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An Examination of Pre-Service Teachers' Attitudes and Views Towards Braille Writing

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Abstract

This study aims to examine the attitudes of senior pre-service teachers from the departments of special education, Turkish, English, mathematics, primary education, social studies, and guidance and psychological counseling, who are more likely to work with visually impaired students, towards Braille literacy, and to explore how these attitudes vary based on various demographic and educational factors. Utilizing a mixed-method approach, the study integrates quantitative data with qualitative insights derived from interviews with pre-service teachers to provide a comprehensive understanding of their perspectives. The research was conducted with 445 senior pre-service teachers from faculties of education located in Southeastern Anatolia and the Mediterranean region of Turkey for the quantitative analysis, while 21 pre-service teachers voluntarily participated in interviews for the qualitative phase. Criterion sampling was employed to select participants, and data were collected through a "Demographic Information Form," the "Attitude Scale Towards Braille Literacy Scale" and semi-structured interviews. Quantitative data were analyzed using SPSS, while qualitative data underwent content analysis. The findings revealed that pre-service teachers generally exhibited positive attitudes towards Braille literacy. Significant differences were found in their attitudes based on factors such as gender, department, previous exposure to courses on visual impairments, encounters with visually impaired individuals, prior familiarity with Braille, exposure to films or series about visually impaired people, participation in scientific meetings on special education, and willingness to accommodate students with special needs in future classrooms. Conversely, age, experiences with students with special needs during teaching practice, and the presence of individuals with special needs in their family or social environment did not result in significant differences in attitudes. Qualitative data analysis identified three key themes: pedagogical competence, sensitivity towards Braille literacy, and barriers to learning Braille. These qualitative findings supported the quantitative data, revealing that pre-service teachers in departments other than special education had limited experience and competence with Braille literacy, while also indicating a strong need for coursework related to Braille literacy and visual impairments. Nevertheless, pre-service teachers generally demonstrated a high level of awareness regarding Braille.

Keywords: Visiual Impairment, Braille, attitude, pre-service teachers.

Introduction

The World Health Organization (2023) reports that approximately 2.2 billion individuals globally experience varying degrees of vision loss. A meta-analysis investigating the global prevalence of visual impairment estimates that, as of 2020, 295 million individuals are affected by moderate to severe visual impairment, while 258 million experience mild visual impairment (Bourne et al., 2021). This large population of visually impaired individuals encompasses significant diversity. Visual impairment represents a heterogeneous condition characterized by varied etiologies, levels of severity, and rates of progression (Bonsaksen et al., 2023; Teoh et al., 2021). The most widely accepted classification of visual impairment is the distinction between low vision and blindness (Maberley et al., 2006). This classification is instrumental in identifying the specific needs and support systems required by individuals with visual impairment. While those with low vision may utilize their remaining sight with appropriate adaptations, blind individuals rely primarily on their senses of touch and hearing to navigate and perceive their environment.

The sense of touch is critically significant in the educational dev elopment of blind students (Panotopoulou et al., 2020). This sensory modality also plays a fundamental role in enabling blind children to explore their surroundings

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and perform daily tasks. Tactile skills are essential for visually impaired children to foster independence in their lives (Withagen, 2010). In educational contexts, tactile materials have been shown to enhance learning experiences for blind students (Phutane, 2022). The Braille system, which places tactile perception at the center of educational processes, is integral to the education of blind students. Historically, Braille traces its origins to Francesco Lana Terzi (1631–1687), who devised a system distinct from printed writing. Subsequently, Valentine Haüy (1745–1822) developed an embossed version of the Latin alphabet for educational purposes. The precursor to the modern Braille system, utilizing raised dots for tactile reading, was developed by artillery captain Charles Barbier de la Serre (1767–1841) (Jiménez et al., 2009). This tactile reading and writing system was later refined into the contemporary Braille alphabet by Louis Braille (1809–1852) (Karataş et al., 2024). While Louis Braille conceptualized his eponymous tactile alphabet in the early 19th century, the complete Braille system, as used today, underwent further development in the 20th century (D'Andrea, 2009). UNESCO has played a pivotal role in the global promotion and standardization of Braille. In 1950, UNESCO formalized the international adoption of Braille, and in 2005, it officially recognized Braille as "a legitimate and vital language of communication, equal to any other language in the world" (Jiménez et al., 2009).

Originally developed in the 19th century by Louis Braille, the Braille system is a universally recognized code utilized by individuals who are blind or visually impaired for reading and writing purposes. The Braille system comprises embossed dots, enabling individuals with visual impairments to read tactilely through the use of their fingertips. It is important to clarify that Braille is not a language; rather, it is a coding system that can be applied to various languages, including Turkish, English, and Arabic. By utilizing the Braille system, visually impaired individuals around the world are afforded the opportunity to read and write in their native languages (American Foundation for the Blind, 2024).

The scope of the Braille writing system extends across a wide array of applications. It is predominantly employed in educational contexts (Croake et al., 2024; Roe et al., 2014), but its use is also prevalent in other domains, such as in banking ATMs (Sharma et al., 2017), pharmaceutical packaging inserts (Almukainzi et al., 2020), the clothing industry (Özsan & Hasret, 2017), and elevators (Edwards, 1998). This widespread usage underscores the fact that the Braille system is not confined to educational settings, but is also integrated into many aspects of daily life (Şafak, 2017).

The Braille system constitutes a fundamental tool that facilitates the acquisition of literacy skills for visually impaired individuals, thereby promoting their independence in academic, social, and professional spheres. It is essential for tasks such as note-taking, completing academic and professional responsibilities, and participating in recreational activities.

The utilization of Braille by individuals with visual impairments is a critical variable in mitigating the barriers posed by their disabilities, such as accessing information and performing daily tasks independently. It can be argued that Braille plays an indispensable role in overcoming numerous obstacles encountered in educational contexts (Karataş et al., 2024). Additionally, it is asserted that the acquisition of Braille literacy and its application within society constitutes a fundamental human right for visually impaired individuals (Harris et al., 2023). Teachers play a pivotal role in ensuring that visually impaired individuals acquire proficiency in the Braille system, which is a recognized human right, and utilize it effectively in societal contexts. Thus, it is imperative that educators working with visually impaired students achieve mastery of the Braille writing system (Herzberg & Rett-McBride, 2023). Such mastery enables teachers to more effectively design educational processes, prepare appropriate instructional materials, and conduct accurate assessments. Nonetheless, an examination of the literature reveals that teachers often exhibit significant deficiencies in their proficiency with the Braille writing system (Aktaş & Argün, 2021; Atila, 2017; Çifci, 2021; Mallik & Mishra, 2021; Öz, 2019; Yazıcı & Sözbilir, 2020). Despite the consensus that teachers working with visually impaired students should possess competency in Braille, there is no uniform agreement on how Braille instruction should be incorporated into pre-service teacher education (D'Andrea et al., 2009).

Research indicates that pre-service teacher education programs which emphasize Braille reading instruction methodologies produce educators who are more confident in both their Braille skills and their ability to teach Braille (Wittenstein, 1994). The literature also highlights discussions concerning online education, program standards, teacher competencies, and the availability of learning resources (Farrand et al., 2022). An analysis of the teacher training curricula in Turkey reveals that Braille reading and writing courses are mandatory within special education departments. However, these courses are not included as compulsory or elective options in other teacher training programs. The limitations teachers experience in relation to Braille proficiency (Öz, 2019; Yazıcı & Sözbilir, 2020) can be attributed to the content of their undergraduate education. An evaluation of the competencies required for teacher appointments in schools serving visually impaired students in Turkey indicates that securing a satisfactory exam score is deemed sufficient for appointment (Eğitimde Görme

Engelliler Derneği [Association for the Visually Impaired in Education], 2022). The absence of specific competency requirements pertaining to the Braille writing system, despite its widespread use among visually impaired individuals, has led to the neglect of Braille-related competencies among teachers outside the special education field. Consequently, considering the broader findings within the existing literature, it is reasonable to conclude that teachers' lack of proficiency in Braille may adversely affect the quality of education provided to visually impaired students.

Within this context, it can be stated that under the current system, teachers are expected to acquire Braille proficiency through their own initiative and personal motivation, which directly relates to their attitudes toward Braille (Kurt & Ketenoğlu-Kayabaşı, 2022). A meta-analysis further demonstrates that attitudes are significant predictors of future behavior (Glasman & Albarracín, 2006). Given that undergraduate education is a critical period during which attitudes toward the Braille writing system begin to take shape, it holds considerable importance for pre-service teachers. Studies conducted in Turkey reveal that pre-service teachers generally hold positive attitudes toward Braille (Karataş et al., 2024; Kurt & Ketenoğlu-Kayabaşı, 2022). However, an examination of domestic literature reveals a notable absence of qualitative studies investigating pre-service teachers' perceptions of the Braille writing system. Analyzing the perspectives of pre-service teachers on Braille is therefore invaluable for understanding the current state of Braille education. The purpose of this study is to examine pre-service teachers' attitudes toward Braille writing across various variables and to explore their views on the Braille writing system.

Method

Research design

The objective of this study was to explore the attitudes and perceptions of pre-service teachers towards Braille writing. The study focused on the attitudes of 4th-year pre-service teachers enrolled in the departments of special education, Turkish, English, mathematics, classroom teaching, social studies, and guidance and psychological counseling, who are likely to work with visually impaired students upon entering the teaching profession. While quantitative data were used to measure their attitudes, it was deemed that quantitative data alone would not be sufficient. Therefore, qualitative data obtained through interviews with the pre-service teachers were incorporated to complement the findings.

In line with this aim, a "mixed research method" was adopted, which combines both quantitative and qualitative research approaches to offer a more comprehensive understanding of the research objectives and sub-questions. Specifically, the parallel mixed-method design, a variant of mixed methods, was employed in this study. Mixed-method design involves the simultaneous collection and integration of both quantitative and qualitative data to address a research problem more comprehensively (Gay et al., 2012; Mills & Gay, 2016). In parallel mixed-method research, the goal is to collect and merge both types of data concurrently to enhance the understanding of the research problem (Fırat et al., 2014). Utilizing both data sets together provides a deeper understanding of the research problem and sub-questions, leading to more robust results (Creswell, 2008). Figure 1 illustrates this approach.

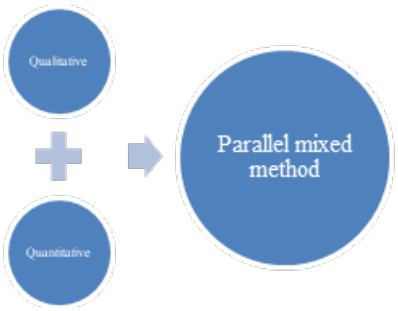

Fig. 1. Parallel mixed method (Fırat et al., 2014)

Study group

The quantitative phase of the study was conducted with 445 pre-service teachers enrolled in the 4th year across five faculties of education located in the Southeastern Anatolia Region and one in the Mediterranean Region of Turkey during the 2023-2024 academic year. The qualitative phase involved 21 pre-service teachers who volunteered to participate in interviews. The criterion sampling method was employed for participant selection. In this context, participants were required to meet the following criteria: (a) they must be in their 4th year at the faculty of education, (b) they must be enrolled in departments such as special education, Turkish, English, mathematics, social studies, classroom teaching, or guidance and psychological counseling, (c) they must have completed two semesters of a teaching practicum course, and (d) they must be willing to participate in the study.The demographic details of the participants involved in the quantitative phase of the study are presented in table 1.

Upon analyzing Table 1, it is observed that 59.3% (n=264) of the pre-service teachers participating in the quantitative phase of the study were aged 23 years or younger, while 40.7% (n=181) were aged 24 years or older. Among the participants,

Table 1. Demographic Characteristics of Pre-service Teachers

	Number of Participants (n=445)	*Percentage (%)*
Age Group (Average)	23,21	
23 years and under	264	59,3
24 years and over	181	40,7
Gender		
Woman	325	73,0
Male	120	27,0
Department		
English Language Teaching	42	9,4
Mathematics Teacher Education	68	15,3
Special Education	76	17,1
Guidance and Psychological Counseling	82	18,4
Classroom Teaching	56	12,6
Turkish Language Teaching	39	8,8
Social Studies Teacher Education	82	18,4
Taking courses related to the visually impaired		
Yes	167	37,5
No.	278	62,5
Encountering a student with special needs in teaching practice		
Yes	217	48,8
No.	228	51,2
The presence of an individual with special needs in the family or surroundings		
Yes	254	57,1
No.	191	42,9
Previous encounter with an individual with visual impairment		
Yes	347	78,0
No.	98	22,0
Preference for having a visually impaired student in the classroom when beginning a teaching career.		
Yes	220	49,4
No.	225	50,6
Previous exposure to Braille		
Yes	241	54,2
No.	204	45,8
Watching movies/series about visually impaired people		
Yes	280	62,9
No.	165	37,1
Participation in a seminar, panel, symposium on special education (visually impaired, etc.)		
Yes	99	22,2
No.	346	77,8

Mean=Mean, SD=Standard Deviation

73.0% (n=325) were female, and 27.0% (n=120) were male. In terms of academic discipline, 9.4% (n=42) were enrolled in English language teaching, 15.3% (n=68) in mathematics teaching, 17.1% (n=76) in special education teaching, 18.4% (n=82) in guidance and psychological counseling, 12.6% (n=56) in classroom teaching, 8.8% (n=39) in Turkish language teaching, and 18.4% (n=82) in social studies teaching.

Additionally, 37.5% (n=167) of the pre-service teachers had taken a course related to visual impairments, while 62.5% (n=278) had not. During their teaching practice, 48.8% (n=217) had encountered a student with special needs, whereas 51.2% (n=228) had not. Moreover, 57.1% (n=254) reported having a family member or acquaintance with special needs, while 42.9% (n=191) did not. Furthermore, 78.0% (n=347) had previously encountered an individual with visual impairment, while 22.0% (n=98) had not.

Regarding their preferences for classroom composition, 49.4% (n=220) expressed willingness to have a visually impaired student in their classroom when they begin teaching, whereas 50.6% (n=225) did not. With respect to familiarity with Braille, 54.2% (n=241) had encountered Braille before, while 45.8% (n=204) had not. In terms of exposure to media, 62.9% (n=280) had watched films or series involving visually impaired individuals, while 37.1% (n=165) had not. Finally, 22.2% (n=99) of the pre-service teachers had participated in seminars, panels, or symposia related to special education (such as visual impairment), while 77.8% (n=346) had not.

Details regarding the participants involved in the qualitative phase of the study are presented in Table 2.

Upon examining Table 2, it is observed that three pre-service teachers from each teaching discipline participated in the qualitative phase of the research, all of whom were in their 4th year of study. Among the participants, only three pre-service teachers enrolled in the special education program had taken a course on Braille, whereas 18 participants had not received any formal instruction on Braille.

Table 2: Demographic Characteristics of Pre-service Teachers

Participant code	*Department*	*Grade level*	*Having taken Braille lessons*
P1	Special education	4	Yes
P2	Special education	4	Yes
P3	Special education	4	Yes
P4	Guidance and psychological counseling	4	No.
P5	Guidance and psychological counseling	4	No.
P6	Guidance and psychological counseling	4	No.
P7	English teaching	4	No.
P8	English teaching	4	No.
P9	English teaching	4	No.
P10	Turkish teaching	4	No.
P11	Turkish teaching	4	No.
P12	Turkish teaching	4	No.
P13	Classroom teaching	4	No.
P14	Classroom teaching	4	No.
P15	Classroom teaching	4	No.
P16	Social Studies Teacher Education	4	No.
P17	Social Studies Teacher Education	4	No.
P18	Social Studies Teacher Education	4	No.
P19	Mathematics Teacher Education	4	No.
P20	Mathematics Teacher Education	4	No.
P21	Mathematics Teacher Education	4	No.

Data collection tools

Within the scope of this research, three data collection tools were employed. The details of these tools are outlined below.

Personal Information Form

The personal information form was developed by the researchers to collect demographic data of the participants involved in the quantitative phase of the study, as well as their experiences with visually impaired individuals or individuals with special needs. The form also included questions regarding the participants' prior coursework on special education, their familiarity with Braille, their willingness to teach visually impaired students when they begin their teaching careers, and their attendance at symposia or panels related to special education.

Attitude Scale Towards Braille Writing

The *Attitude Towards Braille Writing* scale, developed by Doğuş et al. (2019), aims to measure attitudes toward Braille writing. To achieve this, the researchers followed a systematic approach. The study participants were undergraduate students enrolled in special education programs within faculties of education during the spring semester of the 2017-2018 academic year. In this context, the finalized scale was administered to a total of 567 students. The collected data were randomly divided into two groups: one group (n1=273) underwent exploratory factor analysis (EFA), while the second group (n2=294) was subjected to confirmatory factor analysis (CFA).

As a result of the exploratory factor analysis, a structure consisting of three factors—interest and desire, learning, and belief—comprising 15 items, was identified. The validity of this structure was tested through confirmatory factor analysis, and the scale was found to have acceptable fit index values. The Cronbach's Alpha reliability (internal consistency) coefficient for the entire scale was determined to be .88, while the reliability coefficients for the individual factors ranged between .73 and .86. These findings demonstrate that the scale is both valid and reliable for assessing attitudes toward Braille writing (Doguş et al., 2019).

Semi-structured Interview Form

The semi-structured interview form was developed by the researchers following a comprehensive and systematic literature review. After the review, the semi-structured

interview form was drafted with the questions selected for inclusion. The draft form was then submitted for review to two faculty members specializing in special education and one faculty member specializing in educational measurement and evaluation. Based on the feedback provided by these experts, the necessary adjustments were made to the questions. The revised form was subsequently sent to two experts in the field of Turkish education to evaluate its linguistic appropriateness. Following their feedback, linguistic adjustments were made, and the form was finalized.

Data collection process

To collect data for the quantitative phase of the study, the questions from the personal information form and the items from the *Attitudes Toward Braille Scale* were transferred to Google Forms. The quantitative data were collected face-to-face by the researchers. In this process, the researchers obtained permission from the relevant course instructor and visited the classrooms either before or after the lessons. They distributed the research information and consent forms to the students and explained the purpose of the study. The data collection tools were administered digitally to those participants who voluntarily agreed to participate in the study.

For the qualitative phase, the data were collected face-to-face by the first researcher. Prior to each interview, the purpose of the research was explained to the participants, and research information and consent forms were provided. The interviews were recorded using a voice recorder. All interviews took place in a quiet environment with a table and two chairs. The duration of the interviews ranged from 16 to 34 minutes. In cases where participants gave brief responses to questions, additional probing questions were employed to encourage more detailed answers and to support the participants in expressing their views. At the conclusion of each interview, the researcher thanked the participant and formally ended the session.

Data Analysis

Analysis of quantitative data

The study data were transferred to IBM SPSS Statistics 26.0 (IBM, Armonk, NY, USA) for analysis. In evaluating the data, frequency distributions were reported for categorical variables, and descriptive statistics (mean, standard deviation, median) were provided for numerical variables. The reliability of the Attitude Towards Braille Writing Scale, which was used as the primary measurement tool in the study, was assessed using Cronbach's Alpha internal consistency coefficient. The attitude and sub-dimension scores of the participating pre-service teachers towards Braille writing were calculated by averaging the relevant items.

To determine the appropriate statistical tests, the Kolmogorov-Smirnov Test ($n > 30$) was applied to all scores to check the assumption of normal distribution. The test results indicated that the scores met the assumption of normality, and thus, parametric tests were utilized for comparisons. To examine differences between two independent groups (e.g., gender), the Independent Samples T-Test was employed. For comparisons involving more than two independent groups (e.g., department), One-Way Analysis of Variance (ANOVA) was conducted, followed by the Tukey Test to identify specific group differences. Pearson's Correlation Coefficient was used to assess the strength of non-causal relationships between two quantitative variables.

Further details on the reliability analysis are provided below.

Reliability Analysis

While the construct validity of scales is determined through exploratory factor analysis and confirmatory factor analysis, it is also essential to evaluate whether the scales provide consistent measurements, and whether there is internal consistency among the items. The most commonly employed analysis for this purpose is reliability analysis (Gürbüz & Şahin, 2018). Reliability analysis forms the foundation for interpreting the obtained measurements and for conducting further analyses. It is a method developed to evaluate the characteristics and reliability of tests, questionnaires, or scales used in measurement. Through the reliability analysis procedure, coefficients are calculated to determine the reliability of scales, such as Likert-type scales, where total scores are used, and insights are gained regarding the relationships between the items in the scale (Kalaycı, 2010: 403).

All items in an instrument with K questions should contribute to explaining a particular phenomenon, and this requires a high degree of correlation among the items. Reliability measures are developed based on these correlations or covariances (Özdamar, 2002: 663). In this study, Cronbach's Alpha internal consistency coefficient was employed to assess the reliability of the scales.

Cronbach's Alpha Coefficient of Internal Consistency (Alpha Method) is a weighted, standardized mean of variation, obtained by proportioning the sum of the variances of K questions in the scale to the overall variance. This value ranges between 0 and 1. The Alpha method is used to derive other statistics or tests by utilizing the correlations or covariances within the scale (Özdamar, 2002: 663). This method examines whether the K questions in the scale form a coherent whole, reflecting a homogeneous structure. It provides a weighted standard mean of variation by proportioning the sum of

the variances of the K questions to the overall variance. The interpretation of a scale's reliability, based on the alpha (α) coefficient, is as follows (Kalaycı, 2010: 405).

Table 3: Reliability levels of the scale based on alpha (α) coefficient

Alpha Coefficient	*Description*
0,00≤ α ≤0,39	The scale is not reliable
0,40≤ α ≤0,59	Scale reliability is low
0,60≤ α ≤0,79	The scale is quite reliable
0,80≤ α ≤1,00	The scale is highly reliable

The Cronbach's Alpha internal consistency coefficients for the *Attitude Towards Braille Writing* scale and its sub-dimensions are presented in Table 4.

Table 4: Cronbach's Alpha Internal Consistency Coefficient of the Attitude Towards Braille Writing Scale

	Number of Articles	**Cronbach's Alpha (α)**	**Reliability Level**
Attitude Scale Towards Braille Writing	15	0,916	Highly Reliable
Sub Dimensions			
Interest and Desire	8	0,912	Highly Reliable
Learning	4	0,783	Quiet Reliable
Belief	3	0,773	Quiet Reliable

Upon examining Table 4, the results of the reliability analysis indicate that the *Attitude Towards Braille* scale, consisting of 15 items, demonstrated high reliability (α=0.916). Similarly, the sub-dimension of *interest and desire* showed high reliability (α=0.912), while the sub-dimensions of *learning* (α=0.783) and *belief* (α=0.773) exhibited quiet reliability.

Analysis of qualitative data

Content analysis was employed to analyze the qualitative data in this study. Content analysis is a method that involves thoroughly examining the collected data and making conceptual, categorical, and thematic inferences from these data. During this process, the data set is closely examined to identify events and phenomena that are frequently repeated or strongly emphasized by the participants, which are then coded. The codes are subsequently transformed into categories, and themes are generated from these categories. Ultimately, the data (codes) that display similarities and relationships are systematically grouped and interpreted within the framework of specific concepts (categories) and themes (Baltacı, 2019). In this study, following the transcription of the interviews, the texts were systematically analyzed, and codes were created. Categories were derived from the codes, and themes were developed from the categories.

Inter-coder reliability

Within the qualitative phase of this study, inter-coder reliability was calculated. Inter-coder reliability refers to the process in which two or more coders independently analyze qualitative data and assign appropriate codes, after which their results are compared to assess the level of agreement (Creswell, 2016). According to a widely accepted formula, when two or more researchers independently code the same data set, the level of agreement between them is calculated as follows: number of agreements / (number of agreements + number of disagreements) × 100. This formula is a common method for evaluating consistency between coders. In qualitative research, inter-coder reliability is typically expected to be 80% or higher (Miles & Huberman, 1994). In this study, the qualitative data set was coded by both the first researcher and a scientific expert with a PhD in special education. Following the calculation, the inter-coder reliability was determined to be 96.4%.

Compliance with Ethical Rules

In this study, all the guidelines outlined in the *Directive on Scientific Research and Publication Ethics of Higher Education Institution* were adhered to. Additionally, an official document was obtained from the Gaziantep University Social and Human Sciences Ethics Committee, confirming that the research was designed in accordance with scientific ethical standards.

Findings

In this section, the findings from both the quantitative and qualitative phases of the study are presented.

Findings Related to Quantitative Phase

The quantitative analysis of the research data was conducted under two main sections. In the first section, descriptive statistics regarding teachers' attitudes toward Braille writing and their sub-dimension scores were provided. Additionally, the relationship between demographic characteristics was analyzed based on these scores. In the second phase, the correlations between the scores were examined through correlation analysis.

Descriptive Statistics of the Scales and Comparison Results

In this section, the descriptive statistics (mean, standard deviation, and median) of the pre-service teachers' scale scores are first presented. Subsequently, the normality assumption of the scores was tested, followed by an examination of whether there were any differences in the teachers' demographic characteristics based on their scale scores.

The examination of the mean and standard deviation values of the scale scores, as well as the assumption of normal distribution, is presented in table 5.

Upon examining Table 5, it is evident that the mean attitude score of teachers towards Braille writing is 3.79 (±0.623). The mean score for the subdimension of interest and desire is 3.72 (±0.742), for the learning subdimension it is 4.29 (±0.610), and for the belief subdimension it is 3.30 (±0.843). These findings suggest that the scores obtained by the pre-service teachers on the Braille Writing Attitude Scale and the interest and desire subdimension can be classified as 'high,' the scores on the learning subdimension as 'very high,' and the scores on the belief subdimension as ' moderate'.

The Kolmogorov-Smirnov Test (n>30) was applied to determine whether the total score and sub-dimension scores of attitudes towards Braille writing met the assumption of normal distribution. The results indicated that both the total score and sub-dimension scores did not meet the assumption of normality (p<0.05). However, the p-value significance level alone is insufficient to make a definitive conclusion. In conjunction with the significance level, skewness and kurtosis values, as well as histogram graphs, should be analyzed.

The skewness and kurtosis values for the total behavior scores and sub-dimension scores fall within the ±3 range. These values, provided with their standard errors in SPSS, indicate that if the standardized value (obtained by dividing by its standard error) lies between -1.96 and +1.96, the distribution can be considered normal. Furthermore, according to most sources, a skewness and kurtosis coefficient between ±3 suggests that the distribution is normal (Alpar, 2020). Finally, upon reviewing the histogram graphs, it can be concluded that the scores conform to a normal distribution. Given that normality was established, parametric tests were employed in the comparisons of the scores. The results of these comparisons are presented in the following table 6.

Table 5: Mean and Standard Deviation Values of Scale Scores and Examination of Normal Distribution Assumption

Points	*Mean±SD*	*Median*	*Min-Max*	*Skewness*	*kurtosis*	*Kolmogorov Smirnov (p)*
Attitudes towards Braille	3,79±0,623	3,80	1-5	-2,93	2,07	0,000
Sub Dimensions						
Interest and Desire	3,72±0,742	3,75	1-5	-2,60	2,37	0,000
Learning	4,29±0,610	4,25	1-5	-2,31	2,66	0,000
Belief	3,30±0,843	3,33	1-5	-1,64	-0,55	0,000

Mean=Mean, SD=Standard Deviation, Min=Minimum, Max=Maximum

Table 6: Examination of Differences between Demographic Characteristics According to Scale Scores

			Attitude Scale Towards Braille Writing		
Demographic Characteristics and Information on Visually Impaired Students	*n*	*Total Score Mean±SD*	*Interest and Desire Mean±SD*	*Learning Mean±SD*	*Belief Mean±SD*
Age Group					
23 years and under	264	3,75±0,599	3,68±0,707	4,25±0,594	3,28±0,807
24 years and older	181	3,84±0,655	3,79±0,788	4,35±0,629	3,34±0,893
t; p		-1,589; 0,113	-1,525; 0,128	-1,695; 0,091	-0,659; 0,510
Gender					
Woman	325	3,84±0,573	3,79±0,682	4,31±0,558	3,34±0,797
Male	120	3,65±0,729	3,54±0,861	4,22±0,729	3,21±0,952

Demographic Characteristics and Information on Visually Impaired Students		*Attitude Scale Towards Braille Writing*			
		Total Score	*Interest and Desire*	*Learning*	*Belief*
	n	*Mean±SD*	*Mean±SD*	*Mean±SD*	*Mean±SD*
Department					
English Language Teaching	42	3,66±0,714	3,52±0,845	4,39±0,697	3,06±0,878
Mathematics Teacher Education	68	3,77±0,480	3,70±0,622	4,27±0,522	3,31±0,755
Special Education Department	76	4,08±0,584	4,12±0,627	4,41±0,624	3,54±0,880
Guidance and Psychological Counseling	82	3,67±0,666	3,57±0,794	4,19±0,581	3,23±0,904
Grade Teacher Education	56	3,68±0,572	3,62±0,629	4,14±0,632	3,21±0,793
Turkish Language Teaching	39	3,53±0,655	3,39±0,768	4,11±0,734	3,14±0,823
Social Studies Teacher Education	82	3,92±0,584	3,85±0,730	4,42±0,517	3,42±0,796
F; p		5,888; 0,000***	7,058; 0,000***	2,882; 0,009***	2,295; 0,034*
Difference		3-1,2,4,5,6	3-1,2,4,5,6	3,7-4,5,6	3-1,2,4,5,6
Taking courses related to the visually impaired					
Yes	167	3,90±0,636	3,88±0,723	4,34±0,636	3,37±0,868
No.	278	3,72±0,607	3,63±0,739	4,26±0,592	3,26±0,826
t; p		2,927; 0,004**	3,461; 0,001**	1,441; 0,150	1,319; 0,188
Encountering a student with special needs in teaching practice					
Yes	217	3,82±0,649	3,78±0,763	4,29±0,641	3,29±0,858
No.	228	3,76±0,599	3,67±0,720	4,28±0,579	3,32±0,829
t; p		0,943; 0,346	1,539; 0,125	0,207; 0,836	-0,318; 0,750
Having someone with special needs in the family or environment					
Yes	254	3,83±0,573	3,77±0,669	4,32±0,552	3,36±0,825
No.	191	3,73±0,682	3,66±0,827	4,24±0,678	3,23±0,863
t; p		1,761; 0,079	1,533; 0,126	1,406; 0,161	1,550; 0,122
Previous encounter with an individual with visual impairment					
Yes	347	3,82±0,612	3,76±0,726	4,33±0,589	3,34±0,862
No	98	3,66±0,650	3,59±0,787	4,15±0,664	3,19±0,763
t; p		2,321; 0,021*	1,949; 0,052	2,537; 0,012*	1,550; 0,122
Preference for having a visually impaired student in the classroom when beginning a teaching career.					
Yes	220	3,95±0,590	3,93±0,674	4,34±0,610	3,50±0,818
No	225	3,63±0,615	3,52±0,753	4,24±0,607	3,11±0,822
t; p		5,636; 0,000***	5,965; 0,000***	1,788; 0,074	5,080; 0,000***
Previous exposure to Braille					
Yes	241	3,84±0,611	3,78±0,743	4,36±0,580	3,33±0,821
No	204	3,72±0,633	3,65±0,737	4,20±0,633	3,27±0,867
t; p		2,075; 0,039*	1,764; 0,078	2,779; 0,006**	0,853; 0,394
Watching films/TV series about visually impaired individuals					
Yes	280	3,85±0,630	3,80±0,747	4,33±0,584	3,34±0,865
No	165	3,68±0,600	3,59±0,716	4,21±0,645	3,25±0,802
t; p		2,717; 0,007**	2,951; 0,003**	2,135; 0,033*	1,055; 0,292

Attending a seminar, panel, or symposium related to special education (e.g., for the visually impaired)					
		Attitude Scale Towards Braille Writing			
Demographic Characteristics and Information on Visually Impaired Students	*n*	*Total Score* Mean±SD	*Interest and Desire* Mean±SD	*Learning* Mean±SD	*Belief* Mean±SD
No	346	3,75±0,605	3,67±0,736	4,27±0,581	3,26±0,817
t; p		2,593; 0,010*	2,910; 0,004**	0,939; 0,348	1,849; 0,085

*p<0.05, **p<0.01, ***p<0.001, Mean=Mean, SD=Standard Deviation

t=Independent Sample T Test,

F=One-Way Analysis of Variance (ANOVA),

Difference=Tukey Test p=Significance Level

Table 6 presents the results of the analysis examining whether there are differences in the demographic characteristics of the teachers based on the overall attitude scores and sub-dimension scores towards Braille writing. The findings indicate that there were statistically significant differences (p<0.05) in relation to gender, department, completion of a course about visual impairment, previous encounters with visually impaired individuals, willingness to have visually impaired students in the classroom, familiarity with Braille, watching movies or series about visually impaired individuals, and participation in seminars, panels, or symposiums about special education (including visual impairment), based on the total and sub-dimension scores of attitudes towards Braille writing. The specific demographic characteristics demonstrating these differences are detailed below.

A statistically significant difference was observed between the genders of the pre-service teachers in relation to the mean attitude scores towards Braille writing and the interest and desire sub-dimension scores (p<0.05). Accordingly, it can be stated that the mean scores of women in both the total attitude score and the interest and desire score were significantly higher than those of men.

Additionally, significant differences were found across the departments of the pre-service teachers concerning the mean scores for attitudes towards Braille writing, as well as the interest and desire, learning, and belief sub-dimension scores (p<0.05). It can be concluded that pre-service teachers from the special education department had significantly higher mean scores in the total attitude score, interest and desire, and belief scores compared to those from English, mathematics, PDR (guidance and psychological counseling), classroom, and Turkish departments. Furthermore, the mean scores of learning subscale for pre-service teachers in the special education and social studies departments were significantly higher than those for teachers in the counseling, classroom, and Turkish departments.

There was a statistically significant difference between pre-service teachers who had taken a course on visually impaired individuals and those who had not, with respect to the mean scores of attitudes towards Braille writing and the interest and desire sub-dimension (p<0.05). Those who had completed a course on visual impairment scored significantly higher in both the total attitude score and the interest and desire score compared to those who had not taken such a course.

Furthermore, pre-service teachers who had previously encountered individuals with visual impairments exhibited significantly higher mean attitude scores and learning sub-dimension scores towards Braille writing compared to those who had not (p<0.05).

The results also demonstrated a statistically significant difference between pre-service teachers who expressed a desire to have visually impaired students in their classroom at the start of their teaching career and those who did not, in terms of the total attitude score, as well as the interest and desire and belief sub-dimension scores (p<0.05). Those who expressed this desire scored significantly higher on all these dimensions.

Moreover, a statistically significant difference was observed between pre-service teachers who had previously encountered Braille and those who had not, in terms of the mean attitude score and learning sub-dimension score (p<0.05). Pre-service teachers familiar with Braille scored significantly higher on both these measures.

There was also a significant difference between those who had watched movies or series about visually impaired individuals and those who had not, in terms of the mean attitude score, interest and desire, and learning sub-dimension scores (p<0.05). Those who had watched such media had significantly higher scores in all these dimensions.

Finally, a statistically significant difference was found between pre-service teachers who had participated in seminars, panels, or symposiums related to special education

(including visual impairment) and those who had not, regarding the total attitude score and the interest and desire sub-dimension score ($p<0.05$). Those who had participated in such events scored significantly higher on both measures.

Correlation Analysis

Correlation analysis is employed to determine the degree of non-causal relationships between two quantitative variables. Two primary correlation coefficients are used for this purpose: Pearson's and Spearman's rho. Pearson's Correlation Coefficient is applied when the variables are numerical and normally distributed, whereas Spearman's rho is used when the variables do not follow a normal distribution (Alpar, 2020).

In this study, the normal distribution assumptions of the attitude towards Braille writing and its sub-dimension scores, which were used as a measurement tool, were assessed, and it was found that the scores followed a normal distribution. Therefore, Pearson's Correlation Coefficient was utilized to examine the relationships between the scale scores. The relationship strength and direction of Pearson's correlation coefficients are presented in Table 7, and the relationship between the attitude towards Braille writing scale and its sub-dimensions is displayed in Table 8.

Table 7: Pearson Correlation Values used to examine the relationship between scale scores (Gürbüz & Şahin, 2018)

r (Correlation Coefficient)	*Relationship Level*	*Relationship Direction*
0,00 - 0,29	Low level of relationship	negative relationship if r= -
0,30 - 0,69	Moderate relationship	Positive relationship if r= +
0,70 - 1,00	High level of relationship	

Table 8: Examination of the Relationships between Scale and Subscale Scores

Points		*1*	*2*	*3*	*4*
1. Attitude Score towards Braille Writing	r	1			
	p				
2. Interest and Desire	r	0,954	1		
	p	0,000***			
3. Learning	r	0,698	0,534	1	
	p	0,000***	0,000***		
4. Faith	r	0,786	0,663	0,362	1
	p	0,000***	0,000***	0,000***	

***p<0.001, r=Pearson Correlation Coefficient, p=Significance Level

The results of the correlation analysis between the scale and sub-dimension scores are presented in Table 8. Upon examining the relationships between the scale scores, a significant positive linear relationship was identified between the attitude score towards Braille writing and the interest and desire score at a high level ($r=0.954$; $p<0.001$), between the attitude score and the learning score at a moderate level ($r=0.698$; $p<0.001$), and between the attitude score and the belief score at a high level ($r=0.786$; $p<0.001$).

Additionally, a significant positive linear relationship was found between the interest and desire score and the learning score at a moderate level ($r=0.534$; $p<0.001$), as well as between the interest and desire score and the belief score at a moderate level ($r=0.663$; $p<0.001$). Furthermore, a significant moderate positive linear relationship was observed between the learning score and the belief score ($r=0.362$; $p<0.001$).

Findings Related to the Qualitative Phase

The findings related to the qualitative phase of the research were derived through content analysis. Three primary themes emerged as a result of this analysis: pedagogical competence, sensitivity to Braille, and barriers to learning Braille. Below, the categories and codes associated with each theme are presented, along with sample participant statements.

Pedagogical Competence

The categories and codes related to the pedagogical competence theme are illustrated in Figure 2.

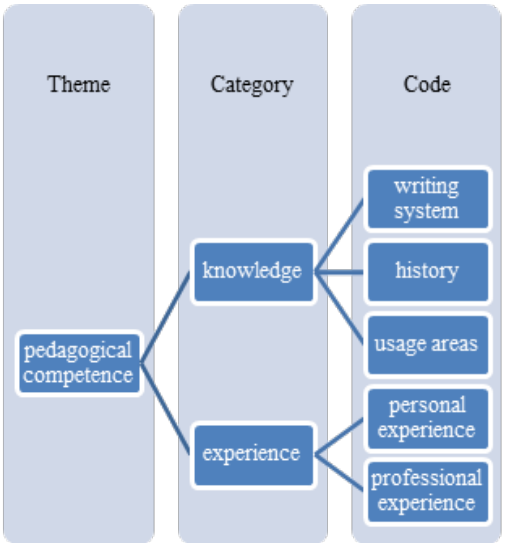

Fig. 2. Categories and codes related to the pedagogical competence theme

Upon analyzing Figure 2, two categories emerge related to the pedagogical competence theme: knowledge and experience. The knowledge category consists of three codes: writing system, history, and usage areas. The experience category is composed of two codes: personal experience and professional experience. Below, explanations and sample participant statements regarding the themes, categories, and codes are provided.

The theme of pedagogical competence was constructed based on the theory and practice of Braille writing. In this context, the pedagogical competence of pre-service teachers was analyzed in the categories of knowledge and experience with Braille. The writing system code in the knowledge category highlights the distinct nature of Braille compared to sighted print. Participant statements about the writing system reveal that pre-service special education teachers have a strong understanding of the Braille system. For example, P1 noted, *"The logic of Braille is actually the same as sighted writing. The sensory channels they use are different. One focuses on sight, the other on touch."*. P2 elaborated on the sensory foundation of Braille, stating, *"It is called 'Braille.' It is designed for children to read by touch. It consists of six dots, and different sequences form letters, numbers, and punctuation marks. It is not read with the eyes but by touch, especially for children. Writing is a bit different; we need to write the letters symmetrically upside down."*.

It was observed that pre-service teachers from other programs had limited knowledge of the Braille writing system. For instance, K7 stated, *"I don't know much, teacher. I only know it as the writing used by the visually impaired."*. Similarly, P20 mentioned, *"I know it as the alphabet for the blind. It is read by touch."*.

Understanding the history of Braille is critically important for recognizing past attempts to develop writing systems for the visually impaired and for internalizing the significance of international efforts to standardize Braille. Participant statements on the history of Braille indicate that, similar to the writing system code, special education pre-service teachers have a strong grasp of Braille's history, while others have limited knowledge. P3 commented, *"We use what Louis Braille invented. Different alphabets were used before. What impressed me most was how regular writing was embossed. It seemed to minimize the difference between sighted and blind people. But Braille was found to be read faster."*. P5 added, *"Braille is the person who invented the script. He uses the alphabet he found."*. Conversely, P9 expressed limited knowledge, stating, *"I know it's called Braille, but I don't know much about how it was invented."*.

Braille's application ranges from academic to social contexts, technical work, and even medicine. Many participants expressed accurate views on the use of Braille. P2 highlighted its broad application: *"There is nothing that cannot be written in Braille. It should be everywhere in life, and it is widely used today."*. P12 observed the practical importance of Braille on medicine boxes: *"Embossed writing is crucial for visually impaired patients to identify their medicines. Without it, they would need assistance."*. P14 noted, *"There is Braille in elevators. There are embossed dots under each button. In some museums, Braille is also under the descriptions, especially in front of artifacts."*.

Personal and professional experience with Braille is vital for pre-service teachers to effectively utilize it in educational settings. The analysis of the experience category revealed that special education pre-service teachers reported rich personal and professional experiences, while other pre-service teachers provided limited examples. Regarding personal experience, P1 shared, *"Braille is present in many places today. Before I started the program, I was interested in feeling the dots by touch. After taking the course, my personal interest increased. I try to write faster and avoid forgetting it between uses."*. P2 reflected, *"Braille is important in my personal life because I might work with visually impaired children in the future. I collect Braille magazines and books to improve my reading speed. Sometimes, I write Braille to maintain my skills."*. In contrast, P6, a non-special education student, stated, *"I wish I had more experience, but I have almost none. It was briefly covered in the special education course. I don't even know the letters."*. P10 added, *"I'd like to learn, but without knowing it, there's no experience. Maybe this reflects a gap in our education system."*.

Professional experience, in this context, focuses on the use of Braille in educational settings. Special education pre-service teachers often utilized Braille in their internships and material preparation. P1 remarked, *"We used Braille in many places during internships, especially when working with visually impaired children and preparing materials."*. P3 shared, *"Knowing Braille was crucial when preparing materials. Even if there is only one blind student in the class, we write Braille alongside sighted writing. During the internship, it was necessary to understand Braille to follow the student's reading progress."*. In contrast, non-special education pre-service teachers had minimal professional experience. P8 stated, *"I have almost no professional experience. I'd like to, but what experience can I gain without knowing Braille?"*. P11 echoed a similar sentiment: *"I've never used Braille. If I need it in the future, I will have to learn it somehow."*. P20 stated, *"I didn't need Braille during my internship. It would be useful for subject-specific teachers, but I don't think it's essential."*.

Braille Sensitivity

The categories and codes related to the theme of sensitivity to Braille are illustrated in Figure 3.

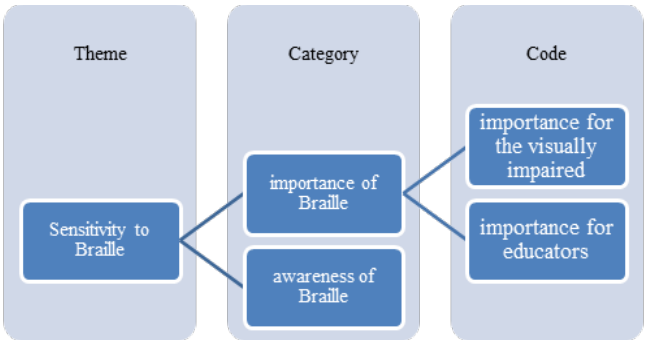

Fig. 3: Categories and codes related to the theme of sensitivity

When Figure 3 is analyzed, two categories related to the theme of sensitivity to Braille emerge: the importance of Braille and awareness of Braille. The importance of Braille category is composed of two codes: the importance for the visually impaired and the importance for educators. The awareness of Braille writing category was not divided into further codes. Below, explanations and sample participant statements regarding the themes, categories, and codes are presented.

Braille sensitivity involves internalizing the importance of Braille and raising awareness of Braille. It can be argued that pre-service teachers who are sensitive to Braille have a high potential to support their students who use Braille in educational contexts. In this study, most participants emphasized the importance of Braille in various contexts, and the interviews revealed that awareness of Braille was also high.

In the context of the importance of Braille for the visually impaired, P3 expressed, *"The importance and necessity of Braille for visually impaired children cannot be debated. Although not all of them use Braille, especially the majority of students at the school for the visually impaired use it. They spend their entire school life with Braille. This continues in middle school and high school."*. Similarly, P5 emphasized the role of Braille in the educational lives of visually impaired students, stating, *"Braille writing has a very important place for these students to receive education. This writing is the same for them as the normal writing we use is for us."*. P11 underscored the significance of Braille in the healthcare field, commenting, *"Braille is used in many places today. It is even in medicines. This is a very important thing for visually impaired people."*.

Regarding the importance of Braille for educators, P1 stated, *"Its importance for teachers cannot be debated. No matter which branch they are in, there is no guarantee that there won't be a visually impaired student in their class. So we cannot know. Therefore, it is a really important skill."*. P13, reflecting on his future professional life, remarked, *"There are mainstreaming students. There were also in the internship. Students with mental disabilities, learning disabilities, etc. Our internship teacher was having a hard time and so were we... I did not see any visually impaired students. They had disabilities, but at least they could see. To educate a blind child, you need to know Braille as well. Otherwise, you cannot educate..."*.

When examining the participant views on the awareness of Braille writing, it can be inferred that pre-service teachers' awareness is high. P8, highlighting inclusiveness, stated, *"All students should have a say in the classroom. Braille provides this for a small group. If we are really going to talk about equality, we should look at Braille as something that makes the student free, not just as a writing."*. Similarly, P16 commented, *"Actually, when I think according to your questions, Braille is an important skill for us to know. This is important not only for us but also for our future students. It is a necessity for them to take part in education..."*. P21 remarked, *"It is actually a human right for visually impaired people. Getting education is a right in the constitution. In order for these children to receive this right, they need to use Braille, and their teachers need to use it too."*.

Barriers to Learning Braille

The categories and codes related to the theme of barriers in learning Braille are illustrated in Figure 4.

When Figure 4 is analyzed, two categories related to the theme of barriers in learning Braille emerge: barriers arising from the nature of Braille and barriers arising from undergraduate education. The category of barriers arising from the nature of Braille was not divided into codes. The barriers arising from undergraduate education category consists of two codes: the absence of the Braille literacy course and the absence of a course on visual impairment. Below, explanations and sample participant statements regarding the themes, categories, and codes are presented.

Ideally, basic courses such as Braille literacy and introduction to the education of the visually impaired should be offered to all pre-service teachers through compulsory and elective courses during their undergraduate education.

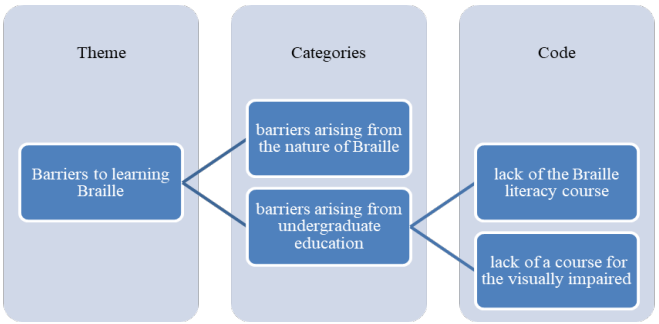

Fig. 4. Categories and codes related to the theme of barriers in learning Braille.

However, in practice, pre-service teachers outside of special education programs generally do not have access to these courses. The lack of such courses, coupled with the challenges posed by the nature of Braille, are the primary reasons why pre-service teachers struggle to acquire Braille skills. Indeed, in this study, participants expressed various opinions about these limitations.

When examining participants' views on the barriers arising from the nature of Braille, it was revealed that they emphasized how Braille, unlike sighted writing, appeals to the sense of touch and noted the uncertainties involved in the writing process. P5 shared, *"I think the reading process is very different from reading normal writing. I mean, it is necessary to read by touching. I think this would have been difficult for me."*. Similarly, P12 stated, *"Braille is actually Turkish; there is no difference in terms of letters, but reading is different. I don't know how to write, but that is also different."*.

In the category of barriers arising from undergraduate education, participants outside the special education program expressed strong opinions about the lack of a Braille literacy course. P9 highlighted this limitation, saying, *"This is not something we can learn on our own. A comprehensive course needs to be given. Your questions are very valuable, but I feel very inadequate now because I know almost nothing."*. P15 emphasized the challenges posed by the inclusion process, stating, *"We will not only teach normal children when we graduate; it was the same in the internship. There are also different, disabled children. How can I teach them when I haven't taken a course? If you ask me to write, I can't."*.

In addition to not taking a Braille literacy course, participants also expressed their limited knowledge about the visually impaired and noted the need for a course focused on this field. P6 commented, *"You told us about the visually impaired in the special education course, but I think it was for one week. We need to understand this group better. For example, there were people with low vision who did not use Braille. Who uses Braille and who doesn't? How do we determine this? It could be covered in a broader lesson. At least if it were offered as an elective course, I would choose it."*. Similarly, P21 reflected, *"As far as I remember, the visually impaired were a broad topic. So was relief writing. There were also math symbols. I would like to take a course on the visually impaired in addition to Braille, yes."*.

Discussion

This study aimed to explore the attitudes and perceptions of pre-service teachers who are expected to work with visually impaired students regarding Braille literacy. A mixed-methods approach was employed for this purpose. In the quantitative dimension, pre-service teachers' attitudes towards Braille literacy were measured using the Attitude Scale Towards Braille Writing, developed by Doğuş et al. (2019). For the qualitative dimension, a semi-structured interview form, designed by the researchers, was used to gather in-depth views on Braille literacy from pre-service teachers. This section first presents the quantitative findings, followed by a discussion of the qualitative data in relation to the existing literature.

The findings revealed that pre-service teachers hold predominantly positive attitudes towards Braille. Previous research conducted in Turkey similarly indicates a high level of positive attitudes among pre-service teachers towards Braille literacy (Karataş et al., 2024; Kurt & Ketenoğlu-Kayabaşı, 2022). These results underscore the critical importance of fostering positive attitudes towards Braille among pre-service teachers as a prerequisite for their successful acquisition and use of the Braille system. A positive stance on Braille literacy is not only essential for ensuring inclusion and equality in education but also reflects an increased awareness of the unique educational needs of visually impaired individuals. Furthermore, it enhances pre-service teachers' commitment to supporting Braille literacy processes.

Understanding that Braille serves as a vital tool for visually impaired students to achieve independence and academic success is likely to improve pre-service teachers' effectiveness in supporting these students' educational journeys. Additionally, sufficient knowledge of Braille literacy is expected to contribute to the professional growth of pre-service teachers and improve their communication skills with visually impaired students. In this context, the positive attitudes observed suggest that pre-service teachers are developing a more inclusive and empathetic approach to education.

The study found that the age variable did not have a significant effect on pre-service teachers' attitudes towards Braille writing. Previous research in the literature presents mixed findings regarding the impact of age on attitudes towards Braille writing and individuals with special needs (Karataş et al., 2024; Yaralı, 2015; 2016). For instance, Karataş et al. (2024) examined pre-service teachers' attitudes towards Braille writing and found no significant differences based on the age variable. Similarly, Yaralı (2015) investigated pre-service teachers' attitudes towards individuals with special needs and found that attitude levels did not differ according to age. However, in another study by Yaralı (2016), it was discovered that pre-service teachers' attitudes towards individuals with special needs varied significantly depending on the age variable. Therefore, it can be stated that the findings of this study regarding age align with many studies in the literature.

In contrast, the study found significant differences in pre-service teachers' attitudes towards Braille writing based on gender. Female pre-service teachers were found to have more positive attitudes towards Braille writing than their male counterparts. Similar findings have been reported in two previous studies conducted in Turkey, which examined pre-service teachers' attitudes towards Braille literacy (Karataş et al., 2024; Kurt & Ketenoğlu-Kayabaşı, 2022). Lazarus (2019), in her study with teachers, also found that female teachers had higher levels of knowledge and more positive attitudes towards the education of students with special needs. These findings regarding gender are consistent with the broader literature. In light of this, it is recommended that future research and training programs consider developing specialized studies aimed at male pre-service and in-service teachers.

Additionally, the study revealed that pre-service teachers enrolled in special education programs had more positive attitudes towards Braille writing compared to those studying in other departments. This outcome was anticipated by the researchers. Special education teaching programs, by their nature, emphasize the inclusion of individuals with special needs into society as equal and independent members more than other fields of study. Moreover, by the time pre-service special education teachers reach their fourth year, they have all completed a Braille literacy course, providing them with both theoretical and practical experiences with Braille writing. These teachers also have more opportunities to work closely with visually impaired individuals through various practicum courses compared to other pre-service teachers. For all these reasons, it can be interpreted that pre-service special education teachers exhibit more positive attitudes towards Braille literacy. In support of these findings, Karataş et al. (2024) also found that pre-service special education teachers had more favorable attitudes towards Braille writing than their peers in other disciplines.

Taking a course focused on visually impaired individuals not only increases pre-service teachers' knowledge but also positively influences their attitudes towards both visually impaired individuals and their education. In this study, it was found that pre-service teachers who had taken a course on visually impaired individuals exhibited more positive attitudes towards Braille writing than those who had not. Consistent with this finding, Karataş et al. (2024) reported that pre-service teachers who completed special education and Braille courses had more positive attitudes towards Braille writing. On the other hand, Kurt and Ketenoğlu-Kayabaşı (2022) found that pre-service teachers' attitudes towards Braille writing did not vary according to the number of special education courses they had taken. This suggests a need for further investigation into the content, organization, and instructional methods of special education courses. Future research could explore the relationship between pre-service teachers' attitudes towards Braille writing and the structure and delivery of such courses.

Additionally, this study found that pre-service teachers' attitudes towards Braille writing did not differ based on whether they had encountered a student with special needs during their teaching practicum or had a family member with special needs. The term "individual with special needs" used in this study was broad and did not specifically refer to individuals with visual impairments. Therefore, interactions with students who have intellectual disabilities or family members with learning disabilities may not directly influence attitudes towards Braille writing, although they may raise general awareness of special needs. This could explain why these variables did not lead to significant differences in attitudes towards Braille writing in this study. Consistent with these findings, Kurt and Ketenoğlu-Kayabaşı (2022) also reported that encountering a student with special needs did not significantly affect pre-service teachers' attitudes towards Braille writing. However, contrary to much of the literature, this study found that the presence of an individual with special needs in the family or close environment positively influenced attitudes towards Braille writing. When examining the broader literature, several studies indicate that the presence of individuals with special needs in the family or immediate environment does not significantly affect attitudes towards individuals with special needs (Gülünay et al., 2019; Şahin-Bekir, 2016; Yaralı, 2015; 2016). Thus, the finding in this study—that family members with special needs did not significantly affect attitudes towards Braille writing—aligns with much of the existing literature. However, this study found that interactions with visually impaired individuals specifically had a significant impact on pre-service teachers' attitudes towards Braille writing. Pre-service teachers who had interacted with visually impaired individuals exhibited more positive attitudes towards Braille writing. This finding suggests that focusing on visually impaired individuals as a distinct category within the broader classification of special needs may explain the observed difference. Given that Braille is an essential part of daily life for many visually impaired individuals, meaningful interactions with these individuals likely provide deeper insight into their specific needs. Moreover, studies have shown that teachers who have experience interacting with individuals with special needs tend to exhibit lower levels of anxiety and greater competence in educating these students (Sharma & Nuttal, 2015). Consistent with this, Karataş et al. (2024) found that pre-service teachers who had interacted with visually impaired individuals during their training displayed more positive attitudes towards Braille writing. In light of these findings,

it can be concluded that this study's results are in alignment with existing literature on the subject.

In this study, pre-service teachers were asked whether they would prefer to have a visually impaired student in their classrooms when they begin their teaching careers. More than half of the participants responded "no," a finding that warrants further attention. Although determining the reasons for this reluctance is outside the scope of this study, one possible explanation is the lack of training these pre-service teachers have received regarding visually impaired students and Braille literacy. In this context, the study revealed that participants who expressed a willingness to teach visually impaired students had more positive attitudes towards Braille writing. These findings are consistent with the results of Karataş et al. (2024) and Kurt and Ketenoğlu-Kayabaşı (2022), who also investigated pre-service teachers' attitudes towards Braille literacy.

Even limited interaction with Braille is valuable for raising awareness, even if pre-service teachers have not yet mastered the system. In this study, it was found that pre-service teachers who had prior experience with Braille exhibited more positive attitudes towards Braille literacy. Similarly, Karataş et al. (2024) demonstrated that completing a course on Braille positively influenced pre-service teachers' attitudes towards the writing system.

This study also examined two variables related to pre-service teachers' awareness of special needs and visually impaired individuals: watching films or TV series about visually impaired individuals and attending scientific meetings on special education. Both of these experiences have the potential to enhance pre-service teachers' awareness of special needs and the visually impaired. Indeed, the study revealed that pre-service teachers who had experienced both of these activities exhibited more positive attitudes towards Braille writing. Therefore, promoting artistic and scientific engagement to foster positive attitudes among pre-service teachers toward Braille literacy is highly recommended.

The findings from the qualitative research component of this study were obtained through content analysis, which identified three main themes: pedagogical competence, awareness of Braille, and challenges encountered in learning Braille. According to the definition of pedagogical competence, teachers must be able to utilize information, materials, and technologies effectively, in accordance with the needs of their students, to facilitate learning (Oktaviania et al., 2023). In this study, the pedagogical competence theme was divided into two main categories: knowledge and experience. The knowledge category consists of three subcodes: the writing system, its history, and its uses. The experience category was divided into personal experience and professional experience. Analysis of the findings revealed that pre-service teachers enrolled in programs other than special education had limited knowledge and experience related to Braille literacy. This lack of knowledge and experience poses a significant barrier to the effective education of visually impaired students. Many general education teachers must work with visually impaired students despite insufficient training and experience in Braille literacy (Aktaş & Argün, 2021; Atila, 2017; Çifci, 2021; Mallik & Mishra, 2021; Öz, 2019; Yazıcı & Sözbilir, 2020).

Research has shown that teachers require comprehensive training to improve their Braille reading and writing skills (D'Andrea et al., 2009). Holbrook and Koenig (2000) also emphasized that Braille education requires specialized expertise, and many teachers lack adequate training in this area. Furthermore, teachers need not only theoretical knowledge but also practical experience to effectively teach Braille to visually impaired students. Without sufficient knowledge and experience, teachers may struggle to teach Braille reading and writing skills effectively, which could negatively impact the academic achievement of visually impaired students. Therefore, it is crucial to offer more professional development opportunities to enhance teachers' knowledge and experience in Braille instruction (Wormsley & D'Andrea, 1997). Improving teachers' mastery of Braille will ultimately contribute to providing visually impaired students with higher-quality, more inclusive education.

The theme of sensitivity towards Braille can be divided into two primary categories: the importance of Braille and awareness of Braille. Within the category of importance, two key codes emerge: its significance for visually impaired individuals and its significance for educators. In contrast, the awareness category is not subdivided into codes, as it is considered from a more holistic perspective. Braille plays a critical role in empowering visually impaired individuals by fostering their independence and granting them access to education. This system provides equal educational opportunities by enabling visually impaired individuals to develop their reading and writing skills. The positive attitudes of pre-service teachers toward Braille encourage the broader adoption of this system in educational contexts. As awareness of Braille increases, so too does teachers' motivation to acquire the skill and teach it to their students. This underscores the importance of incorporating Braille education more thoroughly into teacher training programs. Pre-service teachers who develop positive attitudes towards Braille are better positioned to create more inclusive and accessible educational environments for visually impaired students in the future.

However, there are several challenges associated with learning Braille, many of which stem from the structural characteristics of the system. Braille consists of unique

combinations of six dots for each letter and symbol, and learning these combinations requires time, effort, and consistent practice. Especially for beginners, patience and repetition are key to mastering the system. The complexity of Braille's structure can also impede the development of fluency in reading. Additionally, the size and bulk of Braille materials mean that texts in Braille take up significantly more space than printed materials, which can be a limitation for individuals reading lengthy texts or seeking portable materials. During the learning process, individuals may also face a long adaptation period before becoming fully accustomed to Braille's structure. While these factors present obstacles, they can be mitigated with proper support and time.

One of the most significant barriers to learning Braille is the insufficient training provided to pre-service teachers in this field. Teachers who are not specialists in the education of visually impaired individuals often lack the necessary knowledge and skills to effectively teach Braille. As a result, the Braille learning process for students may be disrupted. The absence of courses on Braille and the education of visually impaired individuals within teacher training programs limits teachers' pedagogical approaches and hinders their ability to meet the individual needs of students. This deficiency can impede visually impaired students' access to equal educational opportunities. When teachers lack expertise in teaching Braille, it becomes difficult to prepare appropriate materials and manage the instructional process. Moreover, a lack of knowledge can negatively impact students' motivation and slow their learning progress. To achieve the goals of inclusion and equity in education, it is crucial for teachers to receive adequate training in Braille and the education of visually impaired individuals. This training would lead to more efficient and effective learning processes for visually impaired students, ultimately fostering their success and independence in education.

Pre-service teachers' attitudes and opinions about Braille represent a pivotal point in the education of visually impaired individuals. This study demonstrates that pre-service teachers' awareness and knowledge of Braille are critical to ensuring that visually impaired students have access to equal educational opportunities. Beyond serving as a mere writing system, Braille plays an essential role in helping visually impaired individuals achieve independence and fully integrate into society. In this regard, fostering positive attitudes and building sufficient knowledge about Braille among pre-service teachers is vital for establishing an inclusive education system. By strengthening the curriculum in this area, faculties of education can enhance the professional competencies of pre-service teachers, enabling them to provide more accessible and meaningful education for visually impaired students.

Conclusion, Limitations and Suggestions

The attitudes and opinions of pre-service teachers towards Braille writing represent a critical turning point in the education of visually impaired individuals. This study highlights that pre-service teachers' awareness and knowledge of Braille are key determinants in ensuring that students have equal access to educational opportunities. It is evident that Braille, far beyond being a mere writing system, plays an essential role in enabling visually impaired individuals to achieve independence and participate fully in society. In this regard, fostering positive attitudes and equipping pre-service teachers with sufficient knowledge of Braille will empower future educators to build a more inclusive education system. Enhancing the curriculum offered by faculties of education in this area will significantly improve the professional competencies of pre-service teachers, enabling them to deliver more accessible and meaningful education to visually impaired students.

However, this research is limited to universities located in two regions in Turkey. Future research could extend the study to include universities in different regions and examine additional variables. Moreover, it could be applied to special education teachers and subject teachers who work with students with visual impairments.

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