, 1986; Jonassen & Grobowski, 1999; Keefe, 1990). However, most researchers state that hereditary elements affect learning styles and intentional and unintentional life experiences (Klement, 2014). While at the beginning of the learning process, which starts with birth and continues until death, behavioral changes primarily occur in line with hereditary characteristics; it, later on, changes according to the factors such as learning attitude, learning opportunities, classroom climate, tools and materials used in learning-teaching activities, educational diversity, curiosity and interest (Türker, 2021).

Educational psychologists state that each individual has a different and unique learning style. If the teaching adapts to these styles, the permanence of learning will increase and develop (Murphy et al., 2004; Robotham, 2003; Suskie, 2003). Due to these individual differences in development and learning, the importance of learning styles emerges when it is considered that incompatibilities may occur during the transfer of knowledge from the educator to the student in teaching activities. By determining the students' learning styles, the inconsistencies in the learning environment can be eliminated, the effectiveness of teaching can be increased, and academic success can be enhanced by providing equal opportunities in teaching.

### *Background*

There are studies in the literature on the learning styles of pre-service teachers who are accepted to higher education only through exams that measure theoretical skills in different fields and with sample groups (Andres & Akan, 2015; Alsobhi & Alyouni, 2019; Balfaqeeh, 2017; Baykan & Naçar, 2007; Berkova et al., 2020; Chan & Mak, 2010; Choi & Sardar, 2011; Drago & Richard, 2004; Espinoza-Poves et al., 2019; Freiberg-Hoffmann et al., 2017; Galperin & Punnett, 2021; Goulding & Syed-Khuzzan, 2014; James-Gordon & Bal, 2001; Jepsen et al., 2015; Katsioloudis & Fantz, 2012; Marantika, 2022; Mozaffari et al., 2020; Nwajiuba & Onyeneke, 2022; Poon Teng Fatt, 2000; Tam, 2022; Tongal & Dağyar, 2022; Yousef, 2016; Yousef, 2018; Wilson et al., 2018; Zapalska & Brozik, 2006). According to these studies, students' dominant learning styles can be visual, aural, reading/writing, or kinesthetic. Talented pre-service teachers are accepted to higher education with two or more staged exams in which both theoretical and individual motor skills are evaluated. Considering this situation, it is thought that the learning styles and preferences of the students studying in the departments of Physical Education, Music, and Arts & Crafts Teaching should be evaluated separately because students in these fields can use and develop learning styles for their special abilities, both formally in lower education institutions and informal methods in life until they reach the education level at the undergraduate studies. Therefore, it is believed that due to the number of both theoretical and practical courses in the curriculum of the respective departments, they may need more teaching diversity during their college years when they are continuing their education for their professional development than pre-service teachers in other fields. In this direction, completed studies have been found in literature that emphasize the importance of talented pre-service teachers' learning styles and determine them (Alemdağ & Öncü, 2015; Alp et al., 2020; Altun, 2015; Bahar et al., 2016; Filimon, 2012; Kaleli & Nayir, 2020; Kocaarslan, 2016; Powers, 2016; Seyihoğlu, 2010; Tanwinit & Sittiprapaporn, 2010; Topoğlu, 2022; Zain et al., 2019).

There are many methods developed to assess learning styles in individuals (Bernice-McCarthy model, Dunn & Dunn model, Grasha-Riechmann model, Gregorc model, Jung model, Kolb model, Lawrance model), and each method can provide different information about individuals' learning style preferences (Boydak, 2001; Forrest, 2004; Orak, 2015; Oral, 2011). In the VARK learning model, which is another one of these methods, Fleming defined visual, aural, reading/writing, and kinesthetic learning styles based on Kolb's learning model and considered that each individual may have a dominant learning style and those with two or more learning styles balanced as a multiple learning model (Fleeming, 1995). However, learning styles of individuals may differ from person to person, as well as according to the fields of science in which students continue their education. Fleming (2013) reported that students in the field of law may be more dominant in the reading/writing style, nursing students in the kinesthetic style, and graphic designers and performing arts students in the visual style compared to university students in other fields. Although there are many studies in the literature using the VARK learning styles inventory to determine the learning styles of students in different fields of science, there is a limited number of studies conducted on pre-service talented teachers in the fields of physical education and sports, music, and visual arts.

Tanwinit and Sittiprapaporn (2010) found that music students used multiple learning models (66.1%) with auditory being the dominant style (62.7%) and uni-model learning being used less frequently (33.9%). In a separate study by Powers (2016), aural, kinesthetic, and visual learning styles were found to be more prevalent than reading/writing style.

In Alkooheji and Al-Hattami's study (2018), it was reported that the most dominant learning preferences of students in the field of visual arts in the uni-model learning were kinesthetic and visual style, respectively, and the least preferred was reading/writing style.

Bostanci (2020) reported that physical education and sports teacher candidates preferred the kinesthetic learning style the most, while visual style was their least preferred. In another study, Braakhuis et al. (2015) found that 65.91% of athletes preferred an uni-model learning, with 37.50% preferring the kinesthetic style, while 34.09% preferred the multiple learning model. Turker (2021) reported that among the 820 sport sciences students in Turkey, 35.2% preferred an uni-model learning, mostly kinesthetic learning, but 57.7% adopted a multiple learning model and did not adhere to an uni-model learning style.

### *Importance and Need for Research*

The current research has important implications for engineering education and training (Shakir & Ebrahim, 2020). To enhance students' academic performance and achievement, educational activities and curriculum should be aligned with their learning styles and strategies in the relevant fields of science. The identification of students' learning styles is a valuable step in improving teaching and learning activities and making students more effective learners (Baykan & Nacar, 2007; Cooper, 2007; Fleming & Mill, 1992; Tanwinit & Sittiprapaporn, 2010). Personalized learning strategies also help educators avoid a one-size-fits-all approach and increase efficiency in education (Fleming, 1995). Some studies suggest that the VARK learning model can also motivate teachers to better align with students' learning styles (Armstrong & Parsa-Parsi, 2005; Bergman & Fors, 2005; Collins, 2004; Forrest, 2004). Consistent with this information in the literature, the research aimed to determine pre-service teachers' preferences for dominant learning styles and models according to the VARK learning model and to compare students' learning preferences according to some demographic variables.

### *Research Problem, Aim and Research Questions*

The learning styles of students differ with the individual but also differ with the disciplines that the students choose to study. The main problem of this research is that although there are a limited number of studies in the educational literature that examined the learning styles of pre-service talented teachers in the fields of music, visual arts and sports sciences separately and reported their results, there is no research that examined the learning styles of pre-service teachers in these fields together according to the VARK model and compared them according to the differences in the department of study. This study aimed to determine the dominant learning styles and models of talented pre-service teachers. Under this general aim, the research sought answers to the following questions.

1. What is the average score of students in physical education and sports, music, and arts & crafts, according to each subject and learning style?
2. Which learning style do the talented pre-service teachers predominantly prefer?
3. Is there a significant difference in the learning styles of talented pre-service teachers according to gender?
4. Is there a significant difference in the learning styles of talented pre-service teachers as a function of the age variable?
5. Is there a significant difference in the learning styles of talented pre-service teachers as a function of the department where they study?
6. Is there a significant difference in the learning styles of talented pre-service teachers as a function of the class variable?
7. Which learning model do talented pre-service teachers prefer most in learning environments?

## Research Methodology

### *Research Design*

Based on the research questions, a cross-sectional descriptive research design as the methodology for this study was preferred. A quantitative, non-experimental, and descriptive design was used (Miles & Banyard, 2007). Although this type of design weakens generalization since it is not a longitudinal study and considering that the type of sampling restricts the generalization as well, the study allows a first approach to the description, which is mandatory to establish the new directions and lines for future research (Namakforoosh, 2005). Stratified random sampling method was used to select the students included in the sample. Pre-service teachers were stratified according to the departments they were studying, and the sample numbers were determined by weighing according to the departments. Additionally, this methodology lends itself to quantitative data analysis consistent with the identified research problem. Further, this research design enabled the informed consent of target population participants to protect the autonomy of students electing to participate in the study and satisfying ethical considerations consistent with contemporary ethical research guidelines. Learning preferences were measured using the VARK Questionnaire. The authors recognize the limitations of this methodology, specifically the inability to generalize the findings to the larger population of student practitioners in Türkiye.

### *Participants and Data Collection*

The population of this study, which aimed to determine the learning styles of talented pre-service teachers with a descriptive research approach and to compare them according to some demographic characteristics, consisted of talented pre-service teachers who continued their education in 10 different state universities (Anadolu, Atatürk, Bayburt, Çukurova, Ege, Gazi, İnönü, Marmara, Ondokuz Mayıs, Van Yüzüncü Yıl) in Türkiye, and the sample group consisted of 1019 volunteer pre-service teachers who continued their education in physical education and sports, music and fine arts departments in the 2020-2021 academic year and were randomly included in the study. The sample of the study was determined by power analysis in the G\*Power program. The minimum sample size was 993 according to the 5% Type-I error level, 95% power and .53 effect size calculated based on the mean score difference of the learning styles scale for research in a similar study on the subject. It was taken into consideration that there might be incorrect answers in the responses to the survey, and the initial sample size was increased to 1040 students. Since 21 of the pre-service teachers' responses to the VARK learning styles were incorrectly coded, the responses of these students were not included in the analyses, and the research analyses were conducted on 1019 pre-service teachers. According to the gender variable, 48.7% of the 1019 pre-service teachers were male and 51.3% were female; according to the distribution of age ranges, 22.3% were 18-19 years old, 30.1% were 20-21 years old and 47.6% were 22 years old or above; according to the department variable, 29.7% were in visual arts, 30.3% in music, and 39.9% in physical education and sports; and according to the year of study variable, 27.1% of the pre-service teachers were in the first, 19.5% in the second, 23.3% in the third and 30.1% in the fourth year (Table 1).

In order to determine the learning styles of pre-service teachers and compare them according to some demographic characteristics, the questionnaire and the VARK learning styles inventory, which were determined by the researchers for the sub-objectives, were digitized using Google Forms and firstly, the accuracy of use was tested. The link address of the form created on Google Forms was sent to the academic units in the relevant universities for the prospective teachers to answer the questions on demographic information and the scale

questions determining their learning style preferences. The study data were collected between January and March 2021 and data collection was completed after the targeted sample size was reached.

**Table 1**  
*Demographic Characteristics of the Study Group*

	Variables	n	%
Gender	Male	496	48.7
	Female	523	51.3
Age	18 – 19	227	22.3
	20 – 21	307	30.1
	22 years and older	485	47.6
Department	Physical education and sports	407	39.9
	Music	309	30.3
	Arts and Crafts	303	29.7
Study years	1	276	27.1
	2	199	19.5
	3	237	23.3
	4	307	30.1
Total		1019	100

#### *Data Collection Tools*

The data collection instruments used were the personal information form and the VARK Learning Style Inventory (7.0 version), which the researchers developed for the study.

#### *VARK Learning Style Inventory (7.0)*

The VARK Learning Style Inventory, developed by Fleming and Mill (1992) and adapted into Turkish by Kalkan (2008), includes visual (V), aural (A), reading/writing (R), and kinesthetic (K) learning preferences hidden in each question (4 sub-dimensions) and consists of 16 questions in total. The highest score that can be obtained with this scale is 64. When responding to the questions, the participant can check one or more options in the same question or leave the question blank if he/she does not think any options are suitable for his/her choice. In the first phase of analysis and scoring, the V, A, R, and K scores are summed and ranked from largest to smallest. The highest score resulting from the preferences is the participant's dominant learning preference. In the second stage, the distance value is 1 if the scores collected for the 4 sub-dimensions are between 10 and 16; it is 2 if the scores are between 17 and 22; 3 if the scores are between 23 and 30, and 4 if a score above 30 is obtained. The second highest score resulting from the preferences is subtracted from the highest score. If this number is greater than the given distance value, the person has Uni-modal Style; if the value is less than the distance value, the 3rd highest score is subtracted from the 2nd highest score. If this number exceeds the distance value, it is concluded that this person has Bi-modal Style. Otherwise, the 4th point is subtracted from the 3rd highest score; if this number is greater than the distance value, it is concluded that the person has Tri-modal Style. If no value is given, the person has a Multi-modal style (Hawk & Shah, 2007; Moayyeri, 2015; Prithishkumar & Michael, 2014).

The learning styles according to the VARK model and the learning tendencies of individuals who prefer these styles are shown in Figure 1 below.

**Figure 1**  
*Learning Tendencies According to the VARK Model*

			
Visual learners	Aural learners	Reading/Writing learners	Kinesthetic learners
<ul style="list-style-type: none"> <li>• Maps</li> <li>• Graphics</li> <li>• Charts</li> <li>• Diagrams</li> <li>• Different colors</li> <li>• Images</li> <li>• Videos</li> <li>• Symbols or diagrams</li> <li>• Designs</li> <li>• Highlighters</li> </ul>	<ul style="list-style-type: none"> <li>• Discussion environment</li> <li>• Recorders</li> <li>• Participation in discussion groups</li> <li>• Reading aloud and remembering</li> <li>• Debate</li> <li>• Chats</li> <li>• Video/audio recordings</li> <li>• Music</li> <li>• Seminars</li> </ul>	<ul style="list-style-type: none"> <li>• Reports</li> <li>• Course/test books</li> <li>• Dictionaries</li> <li>• Reading books</li> <li>• Lists</li> <li>• Taking notes</li> <li>• Bibliographies</li> <li>• Feedback</li> <li>• Tests</li> <li>• Papers</li> </ul>	<ul style="list-style-type: none"> <li>• Educational travel</li> <li>• Trial and error</li> <li>• Learning by doing in the lab</li> <li>• Hands-on approach</li> <li>• Using the senses</li> <li>• Real experiences</li> <li>• Case studies</li> <li>• Physical activity</li> <li>• Role-playing</li> <li>• Internship</li> </ul>

Source: Fleming (2001).

### *Data Analysis*

Frequency analysis was used for percentage distributions and scores, and reliability analysis was performed for reliability coefficients. After descriptive statistics and normality analyzes were performed according to kurtosis and skewness values, it was determined that the values of the distribution are in the range of  $\pm 1.5$  and that it has a normal distribution. Since it is within the limits of Tabachnick and Fidell (2007) and George and Mallery (2010) (-1 to +1; -1.5 to +1.5; -2.0 to +2.0), the data are accepted to have a normal distribution. Since the data had a statistically normal distribution, the t-test for independent samples was used for pairwise comparisons, and one-way analysis of variance (ANOVA) was used for comparisons of more than two variables. The statistical package SPSS (26.0) was used to analyze the data. The level of significant difference was accepted as  $p < .05$  in the interpretation of the analyses.

### *Validity and Reliability*

In this study, pre-service teachers were given sufficient time to answer the scale questions in detail, and sufficient data were collected through document review before the analysis.

The reliability coefficients obtained in the study are shown in Table 2. The pre-service teachers' responses showed that the reliability coefficient of VARK for departments ranged from .79 to .81, and for the sub-dimensions ranged from .70 to .77 at a high level. When the coefficient values of VARK are evaluated as evidence of the scale's reliability, the consistency values increase as the reliability coefficient approaches 1.00 and decrease as it approaches .00. In other words, if the coefficient is between .00 - .30, this means the relationship has low stability, and if it is between .30 - .70, we have medium stability, and between .70 - 1.0 high stability (Balçı, 2009; Gorsuch, 1983; Hovardaoğlu, 2000).

**Table 2**  
*Validity and Reliability of VARK in Research (n = 1019)*

	Number of items	Physical education and sports	Music	Arts and Crafts
Visual	16	$\alpha=.70$	$\alpha=.71$	$\alpha=.72$
Aural	16	$\alpha=.71$	$\alpha=.74$	$\alpha=.70$
Reading/Writing	16	$\alpha=.73$	$\alpha=.70$	$\alpha=.71$
Kinesthetics	16	$\alpha=.76$	$\alpha=.77$	$\alpha=.75$
VARK	64	$\alpha=.81$	$\alpha=.81$	$\alpha=.79$

### *Implementation Process and Ethics*

After the study's objectives were established, approvals were obtained from the researchers who developed the scale; and the scale was adapted to the Turkish language. After the approval of the Ethics Committee of the Presidency of Bayburt University on 29.12.2020 with number 26654, the questions in the data collection instruments were transferred to the digital environment. Google forms were used to collect the research data, and participants were asked to answer the scale questions in a digital environment. The presence of huge population on the web has made web-based survey tools an important mode of data collection for research and thus became the most widely used data gathering method. The Google Forms is a cloud-based data management tool used for designing and developing web-based questionnaires. This tool is provided by Google Inc10., and available on the web to anyone to use and create web-based questionnaires. The anywhere-anytime-access and other advantages (unlimited surveys, 100% free) have made Google Forms a popular product in online survey research (Vasantha & Harinarayana, 2016).

### **Research Results**

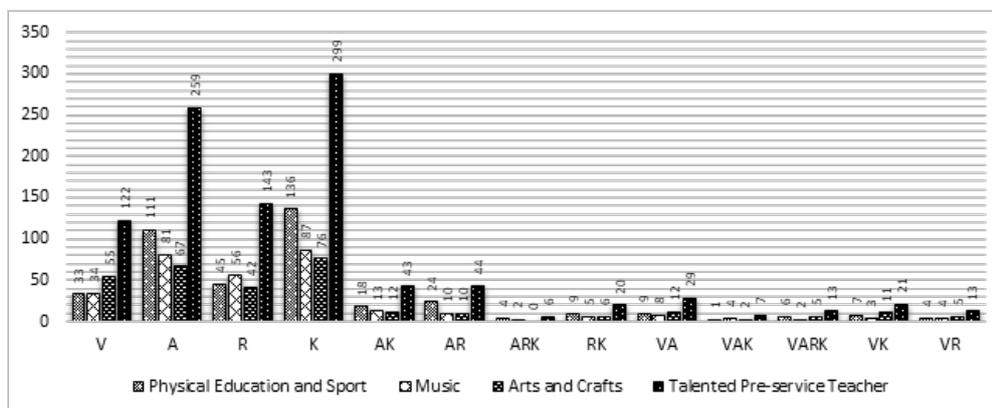
This part of the study presents the results of the analyzes to determine the predominant learning styles of talented pre-service teachers, their comparison based on some variables, and the determination of learning models.

**Table 3**  
*Descriptive Statistics on VARK Learning Styles of Students*

Department	Learning style	Minimum	Maximum	$\bar{X}$	SD
Physical Education and Sport (n = 407)	Visual	0	12	3.59	2.24
	Aural	0	14	5.28	2.31
	Reading/Writing	0	15	4.43	2.24
	Kinesthetic	0	13	5.48	2.44
Music (n = 309)	Visual	0	13	4.06	2.54
	Aural	0	15	5.38	2.69
	Reading/Writing	0	14	4.57	2.52
	Kinesthetic	0	13	5.41	2.59
Arts and Crafts (n = 303)	Visual	0	14	4.59	2.48
	Aural	0	13	5.04	2.51
	Reading/Writing	0	14	4.62	2.43
	Kinesthetic	0	14	5.11	2.41
Talented Pre-service teachers (n = 1019)	Visual	0	14	4.03	2.44
	Aural	0	15	5.24	2.49
	Reading/Writing	0	15	4.53	2.38
	Kinesthetic	0	14	5.35	2.48

When examining the descriptive statistics for pre-service teachers concerning VARK, it was found that talented pre-service teachers preferred the kinesthetic learning style, and the visual learning style had the lowest score with an average of  $5.35 \pm 2.48$ . It was found that students in the Department of Physical Education and Sports and the Department of Music Education were most likely to learn kinesthetically, and students in the Department of Arts and Crafts Education were likelier to learn kinesthetically by listening (Table 3).

**Figure 2**  
*Distribution Dominant Learning Styles of Talented Pre-Service Teachers (n =1019)*



The dominant learning preferences of pre-service teachers according to the different combinations of VARK learning styles are shown in Figure 2. The predominant learning preference of physical education and sports students is kinesthetic ( $n = 136$ ), and the least preferred is visual ( $n = 33$ ). For music and arts & crafts education students, the dominant learning style is kinesthetic and aural, visual learning ( $n = 34$ ) is the least preferred learning style for music students, and reading/writing ( $n = 42$ ) is the least preferred learning style for arts and crafts students. When examining the dominant learning preferences of talented pre-service teachers, they were found to be more kinesthetic ( $n = 299$ ) and aural ( $n = 259$ ).

**Table 4**  
*Comparison of VARK Learning Styles According to Gender (Female= 523; Male= 496)*

Department	Learning style	Gender	<i>n</i>	$\bar{X}$	<i>SD</i>	<i>t</i>	<i>p</i>
Physical Education and Sport ( <i>n</i> = 407)	Visual	Female	193	3.68	2.21	.784	.434
		Male	214	3.52	2.29		
	Aural	Female	193	5.51*	2.11	1.783	.045
		Male	214	5.09	2.46		
	Reading/Writing	Female	193	4.48	2.18	.402	.688
		Male	214	4.39	2.31		
	Kinesthetic	Female	193	5.31	2.25	-1.492	.041
		Male	214	5.65*	2.58		
Music ( <i>n</i> = 309)	Visual	Female	154	3.88	2.46	-1.228	.220
		Male	155	4.24	2.62		
	Aural	Female	154	5.16	2.66	-1.366	.173
		Male	155	5.58	2.71		
	Reading/Writing	Female	154	4.65	2.46	.531	.596
		Male	155	4.51	2.58		
	Kinesthetic	Female	154	5.68*	2.59	-1.835	.047
		Male	155	5.14	2.57		
Arts and Crafts ( <i>n</i> = 303)	Visual	Female	176	4.47	2.54	-.933	.322
		Male	127	4.76	2.42		
	Aural	Female	176	4.67	2.51	-2.893	.001
		Male	127	5.50**	2.54		
	Reading/Writing	Female	176	4.52	2.26	-.677	.010
		Male	127	4.71*	2.58		
	Kinesthetic	Female	176	5.03	2.36	-.576	.194
		Male	127	5.19	2.47		
Talented Pre-service Teacher ( <i>n</i> = 1019)	Visual	Female	523	4.01	2.41	-.293	.306
		Male	496	4.05	2.47		
	Aural	Female	523	5.12	2.43	-1.557	.120
		Male	496	5.36	2.54		
	Reading/Writing	Female	523	4.54*	2.29	.151	.038
		Male	496	4.52	2.48		
	Kinesthetic	Female	523	5.32	2.41	-.397	.691
		Male	496	5.38	2.56		

\* $p < .05$ , \*\* $p < .001$

When comparing the talented pre-service teachers by gender (Table 4), it was found that the mean scores of female physical education and sports students were significantly higher in

aural learning. Those of male students were significantly higher in kinesthetic learning ( $p < .05$ ). Significance was found in terms of gender for kinesthetic learning ( $p < .05$ ) among female students for music and aural learning and aural learning ( $p < .001$ ) for arts and crafts education among male students and for the reading/writing style among female students ( $p < .05$ ). In the general comparison of talented pre-service teachers, regardless of the departments they studied, it was found that female students preferred the reading/writing style more than males ( $p < .05$ ).

**Table 5**  
*Comparison of VARK Learning Styles with Age Groups (n = 1019)*

Department	Learning style	Age	n	$\bar{X}$	SD	F	p	Tukey
Physical Education and Sport (n = 407)	Visual	18 - 19 (a)	108	3.44	2.10	.561	.571	-
		20 - 21 (b)	154	3.73	2.34			
		22 and older (c)	145	3.55	2.25			
	Aural	18 - 19 (a)	108	5.49	2.17	.897	.409	-
		20 - 21 (b)	154	5.11	2.21			
		22 and older (c)	145	5.33	2.50			
	Reading/Writing	18 - 19 (a)	108	4.63	2.22	.606	.546	-
		20 - 21 (b)	154	4.35	2.09			
		22 and older (c)	145	4.36	2.30			
	Kinesthetic	18 - 19 (a)	108	5.62	2.55	.344	.709	-
		20 - 21 (b)	154	5.57	2.36			
		22 and older (c)	145	5.50	2.44			
Music (n = 309)	Visual	18 - 19 (a)	50	4.26	2.45	.296	.744	-
		20 - 21 (b)	65	4.16	2.73			
		22 and older (c)	194	3.98	2.51			
	Aural	18 - 19 (a)	50	6.18	3.06	5.331	.005	a<c (.016)
		20 - 21 (b)	65	5.87	3.06			a<b (.048)
		22 and older (c)	194	5.02	2.38			
	Reading/Writing	18 - 19 (a)	50	4.30	2.37	2.014	.135	-
		20 - 21 (b)	65	5.12	2.75			
		22 and older (c)	194	4.46	2.46			
	Kinesthetic	18 - 19 (a)	50	5.34	2.49	.084	.919	-
		20 - 21 (b)	65	5.52	2.73			
		22 and older (c)	194	5.59	2.58			
Arts and Crafts (n = 303)	Visual	18 - 19 (a)	69	4.72	2.89	.116	.890	-
		20 - 21 (b)	89	4.55	2.42			
		22 and older (c)	145	4.56	2.34			
	Aural	18 - 19 (a)	69	5.14	2.50	.344	.709	-
		20 - 21 (b)	89	4.84	2.45			
		22 and older (c)	145	5.07	2.53			
	Reading/Writing	18 - 19 (a)	69	4.65	2.33	.959	.385	-
		20 - 21 (b)	89	4.31	2.31			
		22 and older (c)	145	4.75	2.48			
	Kinesthetic	18 - 19 (a)	69	5.66	2.83	2.481	.045	b<a (.047)
		20 - 21 (b)	89	4.94	2.48			c<a (.048)
		22 and older (c)	145	4.93	2.09			

Talented Pre-service Teacher ( <i>n</i> = 1019)	Visual	18 - 19 (a)	227	4.01	2.50	.010	.990	-
		20 - 21 (b)	207	4.03	2.44			
		22 and older (c)	485	4.03	2.42			
	Aural	18 - 19 (a)	227	5.53	2.51	2.090	.124	-
		20 - 21 (b)	207	5.20	2.50			
		22 and older (c)	485	5.13	2.47			
	Reading/ Writing	18 - 19 (a)	227	4.56	2.28	.042	.959	-
		20 - 21 (b)	207	4.50	2.32			
		22 and older (c)	485	4.53	2.47			
	Kinesthetic	18 - 19 (a)	227	5.57	2.62	1.189	.305	-
		20 - 21 (b)	207	5.29	2.48			
		22 and older (c)	485	5.28	2.41			

There was no difference in the learning preferences of student teachers for physical education and sports as a function of the age variable ( $p > .05$ ). As the age of music education student teachers increased, the aural learning style decreased. There was a statistically significant difference between students aged 18-19 / 20-21 and students aged 22 and older ( $p < .05$ ). Furthermore, in contrast to the students' aural learning style, an age-related increase was found in the kinesthetic learning style. It was found that there was a significant difference in the kinesthetic learning style of the arts and crafts education department students between the 18-19 years old students compared to the other age groups ( $p < .05$ ). Although there was no statistically significant difference in the age variable in general among talented pre-service teachers, it was found that preferences for aural learning style tended to decrease with age ( $p > .05$ ) (Table 5).

**Table 6**  
*Comparison of VARK Learning Styles According to Studying Departments (n = 1019)*

Learning style	Department	<i>n</i>	$\bar{X}$	<i>SD</i>	<i>F</i>	<i>p</i>	Tukey
Visual	Physical Education and Sport (a)	407	3.59	2.24	14.921	.000	a<b (.025)
	Music (b)	309	4.06	2.54			a<c (.000)
	Arts and Crafts (c)	303	4.59	2.48			b<c (.020)
Aural	Physical Education and Sport (a)	407	5.28	2.31	1.537	.216	-
	Music (b)	309	5.38	2.69			
	Arts and Crafts (c)	303	5.04	2.51			
Reading/Writing	Physical Education and Sport (a)	407	4.43	2.24	.636	.530	-
	Music (b)	309	4.57	2.52			
	Arts and Crafts (c)	303	4.62	2.43			
Kinesthetic	Physical Education and Sport (a)	407	5.48	2.44	2.121	.120	-
	Music (b)	309	5.41	2.59			
	Arts and Crafts (c)	303	5.11	2.41			

When pre-service teachers were compared by the subject areas they study, a higher level of significance was found, in terms of visual learning styles, for students in music departments in comparison to the students in physical education and sports departments ( $p < .05$ ) and for the art students in comparison to students of music and physical education and sports departments ( $p < .0001$ ).

**Table 7**  
*Comparison of VARK Learning Styles According to Study Years (n = 1019)*

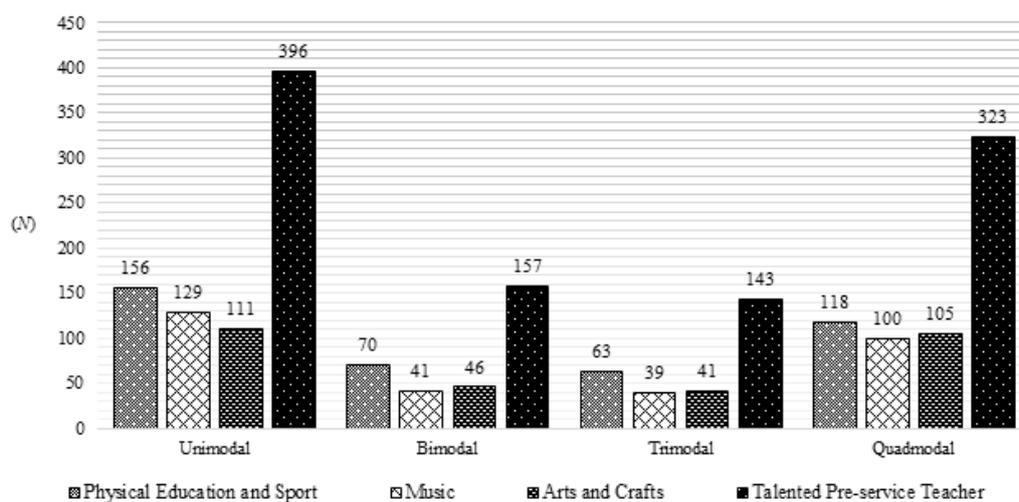
Department	Learning style	Study years	n	$\bar{X}$	SD	F	p	Tukey
Physical education and sport (n = 407)	Visual	1	150	3.47	2.19	.622	.601	-
		2	75	3.46	2.22			
		3	94	3.63	2.31			
		4	88	3.85	2.29			
	Aural	1	150	5.51	2.23	1.368	.252	-
		2	75	5.01	2.01			
		3	94	5.03	2.25			
		4	88	3.43	2.67			
	Reading/ Writing	1	150	4.45	2.17	.377	.769	-
		2	75	4.65	2.14			
		3	94	4.30	2.15			
		4	88	4.35	2.54			
Kinesthetic	1	150	5.70	2.51	.651	.583	-	
	2	75	5.28	2.28				
	3	94	5.36	2.51				
	4	88	5.44	2.40				
Music (n = 309)	Visual	1	56	4.35	2.50	1.944	.122	-
		2	62	3.77	2.18			
		3	63	4.61	2.96			
		4	128	3.81	2.48			
	Aural	1	56	6.23	2.87	4.066	.007	1<4 (.025)
		2	62	5.33	2.75			
		3	63	5.74	2.68			
		4	128	4.84	2.48			
	Reading/ Writing	1	56	4.42	2.13	.743	.527	-
		2	62	4.51	2.42			
		3	63	5.03	2.91			
		4	128	4.46	2.52			
Kinesthetic	1	56	5.41	2.57	.309	.819	-	
	2	62	5.41	2.37				
	3	63	5.66	2.71				
	4	128	5.28	2.66				
Arts and crafts (n = 303)	Visual	1	70	4.01	2.68	2.083	.102	-
		2	63	4.63	2.58			
		3	79	5.02	2.52			
		4	91	4.64	2.19			
	Aural	1	70	4.85	2.38	1.640	.180	-
		2	63	4.60	2.36			
		3	79	5.01	2.48			
		4	91	5.46	2.66			
	Reading/ Writing	1	70	4.31	1.87	.902	.440	-
		2	63	4.44	2.44			
		3	79	4.64	2.59			
		4	91	4.91	2.56			

Talented pre-service teacher ( <i>n</i> = 1019)	Kinesthetic	1	70	5.64	2.48	1.732	.160	-
		2	63	4.85	2.47			
		3	79	4.83	2.51			
		4	91	5.08	2.15			
	Visual	1	276	3.78	2.41	2.789	.041	1<3 (.031)
		2	199	3.89	2.32			
		3	237	4.38	2.64			
		4	307	4.07	2.36			
	Aural	1	276	5.49	2.45	1.620	.183	-
		2	199	4.99	2.38			
		3	237	5.22	2.46			
		4	307	5.19	2.63			
	Reading/ Writing	1	276	4.41	2.09	.389	.761	-
		2	199	4.54	2.32			
		3	237	4.63	2.55			
		4	307	4.56	2.54			
	Kinesthetic	1	276	5.62	2.54	1.597	.188	-
		2	199	5.18	2.37			
		3	237	5.28	2.58			
		4	307	5.27	2.44			

No difference was found in the learning preferences of students in physical education and sports and arts & crafts classes as a function of the class variable ( $p > .05$ ). It was found that the aural learning style of the pre-service teachers in first study year of the Music Teaching Department was significantly different from the senior students in the last study year ( $p < .05$ ), this supports our findings regarding the age variables (Table 5). In addition, when talented teachers are overall assessed, it was found that 3rd-study year students preferred visual learning significantly more than 1st-study year students (Table 7) ( $p < .05$ ).

**Figure 3**

*Distribution of Talented Pre-Service Teachers by VARK Learning Models (n = 1019)*



**Table 8**  
*Distribution of Talented Pre-Service Teachers by VARK Learning Multi-Models*

VARK Modals	Departments						TPT	
	Physical Education and Sport		Music		Arts and Crafts		n	%
	n	%	n	%	n	%		
Unimodal	156	38.3	129	41.7	111	37.7	396	38.8
Multi-modal	251	61.7	180	58.3	192	62.3	623	61.2
TOTAL	407	100	309	100	303	100	1019	100

Note: TPT - Talented Pre-service teacher

The preferences and distributions of talented pre-service teachers continuing their education in higher education concerning VARK learning models are shown in Figure 3 and Table 8. Given the four different learning models, it was found that the most preferred learning model in all departments was unimodal learning at 38.8% ( $n = 396$ ) and multi-modal learning at 61.2% ( $n = 623$ ). However, according to the VARK learning style inventory application procedure, bimodal, trimodal, and quadmodal learning are rated as 'multi-modal learning' in the final assessment phase. Hence, the pre-service teachers in all departments preferred multi-modal learning the most. They were found to have adopted the multi-modal learning model.

## Discussion

This study differs from similar studies in that it assessed talented pre-service teachers and reported that the kinesthetic learning style ( $5.35 \pm 2.48$ ) is dominant among talented pre-service teachers (Table 3 and Figure 2). In contrast, it is believed that this study result could result from the fact that the courses in the subject areas that the pre-service teachers study are mostly related to motor skills; it is also believed that it may also add originality to the literature on learning styles and techniques.

According to the VARK model, the predominant learning preference of pre-service teachers pursuing their education in physical education and sports, music, and arts & crafts is the kinesthetic style. In contrast, the aural learning preference of students receiving music instruction is close to the kinesthetic style (Table 3 and Figure 2). Parallel to our research findings, similar results have been obtained in the literature (Braakhuis, 2015; Braakhuis et al., 2015; Klement, 2014). The kinesthetic learning style is a way of gaining behavior change in which methods such as experience, movement direction, and realization are preferred in learning environments. Considering the scope and content of the curriculum of the departments in which talented pre-service teachers study, the fact that they mostly focus on practical courses explains this situation. In the literature, there are studies with different results. In Klement's (2014) and Kocaarslan's (2016) study of music education students, it was reported that the visual style was dominant, while Filimon (2012) and Tanwinit and Sittiprapaporn (2010) reported that the aural learning style was dominant. Another study reported that kinesthetic and visual styles dominate among arts and crafts education students (Klement, 2014). In the literature, it has been suggested that demographic differences in the sample groups and differences in the methods of application of the scale, as well as the lack of integrity in the curriculum of the respective departments at the universities where the studies were conducted, may be responsible for the emergence of different results regarding the dominant learning styles of talented pre-service teachers.

When learning styles are compared according to the gender variable, it was found that male pre-service teachers in physical education and sports significantly differed in kinesthetic style and females in aural style (Table 4). In some studies on learning styles conducted on physical education and sports pre-service teachers according to the KOLB model, it was reported that there was no significant difference between genders and that both female and male students were predominantly in the Divergent Learning style (Alemdağ & Öncü, 2015; Alp et al., 2020). According to KOLB, the alternating type is a model formed by combining concrete experience (by feeling) and reflective observation (by observing) as a learning style (Veznedaroğlu & Özgür, 2005). This difference in kinesthetic style can be explained by the fact that male pre-service teachers are more susceptible to certain motor skills, such as movement sequences and object control, due to sociocultural influences since school age, and therefore they adopt learning by doing more often (Çalışkan, 2020; Karagöz, 2009; Top, 2012). However, no research has been found in the literature examining talented pre-service teachers according to the VARK model and comparing them by gender.

The predominant learning preference of female pre-service teachers receiving music education in college is kinesthetic at a significant level compared to males. In the visual arts, the aural and reading/writing styles are more preferred by males (Table 4). Kocaarslan (2016) reported in his study with music students that visual and reading/writing styles are the dominant learning preferences for female students. Although the impression that music is an aural art field is the source of the hypothesis that students will learn with aural preferences, there are also studies in the literature suggesting that the dominant learning preferences focus on different styles (Mishra, 2007; Ramsay, 2004; Rickey, 2004; Yağışan & Sünbül, 2009). Similarly, it has been observed that pre-service teachers may focus on different dominant learning styles in the visual arts (Bahar et al., 2016; Seyihoğlu, 2010; Tuna, 2008). It is believed that factors such as the change in dominant learning preferences in the literature, the socio-cultural differences in the sample groups and the curriculum, the geography of the college, the number and sufficiency of tools, materials, and substances that can be used in the practical courses can be effective.

In the overall analysis of the responses of all pre-service teachers participating in the study, female students preferred reading/writing style more than male students ( $p < .05$ ). Türker (2021) reported in his study of talented students that there was a significant difference in the total scores for girls' tendency to use technology, the usefulness of e-learning systems, and attitudes toward e-learning during the COVID -19 pandemic compared to males. As the data was collected in the fall semester of the 2020-2021 academic year, it is possible to interpret that female students to focus more on distance learning activities and adopt the reading/writing style more compared with male students could be since all universities included in the study suspended face-to-face classes during this period due to the SARS-CoV-2 epidemic. A rapid transition to e-learning activities took place for fundamental reasons.

Although there is no significant difference in the ages of sports science pre-service teachers, the average kinesthetic style score decreases with age. On the other hand, it was observed that in visual arts, students in the 18-19 age group had a significant difference in kinesthetic style compared to students in the 20-21 and over 22 age groups, while in music education, students in the 18-19 and 20-21 age groups who preferred the aural style were found to make a statistically significant difference compared to those over 22. First-grade students compared to high school students ( $p < .05$ ). Although, in the general assessment of talented pre-service teachers, no significant difference was found in learning preferences by age ( $p > .05$ ), yet kinesthetic and aural learning preferences decreased with age.

This decline in kinesthetic and aural learning preference scores is thought to be related to the Public Personnel Selection Exam (PPSE) anxiety experienced by talented pre-service teachers who preferred learning by doing and experiencing their studies until they reached higher levels of education and were more likely to prefer reading/writing toward the end due

to this exam. In the literature, it is reported that test anxiety grows with the increase in grade level in music and arts & crafts education students, Kurtuldu and Ayaydın (2010), as well as in physical education and sports students Gençay et al. (2020). In contrast, Piji Küçük's study (2010) reported that music pre-service teachers' success in instrument education increases as test anxiety decreases. These obstacles due to test anxiety negatively affect pre-service teachers' instrument performance. These results in the literature support the research findings and interpretations. It is hypothesized that this change in talented pre-service teachers' dominant learning preferences, which is thought to be caused by test anxiety, may negatively impact learning new and developing existing motor skills.

The predominant learning preference among all 1019 talented pre-service teachers included in the study was the kinesthetic style. However, the analysis of learning preferences in three departments revealed that the students in physical education and sports preferred the kinesthetic style the most, and the pre-service teachers in music education preferred the aural style the most (Table 6). Although the dominant learning preference of students in music is the kinesthetic style compared to the students in the physical education and sports field, students in arts and crafts were found to prefer visual learning significantly more than students in both physical education and sports and music fields ( $p < .05$ ). Bahar et al. (2016) reported in their study conducted using the KOLB learning model that students in music and arts and crafts made a significant difference in the abstract conceptualization learning style compared to physical education and sports students.

According to the KOLB learning model, individuals who prefer to learn with abstract conceptualization emphasize their logic and ideas, make analyses, and use their mental structures in learning. Those who prefer active living rather than just observing a situation are practically interested in what the materials do. They prefer learning by doing rather than observing, feeling, or thinking (Oral, 2011; Türker, 2021). According to the VARK model, individuals who favor a visual learning style prefer to learn with symbols and tools, are sensitive to colors, need support from visual aids (map, poster, graph, etc.), and try to remember the learned topics by visualizing them in their minds (Boydak, 2001). In this context, it is thought that music and pre-service art teachers may primarily need visual or aural learning in order to be able to perform some psycho-motor skills specific to their field (fresco technique, portato technique, octave performance technique, tempera technique, chord technique, gouache technique, etc.) by using abstract conceptualization in the learning environment.

Although talented pre-service teachers prefer kinesthetic and aural learning more than other learning styles, according to VARK, 38.8% of students use the simple learning model, and 61.2% use the multiple learning models (multi-modal) (Table 8 & Figure 3). Filimon (2012) and Tanwinit and Sittiprapaporn (2010) reported that music students strongly prefer the multiple-learning model. Likewise, in the study carried out by James et al. (2010) with nursing department students who continued their education not only with theoretical classes but also with practical classes during their undergraduate education, the Multi-modal learning model was at the level of 79%. Fleming and Mill (1992) reported that individuals could achieve behavior change in learning environments only when they activate more than one sensory organ without depending on a single learning style. Research findings on the learning preferences of talented pre-service teachers support this hypothesis.

## Conclusions and Implications

This research brought new findings to the literature on the learning styles and preferences of pre-service teachers admitted to higher education with special abilities. According to the major results of the study, it was determined that kinesthetic learning was the dominant learning style in the learning environments of pre-service talented teachers. In addition, it was

determined that there was a decrease in aural and kinesthetic learning characteristics of pre-service teachers as age increased. It was also determined that although the kinesthetic learning style was predominantly preferred, they did not stick to an uni-model learning style and tended to use the Multiple Learning Model (61.2%). "This result suggests that pre-service teachers with a high number of applied courses in their education curriculum would benefit from using a multiple learning model. Therefore, it is important to develop other learning styles that reinforce behavior change in addition to the dominant style." In other words, courses or subjects that support aural, visual, and reading/writing learning styles can be included in the curriculum with equivalent credits. This promotes lasting behavioral changes by engaging multiple sensory organs through the use of multiple teaching methods.

Furthermore, to foster harmony between educators and students, university scientists should depart from conventional teaching approaches and adopt strategies based on VARK's multiple learning model. In practical lessons, learning styles should be balanced and phased in gradually, and supported with various materials, instead of emphasizing solely the theoretical or motoric aspects.

In future studies, the learning styles of pre-service teachers in various departments can be compared. This is because reaching desired outcomes in higher education can only be achieved by applying insights from comparable studies to practical. Additionally, it should be examined if the number and content of applied courses in academic units offering both theoretical and practical education impact learning style, in addition to theoretical courses.

### Declaration of Interest

The authors declare no competing interest.

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**Üstün Türker**  
(Corresponding author)

PhD, Assistant Professor, Department of Physical Education and Sport, Gümüşhane University, 29100 Gümüşhane, Türkiye.  
E-mail: [ustunturker@gumushane.edu.tr](mailto:ustunturker@gumushane.edu.tr)  
ORCID: <https://orcid.org/0000-0003-0604-8577>

**Özgür Bostancı**

PhD, Associate Professor, Yasar Dogu Faculty of Sport Sciences, Ondokuz Mayıs University, 55100, Kurupelit, Atakum, Samsun, Türkiye.  
E-mail: [bostanci@omu.edu.tr](mailto:bostanci@omu.edu.tr)  
ORCID: <https://orcid.org/0000-0002-7952-1014>