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Contact (Editor in Chief)

Emre YILDIZ

Department of Science Educatiom, Atatürk University, Kazım Karabekir Faculty of Education, Erzurum, Türkiye

✉ email: emre.yildiz@atauni.edu.tr

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Contact (Publisher)

Atatürk University

Atatürk University, Erzurum, Türkiye

Atatürk Üniversitesi Rektörlüğü 25240 Erzurum, Türkiye

✉ ataunijournals@atauni.edu.tr

https://bilimseldergiler.atauni.edu.tr

☎ +90 442 231 15 16

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Editor: Emre YILDIZ
Address: Atatürk University, Kâzım Karabekir Education Faculty, Erzurum, Türkiye
Phone: +90 442 231 44 80
E-mail: emre.yildiz@atauni.edu.tr

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An Evaluation of the Paid Teaching Policy from the Perspective of Administrators

Dilara VARNA ATEŞ[1]

Canan DEMİR YILDIZ[2]

Muş Alparslan University, Institute of Social Sciences, Educational Administration Department, Muş, Türkiye

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Corresponding author:
Dilara VARNA ATEŞ
E-mail: dilaravarnaa@gmail.com

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ABSTRACT

This article provides an in-depth examination of the effects of the employment of paid teachers on the education system, categorizing these effects into five main areas: school administrators, tenured teachers, students, parents, and differences arising from employment policies. The primary aim of the research is to evaluate the paid teaching policy from the perspective of administrators, focusing on its negative impact on school management and the quality of education. The study involved semi-structured interviews with 9 school principals and 9 vice principals. During the interviews, administrators were asked five key questions, and their responses were analyzed using descriptive analysis. The results indicate that the majority of administrators hold a negative view of the paid teaching policy. They expressed that paid teachers face significant challenges in the educational process due to a lack of subject knowledge and pedagogical training. Furthermore, these teachers often do not feel job security or continuity, leading them to perceive themselves as temporary and distinct from tenured teachers. This perception makes it difficult for them to adapt to the school culture and classroom environment, thereby hindering their ability to effectively deliver course content. Overall, administrators emphasized that the paid teaching policy fails to ensure sustainability and quality in education, arguing that it should be discontinued.

Keywords: Paid teaching, school administrators, productivity, sustainability, education quality.

Introduction

One of the most essential concepts necessary for nations to exist socially, culturally, and economically—and to transfer their cultural heritage to future generations—is instruction. Within the education system, students are considered as inputs, and through instruction delivered in accordance with the curriculum set by the Ministry of National Education and enriched with the cultural characteristics of society, it is expected that students will become beneficial to the national economy and grow into responsible citizens (Erol & Merze, 2023). Education, in this context, refers to the totality of processes through which individuals develop positive attitudes, skills, and behavioral patterns within the society in which they live (Sünbül, 2011). In other words, education is a social process that facilitates the optimal development of individuals' social abilities and personal growth. Within this process, the key components of the education system—students, teachers, curriculum and subject-matter experts, administrators, as well as the technologies, physical resources, and financial means employed—hold significant importance.

The quality of education is determined by the quality of educators. It is essential that teachers receive adequate training both before and during their professional careers, as this directly affects the quality of instruction provided (Ergüven, 2019, p. 2). The education system is a holistic structure, and the lack of qualifications among teachers—who constitute one of its most fundamental components—poses a significant threat to national development (Tuncer, 2012, p. 798). During their undergraduate education, teachers receive subject-specific training in order to become qualified educators, and they represent the core group needed to drive educational development and progress.

Within the context of educational systems, goals and outcomes are represented through achievement; therefore, an education system that contributes more significantly to student success is considered to be more effective than others. The term *school effectiveness* is used within the education system to describe variations among schools. Accordingly, a school that contributes more to student achievement is regarded as more effective (Demir Yıldız, 2020).

In Türkiye, teachers are employed under four different statuses at the primary and secondary education levels: permanent (tenured), contracted, substitute, and hourly-paid teachers who work in return for additional teaching hours. Hourly-paid teachers, considered a subcategory of temporary employment, are appointed based on Article 89 of the Civil Servants Law No. 657, which states: "In cases where no teachers or faculty members are available in educational institutions of all levels, including universities and academies (military academies included), additional teaching duties may be assigned for a fee to existing teachers, faculty members, other civil servants, or external appointees." Accordingly, the Council of Ministers, through its decision dated 01.07.2006 and numbered 11350, ruled that in cases of teacher shortages, university graduates could be employed as teachers in return for an hourly wage. Within this legal framework, hourly-paid teachers are employed under Article 9 of the "Regulation on Teaching and Additional Teaching Hours of the Ministry of National Education's Administrators and Teachers" when there is an insufficient number of teachers. The legal foundation of the hourly-paid teaching practice—arising from varying needs and expectations—is also supported by Article 4/C of the Civil Servants Law No. 657 and the provisions related to teaching and additional teaching hours in the Ministry of National Education's regulations. These provisions allow for the employment of hourly-paid, part-time, and temporary instructors when there is a shortage of qualified teaching staff (Öğülmüş, 2012). The aforementioned legal basis enables the assignment of paid additional teaching duties to teachers, academic staff, other public officials, or external appointees (Doğan & Demir, 2013). Decisions regarding teacher recruitment are made by the provincial and district directorates of national education. Hourly-paid teachers are compensated based on the number of lessons they teach, and their social security contributions are calculated and paid according to the total number of instructional hours (Polat, 2014).).

On the one hand, the issue of unemployed teacher candidates who are unable to secure permanent appointments, and on the other, the assignment of individuals who have merely graduated from any higher education institution to teaching positions due to a shortage of teachers, may appear contradictory on the surface. However, this situation is in fact a consequence of the neoliberal policies pursued. The diversification of teacher employment into permanent, contracted, and hourly-paid forms leads, in general, to problems such as job insecurity, wage injustice, and the erosion of labor organization. More specifically, it results in a decline in the quality of education, job dissatisfaction, alienation from the profession, a weakening sense of institutional belonging, and the emergence of various conflicts among administrators, teachers, students, and parents (Polat, 2014).

In his 2014 study, Polat examined the problems arising from the employment of hourly-paid teachers under five thematic categories. These themes include issues encountered with school administrators, problems in relations with tenured teachers, challenges experienced with students, conflicts with parents, and problems stemming from employment-related disparities.

The findings of the study revealed that the practice was associated with concepts such as "injustice/inequality," "servitude," and "disrespect for labor." It was also observed that hourly-paid teachers face significant disparities in terms of employment rights such as appointment, job security, health insurance, promotion, leave entitlements, salary, and retirement. Similar conclusions have been reached in studies conducted with contracted and hourly-paid teachers (Bayram, 2009; Karadeniz & Demir, 2010).

In conclusion, the segmentation within the teaching profession has led to significant inequalities for hourly-paid teachers, depriving them of job security and rendering them vulnerable in multiple dimensions. While this situation results in the marginalization of hourly-paid teachers, it also negatively affects the education system and students by creating an unregulated and unqualified workforce.

An examination of studies conducted within the scope of Turkiye's hourly-paid teaching policy reveals that;

Turhan (2011), based on survey data collected from 149 school administrators and teachers, concluded that the negative consequences of hourly-paid teaching are significant. The findings indicate that this practice poses an obstacle to improving the quality of education and should not be implemented unless absolutely necessary. In cases where its implementation is deemed unavoidable, the study emphasizes that only graduates of faculties of education should be employed, that in-service training should be provided to these teachers, and that there should be close cooperation between the Ministry of National Education and universities.

In a study conducted by Öğülmüş, Yıldırım, and Aslan (2013), surveys were administered to 122 hourly-paid teachers working in Tokat during the 2010–2011 academic year and to 85 administrators from their respective schools. The results revealed that the hourly-paid teachers held negative perceptions regarding their wages and employment rights, and that their level of professional commitment was low. The administrators, on the other

hand, reported that they found the competencies and performance levels of hourly-paid teachers to be inadequate and unsatisfactory.

In a study conducted by Doğan, Demir, and Turan (2013), a total of 217 minutes of interviews were carried out using a semi-structured interview form. The findings revealed that all of the administrators working within the Ministry of National Education stated that they did not approve of the hourly-paid teaching system and that they only employed hourly-paid teachers out of necessity.

Arslan, Sabah, and Göksu (2006) conducted interviews with 10 administrators working in primary schools in Gebze, Kocaeli. In addition to the administrators, tenured and contracted teachers were also surveyed. As a result, the administrators stated that the productivity of hourly-paid teachers was not at a satisfactory level. The findings of the study revealed that, when the productivity of tenured and hourly-paid teachers was compared, hourly-paid teachers demonstrated lower productivity across multiple dimensions.

In the study conducted by Akça, Meydan, and Sarıbaş (2020), the "Teacher Professional Commitment Scale" was administered to 120 hourly-paid teachers. The results indicated a statistically significant relationship between the teachers' level of professional commitment and the school level and subject area in which they worked. However, no significant relationship was found with variables such as place of assignment, year of graduation, gender, or duration of service. The study also revealed that hourly-paid teachers working in institutions other than preschool education showed lower levels of commitment compared to those working in preschool settings. The group with the lowest commitment scores consisted of hourly-paid teachers assigned to secondary education institutions.

In the study conducted by Tokmak, Ginesar, and Kaya (2023), hourly-paid teachers reported that they received extremely low wages, experienced discrimination from administrators, parents, and fellow teachers, and were unable to adapt to their jobs due to the short-term nature of their employment and the lack of job security. Based on the findings, the study recommended that the title "hourly-paid teacher" be reconsidered, improvements be made in their employment rights, access to in-service training opportunities be provided, and the problems they face not be overlooked.

In their study conducted in Bahçelievler, Istanbul, Cebiroğlu, Kılınçaslan, Çetin, and Apaka (2023) included 10 hourly-paid teachers, 10 tenured teachers, and 10 school administrators. The administrators stated that the primary source of the problems they experienced with hourly-paid teachers stemmed from the latter perceiving themselves as temporary and feeling labeled. They also noted that they did not intentionally differentiate between tenured and hourly-paid teachers. However, hourly-paid teachers reported that school administrators generally treated them differently from tenured teachers, assigned them a heavier workload, and tended to behave more harshly toward them due to their non-permanent status.

In their study involving 16 hourly-paid teachers, Bayar and Çelik (2020) identified key challenges faced by participants, including low salaries, limited employment rights, marginalization, lack of recognition, and inadequate social security coverage. As solutions, the participants recommended salary improvements, fair appointment processes, and enhancements in professional recognition and status.

Similarly, Arısan and Gerçek (2024), Evci (A., 2024), Evci (B., 2024) proposed various solutions to address the problems stemming from the hourly-paid teaching practice. These suggestions include the development of specialized training and support programs for hourly-paid teachers, the organization of stress management seminars, regular assessments of job satisfaction, improvement in wage levels, and the provision of career development support.

In another study, Gökşen and Oğuzhan (2019) conducted 20-minute interviews with 20 hourly-paid teachers working in Siverek, Şanlıurfa. The findings indicated that these teachers experienced low levels of professional satisfaction, exhibited tendencies to leave the profession, and were both financially and psychologically affected. Furthermore, they were found to require support in areas such as assessment and evaluation, subject-matter knowledge, and classroom management.

In their 2022 study conducted in Istanbul with 146 participants, Ayna and Deniz generated 70 metaphors related to the concept of hourly-paid teaching and classified them into seven main categories. These categories included: injustice (regarding wages and employment rights), insecurity (concerning professional, social, and future-related concerns), labor and struggle, necessity/obligation, professional reputation (both positive and negative), quality of education, and employment issues. The five most frequently cited metaphors were *slavery*, *seasonal worker*, *injustice*, *stepchild*, and *unfairness*.

Purpose of the Study

A review of the literature reveals that studies evaluating the outcomes of the hourly-paid teaching policy from the perspectives of administrators at different educational levels remain limited. In this regard, the present study is expected to contribute to the literature. The research aims to identify the problems arising from the employment of hourly-paid teachers and their impact on the quality of education by drawing on the views of school administrators.

In line with this objective, the study seeks to answer the following questions directed to school administrators:

- What are administrators' views on the problems encountered in the employment of hourly-paid teachers?
- What are administrators' perspectives regarding the sustainability of the hourly-paid teaching policy?
- What are administrators' opinions concerning the professional competencies of hourly-paid teachers?
- What do administrators think about the impact of hourly-paid teaching on students?
- How do administrators evaluate hourly-paid teaching in terms of educational quality?

Method

Research Model

In this study, interviews were conducted with school principals and vice principals working in schools that employ hourly-paid teachers, with the aim of identifying their views on the hourly-paid teaching policy. The study employed the phenomenological design, one of the qualitative research methods. Phenomenology is a research design used by researchers to explore and interpret individuals' lived experiences regarding a phenomenon that has been previously defined (Creswell, 2007).

Study Group

The study was conducted with the participation of nine principals and nine vice principals working in nine different schools located in the central district of Muş province. In determining the study group, a purposeful sampling method was employed. This method involves selecting units that best represent the characteristics intended to be studied (Yazıcıoğlu & Erdoğan, 2004). The participants were selected using criterion sampling, one of the purposeful sampling strategies. Criterion sampling is based on the principle of examining all cases that meet a predefined set of criteria. In this approach, only the units that satisfy the established conditions are included in the study (Yıldırım & Şimşek, 2008). Through this method, all schools employing hourly-paid teachers were selected in order to obtain detailed information about the key characteristics targeted by the research.

Among the nine schools included in the study, two are primary schools, three are lower secondary (middle) schools, one is a religious (Imam Hatip) middle school, two are Anatolian high schools, and two are vocational high schools. In the school selection process, particular attention was paid to ensuring that each school met the criterion of employing hourly-paid teachers.

Data Collection Tool

Data were collected through face-to-face interviews using a semi-structured interview form developed by the researcher, with administrators who agreed to participate in the study. The purpose of using a semi-structured interview form is to conduct a guided yet flexible interview based on pre-prepared questions (Ekiz, 2009). The interview form consisted of five open-ended questions. All interviews were conducted in person at a prearranged time and were audio-recorded with the participants' consent.

To ensure the confidentiality of participants' personal information, they were categorized into two groups: principals and vice principals. Each participant was assigned a code as follows: Principal 1 (P1), Principal 2 (P2), Vice Principal 1 (VP1), Vice Principal 2 (VP2), and so on…

The questions included in the semi-structured interview form are as follows:

1. Do you experience any problems regarding the employment of hourly-paid teachers? If so, what are these problems?
2. In your opinion, is the hourly-paid teaching practice sustainable? Why or why not?
3. Do you think there is a difference between hourly-paid teachers and tenured teachers? If so, what are

these differences?

4. From a student perspective, do you believe there are any drawbacks, deficiencies, or negative impacts of hourly-paid teaching? If so, what are they?

5. How do you evaluate the hourly-paid teaching policy in terms of educational quality?

The ethical process in the study was as follows:

- Ethics committee approval was obtained from Muş Alparslan University University Ethics Committee (Date: 18.07.2024, Number:150016)
- Informed consent has been obtained from the participants.

Data Analysis

In this study, descriptive analysis, one of the qualitative data analysis methods, was employed to analyze the data collected. This method was used to organize, interpret, and present the data obtained from interviews conducted with participants. The data were categorized and summarized within the framework of identified themes and findings, and then interpreted. This process also allowed for the identification of causal relationships among the statements provided by participants (Yıldırım & Şimşek, 2008).

During the data analysis phase, the inductive reasoning approach was utilized. All audio recordings were transcribed into Word documents, and the responses were compiled in accordance with the research questions. Repetitive statements were identified and grouped under thematic categories. These themes and related statements were presented in tables as excerpts, and the data were summarized along with frequency values for each expression. Additionally, notable quotations from participants were included to enhance the validity of the findings.

Results

The findings obtained from the study were categorized into six themes in line with the research objectives. These themes are: continuity and sense of belonging, economic and social rights, sustainability, student–teacher relationship, administrative challenges, and educational quality.

In the table below, the responses collected from principals and vice principals are thematized. The statements of the participants have been classified under the relevant themes, and frequency values have been indicated based on the participants' responses.

Upon examining the statements of the administrators, it becomes evident that issues related to continuity and sense of belonging are particularly prominent. Based on their responses, it can be inferred that hourly-paid teaching is a form of employment that negatively affects the continuity of education in both structural and emotional dimensions. The frequently emphasized notions of "short-term employment" (P1, P8, P9) and "perceiving the position as temporary" (VP6) indicate that hourly-paid teachers often view their professional roles as transitional. This perception limits the development of a professional identity and reduces the teacher's willingness to invest in the school or their students. Continuity is a key element in building school culture and enhancing student achievement within educational organizations (Fullan, 2007). However, the frequent turnover of hourly-paid teachers disrupts this continuity. Moreover, the expressions referring to a "lack of sense of belonging" (P2, P4, VP5) and "inability to take ownership of the school" (VP4, P6) demonstrate that hourly-paid teachers tend to form weak connections with their institutions. Organizational commitment is shaped by an employee's perception of being valued and needed within the institution (Meyer & Allen, 1991). Yet, due to the lack of job security and their temporary status, hourly-paid teachers often struggle to develop such a commitment, which in turn leads to disruptions across various dimensions—from teacher-student relationships to teamwork. In addition, several administrators emphasized systemic issues such as "disruption in educational processes" (VP2), "lack of continuity" (VP8), and "motivation problems" (VP7), which highlight the structural challenges posed by the employment of hourly-paid teachers. Students' need for pedagogical consistency and coherent learning experiences is frequently undermined by the constant rotation of teaching staff, thereby negatively affecting both academic performance and classroom engagement.

When analyzing administrators' comments under the theme of economic and social rights, it is clearly emphasized in their statements that hourly-paid teachers are economically disadvantaged. Expressions such as "receiving lower wages" (VP1), "working below minimum wage" (P8), and "low salaries" (P4, VP3, P6) point to the precarious financial situation of these teachers. This condition has a direct negative impact on job satisfaction, motivation, and professional commitment. According to Herzberg's (1959) two-factor motivation theory, *hygiene factors* such as salary must be adequately provided; otherwise, employees are unlikely to experience job

Table 1.
Perspectives of School Administrators on the Hourly-Paid Teaching Policy

Statements	Statements	Participants	f
Continuity and Sense of Belonging	*"Hourly-paid teachers work for short periods of time..." – P1* *"They do not feel sufficiently connected to the school." – P2* *"Due to their short-term employment, there is a lack of continuity in education." – VP2* *"Hourly-paid teachers tend to leave the job frequently... there is a lack of sense of belonging." – P4* *"Hourly-paid teachers are unable to take ownership of the school." – VP4* *"Due to the frequent turnover of hourly-paid teachers..." – M5* *"The sense of belonging remains underdeveloped." – VP5* *"Hourly-paid teachers are unable to take ownership of the school." – M6* *"Their short-term employment and their perception of themselves as temporary staff..." – VP6* *"Their short-term presence leads to problems with school attachment and motivation." – VP7* *"They are generally employed on a temporary basis." – P8* *"...makes it difficult to ensure continuity." – VP8* *"...their short-term employment..." – P9*	P1, P2, VP2, P4, VP4, P5, VP5, P6, VP6, VP7, P8, VP8, P9	13
Economic and Social Rights	"...receiving lower wages..." – VP1 "...working with low salaries..." – P2 "...working with low salaries and insufficient social rights..." – VP3 "The low salaries received by hourly-paid teachers..." – P4 "Improvement of the low salaries and social rights of hourly-paid teachers..." – VP4 "...low pay and inadequate social benefits..." – VP5 "...receiving low wages creates economic injustice." – P6 "...there should be regulations regarding salaries and employment rights." – P7 "...working below the minimum wage and lacking sufficient employment rights..." – P8 "...not being paid on official holidays and not having full insurance contributions..." – P9 "Hourly-paid teachers work for low wages and lack social benefits." – VP9	VP1, P2, VP3, P4, VP4, VP5, P6, P7, P8, P9, VP9	11

Sustainability	"I do not find the practice sustainable." – VP1 "Current conditions need to be improved for it to be sustainable." – VP4 "It is not a sustainable practice; it leads to inequality." – VP5 "It is not sustainable under current conditions." – VP6	VP1, VP4, VP5, VP6	4
Teacher–Student Relationship	"...students who are aware of the situation do not take hourly-paid teachers seriously..." – VP3 "...it negatively affects the teacher–student relationship." – VP5 "...it causes students not to take lessons seriously and leads to disciplinary problems." – VP8	VP3, VP5, VP8	3
Administrative Challenges	"...disruptions in lessons occur..." – VP2 "Out-of-field teachers place a burden on the administration." – P3 "Administrative workload increases due to the frequent turnover of hourly-paid teachers." – VP6 "...it increases the workload of administrators." – VP7 "The documents and lesson schedules of hourly-paid teachers create a significant workload." – P9 "...an increase in administrative tasks..." – VP9	VP2, P3, VP6, VP7, P9, VP9	6
Educational Quality	"...not being sufficiently beneficial to students..." – P1 "...it leads to a decline in the quality of education." – P2 "...students' academic achievement is negatively affected." – P3 "Out-of-field teachers negatively impact educational quality." – VP4 "...they are unable to master the subject matter." – VP5 "It lowers the quality of education." – P6 "Hourly-paid teachers do not take lessons seriously." – MY6 "Hourly-paid teachers' lack of focus on lessons reduces educational quality." – P7 "The inability of hourly-paid teachers to maintain classroom control negatively affects the continuity of education." – VP7 "Hourly-paid teachers working outside their field fail to establish communication." – VP8 "...it negatively affects the quality of education." – P9 "The lack of continuity in education reduces educational quality." – VP9	P1, P2, P3, VP4, VP5, P6, VP6, P7, VP7, VP8, P9, VP9	12

satisfaction, which in turn leads to reduced productivity and organizational commitment. Hourly-paid teachers earn significantly less than their tenured counterparts despite performing similar duties. This not only creates a personal sense of injustice but also fosters a broader perception of systemic inequality.

The administrators' evaluations under the theme of sustainability reveal that the current form of the hourly-paid teaching practice fails to offer a long-term solution, both structurally and ethically. Recurrent expressions such as “not sustainable under current conditions” (VP6) and “I do not find the practice sustainable” (VP1) highlight that, within the framework of current staffing policies, wage structures, and social rights, the hourly-paid teaching model cannot function as a stable or enduring component of the education system. Sustainability is not merely the ability to maintain a practice over time; it also refers to the capacity to provide effective, efficient, fair, and long-term solutions (WCED, 1987). However, due to factors such as low pay, lack of social security, and the temporary nature of employment, the hourly-paid teaching system fails to meet most of these criteria.

When examining the statements under the theme of teacher–student relationship, it becomes evident that the practice of hourly-paid teaching negatively affects students' perceptions of their teachers, the quality of teacher–student interactions, and classroom discipline. These findings also suggest that the practice is problematic in terms of pedagogical legitimacy. The administrators’ observations reveal how the status of hourly-paid teachers is perceived by students and how this perception shapes classroom dynamics. For instance, the statement “students who are aware of the situation do not take hourly-paid teachers seriously” (VP3) indicates that students recognize the teacher’s temporary status within the institution and develop corresponding behaviors. According to social interaction theory (Berger & Luckmann, 1966), individuals are aware of the social structures they operate within, and these structures shape their behaviors. When students perceive that a teacher holds a temporary and less secure position, their perception of the teacher’s authority weakens, making classroom management more difficult. The remark “it negatively affects the teacher–student relationship” (VP5) demonstrates that hourly-paid teaching hinders the formation of meaningful pedagogical bonds within the classroom. Relationship-building is a fundamental component of effective teaching and enables students to participate confidently in the learning process (Pianta, 1999). However, when a teacher is in a temporary, low-paid, and disadvantaged professional position, students are less likely to form long-term, trust-based relationships with them. Additionally, the statement “it causes students to not take lessons seriously and leads to disciplinary problems” (VP8) shows that hourly-paid teaching undermines pedagogical authority. One of the key sources of power in classroom management is the teacher’s institutional and professional authority (Emmer & Evertson, 2016). When this authority is clearly weakened by the system itself, it disrupts classroom discipline, weakens the learning environment, and results in decreased student motivation.

The administrators’ statements reveal that the hourly-paid teaching system causes not only pedagogical issues but also a range of challenges in terms of administrative processes. Through expressions such as “increase in administrative tasks” (VP9), “the workload caused by paperwork and lesson planning” (P9), and “increased workload for administrators” (VP7), they emphasize that the processes involved in hiring, assigning, tracking documents, and scheduling for hourly-paid teachers significantly increase the consumption of time, energy, and resources. This situation may lead administrators to divert attention from their core responsibilities—such as leadership, supervision, and school development—and experience administrative burnout (Grissom, Loeb & Mitani, 2015). Furthermore, the remark “out-of-field teachers are a burden on administration” (P3) highlights that assigning hourly-paid teachers to subjects outside their areas of expertise creates both pedagogical and managerial challenges. Such appointments not only lower the quality of instruction but also contribute to student underachievement and decreased motivation, requiring administrators to intervene and make ongoing adjustments. Out-of-field teaching assignments reduce the efficiency and effectiveness of workforce planning within educational institutions (Leithwood & Jantzi, 2005).

Finally, under the theme of educational quality, frequently recurring expressions such as “decline in the quality of education” (P2, P6, P9, VP4, VP9) and “not being sufficiently beneficial to students” (P1) suggest that the practice of employing hourly-paid teachers undermines the overall quality of educational services. Educational quality is not limited to the transmission of knowledge; it encompasses pedagogical competence, classroom management, communication skills, and assessment practices as a whole (OECD, 2005). However, as hourly-paid teachers often lack sufficient pedagogical training or qualifications, they struggle to perform effectively in these areas. Additionally, statements such as “inability of out-of-field teachers to establish communication” (VP8), “lack of subject mastery” (VP5), and “inability to maintain classroom control” (VP7) indicate that employing teachers outside their area of specialization compromises the pedagogical process. A teacher’s content knowledge is not only essential for conveying information but also for structuring learning,

guiding students, and deepening understanding (Shulman, 1986). When out-of-field teachers are unable to demonstrate these core competencies, learning processes become shallow and student motivation tends to decline. Moreover, remarks such as “lack of continuity” (VP9), “inability to fully focus on lessons” (P7), and “students not taking lessons seriously” (VP6) reflect the lack of motivation and disruption in pedagogical continuity stemming from the temporary nature of hourly-paid teaching. In education, continuity is achieved through the sustained development of teachers, curricula, and interpersonal relationships over time (Hargreaves, 2000). A constantly changing teaching workforce interrupts this continuity and may ultimately diminish the depth and quality of student learning.

Discussion

The findings of this study, which aimed to evaluate the policy of hourly-paid teaching from the perspectives of school administrators, reveal that hourly-paid teaching has long been perceived as a problem, negatively affects the quality of education, disrupts continuity and stability in the educational process, creates economic and social insecurity for hourly-paid teachers, leads to injustices, hinders healthy teacher–student relationships, and imposes administrative burdens on school management.

When examined in terms of continuity and sense of belonging, administrators reported that the short-term nature of hourly-paid teaching disrupts continuity and stability in education, undermines the development of a sense of belonging among hourly-paid teachers, and contributes to decreased motivation. Similar findings have been reported by Öğülmüş et al. (2013), Akça et al. (2020), and Tokmak et al. (2023), who emphasized the short-term employment structure of hourly-paid teachers and arrived at results consistent with those of the current study.

From the perspective of economic and social rights, the findings show that administrators perceive the low wages and insufficient employment and social rights of hourly-paid teachers as indicators of economic and social injustice. Although they perform duties similar to their tenured counterparts, hourly-paid teachers reportedly earn as little as one-fourth of the salary received by tenured teachers. This situation negatively affects their motivation, fosters a sense of job insecurity, and increases their tendency to leave the profession. These factors, in turn, hinder sustainability in education and weaken institutional belonging. Similar issues were highlighted by Öğülmüş et al. (2013) and Tokmak et al. (2023), who underscored the need to improve the wages and employment rights of hourly-paid teachers.

In terms of sustainability, most participants stated that the current hourly-paid teaching policy is not sustainable and that improvements are necessary. They emphasized that the practice lowers academic productivity and educational efficiency. These findings align with those of Aslan et al. (2006), who also concluded that hourly-paid teaching reduces effectiveness in education.

Regarding teacher–student relationships, participants noted that short-term employment disrupts the teacher–student dynamic within schools. Hourly-paid teachers without an educational background were seen to struggle with establishing effective communication with students. Additionally, students reportedly do not take hourly-paid teachers seriously once they realize their temporary status, which results in low student participation and academic engagement. Teachers working outside their subject area were also found to contribute little to students' academic progress. Similar findings were reported by Cebiroğlu et al. (2023), who pointed to teachers' perceptions of themselves as temporary and labeled as the root of these problems.

With respect to administrative challenges, some principals and vice principals stated that hourly-paid teachers place an additional burden on school administration. Participants highlighted challenges in planning and scheduling, difficulties in monitoring educational quality, and the repetitive administrative workload associated with recruiting, onboarding, and orienting each new hourly-paid teacher.

Finally, in terms of educational quality, all participants agreed that the hourly-paid teaching policy negatively affects the quality of education. They emphasized that the policy fails to provide academic benefits to students and creates challenges in classroom management and discipline. The short duration of employment was reported to undermine educational continuity and stability. These conclusions align with the findings of Turhan (2011), who argued that hourly-paid teaching obstructs improvements in education quality and should not be employed unless absolutely necessary. Similarly, Doğan, Demir, and Turan (2013) reported that none of the administrators they interviewed approved of the hourly-paid teaching system, stating that they only resort to it out of necessity.

Conclusion and Recommendations

In conclusion, the current implementation of the hourly-paid teaching policy in Turkey appears to be a significant barrier to improving the quality of education. The system fosters economic and social inequalities, undermines

teachers' sense of institutional belonging and motivation, imposes a continuous administrative burden on school leadership, and damages the continuity of the educational process.

Based on the findings of this study, several recommendations are presented for policymakers and researchers:

Recommendations for Policymakers

- Increase the number of tenured teachers within the national education system.
- Assign current tenured teachers with reduced course loads to schools in need, to cover shortages.
- Improve the economic and social rights of hourly-paid teachers.
- Ensure subject-area relevance, pedagogical training, and appropriate qualifications are considered in the assignment of hourly-paid teachers.
- Simplify administrative procedures and, where necessary, provide additional support personnel.
- Provide communication skills training to hourly-paid teachers to strengthen teacher–student relationships.
- Offer in-service training programs tailored to the needs of hourly-paid teachers.

Recommendations for Researchers

- This study was conducted in the central district of Muş; future research could be carried out in other cities and districts to obtain broader and more generalizable results.
- As this study focused solely on school principals and vice principals, future research could incorporate the perspectives of hourly-paid teachers themselves.
- A more in-depth review of national and international literature on the subject could be conducted to deepen the understanding of the issue.
- Longitudinal studies can be designed to assess the long-term effects of hourly-paid teaching on students' academic achievement, motivation, and overall educational quality.
- Comparative research could be conducted to evaluate the academic performance of classes taught by hourly-paid teachers versus those taught by tenured teachers.
- Further studies may explore the job satisfaction, motivation levels, and professional commitment of hourly-paid teachers.
- Finally, alternative models to the current hourly-paid teaching policy should be investigated and proposed.

Ethics Committee Approval: Ethics committee approval was obtained from Muş Alparslan University Scientific Research and Ethics Committee (Date: 18.07.2024, Number: 150016)

Informed Consent: All participants in this study provided informed consent prior to their involvement. They were informed about the purpose, procedures, and their rights, including the right to withdraw from the study at any time. Confidentiality and anonymity were assured, and the data collected was used solely for academic research purposes.

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Perspectives on Digital Translating and Reviewing in Digital Writing Practices: Insights from Pre-Service Teachers

Erman UZUN[1]

[1] Mersin University, Faculty of Education, Computer Education and Instructional Technology Department, Mersin, Türkiye

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Corresponding author: Erman Uzun
E-mail: ermanuzun@mersin.edu.tr

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ABSTRACT

Digital transformation has fundamentally reshaped writing practices in teacher education. Digital writing turns to be a core competency necessary for effective communication in educational settings. Mastery of digital writing practices empowers pre-service teachers to navigate and leverage digital tools, enhancing both teaching quality and student engagement. However, pre-service teachers face significant challenges in developing essential digital writing skills. Based on data collected through digital writing scale and semi-structured interviews, this mixed method study examines the perspectives of pre-service teachers in Mersin University regarding digital writing including its components, namely digital translating and digital reviewing. Through an Explanatory Mixed Method approach, this study integrates quantitative data from 118 participants and qualitative insights from 10 interviews with representatives, showing how demographic factors, academic fields of study, and systemic gaps impact teachers' digital writing skills. The study employed both quantitative analyses using Mann-Whitney U and Kruskal-Wallis H tests for demographic comparisons, and qualitative contextual analysis of interview data. The findings revealed significant differences in digital writing perspectives across academic departments, while other demographic variables showed no significant impact. Qualitative analysis identified the need for discipline-specific workshops, integration of practical tasks, improved access to resources, supporting peer collaboration and faculty mentorship, and supporting continuous professional development to support teacher educator programs. These findings contribute to digital transformation by understanding how teacher education programs can better prepare pre-service teachers for digital writing in their future classrooms.

Keywords: Digital writing, digital translating, digital reviewing, pre-service teacher education, digital transformation.

Introduction

The place of writing in human development is fundamental, serving as a vehicle for cultural transmission and societal organization. As it has been noted, the establishment of new writing systems and their usage contributed to the administration of agricultural practices, legal matters, and religious activities, and thus their supporting the formation of early societies (Bywater, 2013). For communities, writing serves as a means to pass down knowledge from one generation to the next, thereby preserving its cultural heritage and providing continuity in social practices. Over the years attention has turned to writing not just as a mode of communication but as a medium for social and cognitive growth. Writing practices, as described by Brandt (2015), not only impact individuals' identity formation but also act as a means of social mobility through allowing individuals to voice their thoughts through social discourse. Generating written texts encourages critical thinking and allows individuals to develop their conceptualizations of the world, thus adding value to a broader social stock of knowledge (Bazerman et al., 2018).

Digital platforms have revolutionized the way writing is used for social development. Digital writing has changed how people converse, giving individuals the opportunity to share information and create knowledge in innovative ways (Lankshear & Knobel, 2011). Digital writing can also help students develop skills for digital literacy in schools, including contributing to social inclusion and encouraging civic engagement.

Importance of Writing Skills

Writing involves complex cognitive processes, which can be better understood through the Hayes and Flower (1980) writing model. This model breaks down the writing process into three primary components: the task environment, the writer's long-term memory, and the writing processes, which include planning, translating, and reviewing (Flower

& Hayes, 1981). These components explain how writers actively solve problems by setting goals, generating ideas, and structuring their thoughts into a coherent narrative. By emphasizing the recursive nature of writing—where planning, drafting, and revising overlap—the model highlights the complexity of writing as a problem-solving activity that requires continuous cognitive engagement (Hayes, 2012).

Educational settings have widely applied this writing model to help students improve their writing skills by making them more aware of the underlying processes. Teachers can use this model to guide students in breaking down writing tasks into manageable stages, enhancing their ability to organize thoughts and refine their ideas (Graham & Perin, 2007). This structured approach not only improves writing outcomes but also helps students develop metacognitive skills that are transferable to other learning contexts (De La Paz & Graham, 2002).

Writing skills are fundamental to effective communication, personal development, and success across both academic and professional contexts. In the 21st century, writing has evolved to include not just the creation of coherent text but also the ability to articulate thoughts, engage with others, and analyze information critically (Graham & Harris, 2019). Writing supports individuals in organizing their thoughts and fostering structured approaches to expressing ideas, which are essential for problem-solving and cognitive development (Kellogg & Whiteford, 2012). Writing is also a powerful tool for learning, enabling students to reflect, synthesize information, and construct new knowledge through the process of creating text (Bazerman et al., 2018).

Writing in Education

Building on the previous discussion of writing models, Flower and Hayes (1981) further elaborated the stages involved in writing processes into three levels: the task environment, the writer's long-term memory, and the writing processes, which consists of planning, translating and reviewing functions. These elements describe how writers purposefully resolve challenges by making plans, producing concepts, and structuring their thoughts to create a complete story. The model emphasizes the iterative nature of writing (in which one plans, drafts, and revise), and the recursively-overlapping nature of this process (Hayes, 2012). This represents writing as a complex problem-solving activity that demands constant cognitive activity.

This model has been used extensively in educational contexts to make students aware of the underlying processes of writing so that they can improve their own writing behaviour. This model helps teachers to shape the writing process by guiding students in breaking writing down into manageable stages so that they are better able to organize their ideas and develop those ideas (Graham & Perin, 2007). In addition to improving writing results, this type of structure also assists students in developing metacognitive skills that transfer to other areas of learning (De La Paz & Graham, 2002).

Writing skills are also key to effective communication, personal development, and ultimately success in academic and professional aspects of life. In the 21st century, writing has expanded to not only producing coherent text but also composing thoughts, communicating with others, and critically engaging with information (Graham & Harris, 2019). Writing helps individuals to formulate their ideas and leads to structured means of expressing thoughts, which are vital for problem-solving and intellectual growth (Kellogg & Whiteford, 2012). Writing also serves a significant role in learning during literacy instruction (Graham & Harris, 2019).

Digital Writing from the Perspectives of Digital Transformation

The way education is delivered and skills develop, including writing, has been significantly transformed by digital transformation. The integration of technologies into educational contexts has radically reshaped conventional practices of writing as a dynamic, multi-layered digital process (Selwyn, 2011). The practice of writing has since evolved from pen and paper to digital, implying digital writing practices involving typing, multimedia, and online publishing (Davies & Merchant, 2014). This evolution corresponds with the reality that a multitude of possibilities are now available to both teachers and students for collaboration, production, and accessibility, contributing to a writing process that is far more inclusive of modern modes of communication (Richardson & Mancabelli, 2011). Accordingly, digital writing is defined as writing with IT tools (all kind of computers, smartphones, handheld devices, game consoles, smart TVs etc.) (Atabek, 2020).

Digital literacy is a concept that refers to the skills needed to effectively use digital technologies to access, evaluate, create, and communicate information (Bawden, 2008). In this regard, digital writing is an important part of this literacy, both in the sense of writing the text (the mechanical skill needed for writing) but also writing alongside incorporating forms of multimedia; also, writing accordingly to the different types of audience and knowing the different types of online "places" where these types of writing can take place (Ng, 2012). As well as education, promoting digital literacy, including digital writing, is critical for preparing students for the 21st century economy. Digital writing skills are beneficial, as students can thrive in the

knowledge economy where being able to communicate ideas clearly and creatively through creative digital products is so highly valued (Jenkins et al., 2016).

Impact of Digital Writing on Pre-Service Teachers

Recent studies have shown that digital writing significantly impacts pre-service teachers by enhancing their ability to integrate technology into their teaching practices and fostering a deeper understanding of digital literacy (Tondeur et al., 2017). Digital writing not only allows pre-service teachers chances to practice different methods for creating and sharing content in classroom, but also gives them a valuable opportunity to develop as versatile and reflective practitioners (Koehler et al., 2013). In addition, digital writing tasks promote collaborative learning (Kessler, 2018), providing further opportunities for pre-service teachers to co-create, revise and review content through collaborative efforts, reinforcing their pedagogical comprehension to assist students in a digital world.

Pre-service teachers are more confident using digital writing tools to support learning (Cochran-Smith et al., 2016). Through the act of writing digitally, pre-service teachers can come to experience the affordances and challenges of these technologies as they prepare to make decisions about how to appropriately and effectively incorporate digital tools into their classrooms. By practicing digital writing, themselves, these teachers build their own professional development as well as the ability to model digital literacy for their students, who will face an increasingly digital future.

Purpose of the Study

This study sheds light on how teacher education has changed in our digital era. With education aligning with technologically interactive trends, digital writing skills are crucial to develop /acquire. Digital writing is more than a means of communication; it is an integral element of digital-literacy skills, and teachers need those skills to be effective in digitally transformed classrooms. As Selwyn (2011) has highlighted, the digital age of education requires a different writing approach, especially within teacher education to prepare them for meaningful interactions with technology. In light of this need to mediate technology and pedagogy and the challenges posed by holding an analog mindset in response digital professional demands, this study contributes to the literature on digital writing in teacher education by examining the responses of pre-service teachers to issues related to adapting to the digital world. This was pedagogically important as this work contributes to the understanding of how we can develop and design teacher education programs that incorporate digital writing skills such as digital translating and digital reviewing to facilitate teacher education for teaching in the 21st century (Jenkins et al., 2016).

This study aimed to explore the perspectives of the pre-service teachers at Mersin University regarding what skills digital writing involves and to what end, which constitutes an important cornerstone for advancing teacher education in the context of digital transformation. Digital writing consists of key elements like digital translating, through which texts individuals modify and adapt into digital formats, and digital reviewing involving analytical evaluation and editing of digital texts. This study aims to provide valuable insights on how pre-service teachers perceive these components and the underlying value they assign to them, which will then inform the design of programs for teacher education. Integrating these programs should be done in a way that facilitates digital literacy, flexibility and develops professional growth of future educators, and thereby contributes to the improvement the quality of teaching and the academic benefits of students.

In the digital age, writing has become an essential aspect of education where it has many advantages, both within and beyond the educational environment. Despite the challenges, particularly around maintaining writing quality, controlling information overload, and navigating biased content, the benefits—like improved collaboration, increased access, and the empowerment of underrepresented voices—position digital writing as an essential ability to possess in the 21st century. With education systems also undergoing changes to keep pace with technological developments, incorporating digital writing into curricula is key to preparing both students and educators for success in a progressively more digital world. In this regard, research questions of this study:

- Are there significant differences in the perspectives of pre-service teachers on digital writing, digital translating, and digital reviewing based on demographic variables such as age, prior digital experience, and field of study?
- What are the perspectives of pre-service teachers on digital writing?
- What are the primary challenges faced by pre-service teachers on digital writing?
- What strategies do pre-service teachers suggest for improving digital writing skills?

Method

Research Model

This study used an explanatory mixed method design, which combines quantitative and qualitative methods in the development of knowledge, clarify pre-service

teachers' perspectives on digital writing, specifically digital translating and digital reviewing. This mixed method design enables researchers to collect preliminary quantitative data to reveal broad trends, followed by qualitative data collection that helps to explain the quantitative trends (Creswell & Plano-Clark, 2018). This method works well for the phenomena under study, digital writing in teacher education, synthesizing broad curricular trends and individual participants' data into a viable model for developing teacher education programs.

Population and Sample

The population of the study consists of pre-service teachers enrolled at the Faculty of Education at Mersin University during the 2023-2024 academic year. The study utilized convenience sampling to collect data, which facilitated the participation of those who were more readily accessible and willing to contribute, making it easier to include participants without imposing. Convenience sampling can help improve response rates and overall participation, contributing to a more representative sample of pre-service teachers at Mersin University (Etikan et al., 2016). 118 pre-service teachers from various departments were the participants of the quantitative phase of the study.

Table 1 summarizes the demographic and usage-related characteristics of the participants (N = 118). The majority of participants were female (67.8%), and the age distribution was primarily centered around 20–21 years (60.17%). Participants represented various academic departments, including Science Education (27.12%), Guidance and Psychological Counseling (11.86%), Turkish Education (16.95%), Elementary Mathematics Education (22.88%), and other fields (21.19%). GPA levels were predominantly within the 2.50–3.49 range (81.36%), indicating strong academic performance overall. In terms of technology usage, 56.78% of participants reported moderate proficiency, while 29.66% identified as good users. Regarding internet usage, most participants (50%) reported using the internet for 3–5 hours daily, with 33.05% exceeding 5 hours.

In the qualitative phase, 10 pre-service teachers from different departments were interviewed. The interviewees included class representatives, who were chosen to ensure a diverse range of perspectives regarding digital writing practices. This two-phase approach aimed to provide both a broad overview and in-depth exploration of pre-service teachers' experiences and attitudes towards digital writing (Teddlie & Tashakkori, 2009).

Table 1.

Descriptive Statistics of Participants' Demographic and Usage Characteristics (n=118)

Variable	F	%	Cum. %
Gender			
Female	80	67.8	67.8
Male	38	32.2	100
Total	118		
Age			
18	3	2.54	2.54
19	13	11.01	13.55
20	33	27.97	41.52
21	38	32.20	73.72
22	19	16.10	89.82
23 or older	12	10.17	100
Department			
Science Education	32	27.12	27.12
Guidance and Psychological Counseling	14	11.86	38.98
Turkish Education	20	16.95	55.93
Elementary Mathematics Education	27	22.88	78.81
Other	25	21.19	100
GPA			
1.00-1.99	1	.85	.85
2.00-2.49	5	4.24	5.09
2.50-2.99	41	34.75	39.84
3.00-3.49	55	46.61	86.45
3.50-4.00	16	13.55	100
Technology Usage Level			
Weak	9	7.63	7.63
Moderate	67	56.78	64.41
Good	35	29.66	94.07
Very Good	7	5.93	100
Internet Usage			
Less than 3 hours	20	16.95	16.95
3-5 hours	59	50.00	66.95
More than 5 hours	39	33.05	100

Data Collection Tool

For the quantitative phase, data was collected using a Digital Writing Scale, designed to measure teachers' perspectives on digital writing. The scale was developed by Atabek (2020) and consists of 14 items in a 5-point Likert format. A two-factor model, both of which consists of 7 items, was obtained. First factor is digital translating which is restructuring and organising texts in digital format. Second factor is digital reviewing. It is analytical evaluation and organisation of digital texts. The Cronbach's α coefficients were .899 for the whole digital writing scale, .851 for the digital translating factor and .852 for the digital reviewing factor. The scale consisted of items addressing various aspects of digital writing, including digital translating and digital reviewing. It was administered to

approximately 118 pre-service teachers. The qualitative phase involved semi-structured interviews with 10 pre-service teachers. The interview questions were developed by the researcher and reviewed by two experts in the field of educational technology to ensure content validity. Additionally, a pilot interview was conducted with one pre-service teacher to test the clarity and appropriateness of the questions (Kallio et al., 2016).

Validity and Reliability

To ensure validity and reliability in both quantitative and qualitative phases, several strategies were employed. For the quantitative scale, content validity was established through expert reviews, and a pilot study was conducted to refine the items based on feedback. The internal consistency of the scale was assessed using Cronbach's alpha to ensure reliability, with a value of .80 or higher being considered acceptable (Field, 2018). For the qualitative interviews, credibility was ensured through member checking, where participants were given the opportunity to review and confirm the accuracy of the interview transcripts. Additionally, triangulation was employed by using multiple data sources (quantitative and qualitative) to enhance the validity of the findings (Lincoln & Guba, 1985).

The ethical process in the study was as follows:

- Ethics committee approval was obtained from Mersin University, Social and Human Sciences Ethics Committee (Date: 11.06.2024, Number: 188)
- Informed consent has been obtained from the participants.

Data Analysis

The data analysis in this study was conducted using both quantitative and qualitative methods, aligning with the Explanatory Mixed Method design. The combination of these approaches aimed to provide a comprehensive understanding of pre-service teachers' perspectives on digital writing, including aspects such as digital translating and digital reviewing.

Quantitative Data Analysis

The quantitative data obtained from the Digital Writing Awareness Scale were analyzed descriptively and were used to summarize the general trends in participants' responses, providing insights into their perspectives on digital writing. Measures such as means, standard deviations, and frequency distributions were calculated to understand the central tendencies and variability in the responses (Field, 2018).

In addition, Mann-Whitney U and Kruskal-Wallis H were conducted to examine potential differences in digital writing skills based on demographic variables such as gender, age, GPA, department, technology usage level, or Internet usage. These analyses were used for an exploration of whether specific groups demonstrated significantly different levels of digital writing awareness or skills (Pallant, 2020).

Qualitative Data Analysis

The qualitative data gathered from semi-structured interviews with 10 pre-service teachers were analyzed using contextual analysis. This approach facilitated an in-depth examination of participants' experiences and perspectives on digital writing within their unique personal, social, educational, and professional contexts. The analysis involved thematic coding to identify key elements inductively to reflect participants' experiences about digital writing tools. The aim was to explore how participants perceive the digital writing, their view on future teaching practices and to uncover specific challenges they face. The analysis followed these key steps:

Systematic Coding: The interview data were initially coded into concise units, each representing a specific concept or experience. This process aimed to reduce the data into manageable segments while retaining its richness and diversity (Saldaña, 2021).

For instance, statements about "formatting difficulties" or "struggles with LaTeX" were coded as "digital translating challenges." Similarly, comments on "peer feedback" and "meticulous error correction" were coded as "digital reviewing practices." These codes captured specific elements while remaining sensitive to the participants' professional training context.

Thematization: The codes were grouped into broader themes that captured shared patterns across the data. These themes, such as "technical challenges," "preparedness for teaching," and "educational support needs," provided a structured understanding of the data (Braun & Clarke, 2006).

The codes were grouped into broader themes, reflecting patterns in the data. For example:

- The code "formatting difficulties" became part of the theme "Technical Barriers."
- Codes such as "peer collaboration" and "feedback mechanisms" informed the theme "Collaborative Reviewing Processes." This step ensured that the participants' challenges and experiences were systematically organized into meaningful categories.

Contextualization: The themes were interpreted within the unique context of the participants—pre-service teachers preparing for future roles in a digitally evolving educational

environment. This step ensured that the analysis considered the local challenges, resources, and expectations shaping the participants' experiences (Miles et al., 2014).

The identified themes were interpreted in relation to the specific context of pre-service teachers at Mersin University Faculty of Education. For instance:

- The theme "Technical Barriers" was linked to the availability and usage of tools like Microsoft Word and GeoGebra in teacher education programs.
- The theme "Preparedness for Future Teaching" emphasized how participants connected their current digital skills to their future teaching responsibilities.
- By aligning the themes with this specific educational context, the analysis captured not only what participants experienced but also why these experiences mattered within their training environment.

Alignment with Research Questions: Themes were refined and categorized to directly address the study's research questions. Categories like "technical barriers in digital translating" and "preparedness for future teaching" were developed to maintain alignment with the study's objectives (Nowell et al., 2017).

The themes were further refined into categories and subcategories to directly address the research questions. For example:

- For the question " What are the primary challenges faced by pre-service teachers on digital writing?" categories like "Technical Challenges", "Motivational Barriers", and "Curriculum Gaps" were created.
  These categories ensured that the analysis remained focused and aligned with the study's objectives.

Synthesis and Reporting: The findings were synthesized to provide a cohesive narrative that links the participants' experiences to the broader educational context. This approach facilitated a deeper understanding of how digital skills are developed and supported within the teacher education program (Creswell & Poth, 2018).

Finally, the findings were presented with a clear connection to the participants' educational context. For example, challenges like "limited access to digital tools" and "insufficient practical training" were interpreted within the framework of teacher education at Mersin University. This ensured that the analysis was both comprehensive and context-sensitive.

Contextual analysis is distinct from other qualitative methods as it prioritizes the integration of participants' lived experiences with the specific setting in which these experiences occur.

To ensure credibility, preliminary findings were shared with participants for validation. This process allowed for a comprehensive understanding of the data while maintaining trustworthiness and rigor (Lincoln & Guba, 1985).

Triangulation

To enhance the validity of the findings, triangulation was used by comparing and contrasting the quantitative and qualitative data. This integration allowed for the verification of results and provided a more comprehensive picture of pre-service teachers' attitudes toward digital writing. By utilizing both types of data, the study aimed to establish stronger conclusions and ensure the credibility of the research outcomes (Creswell & Plano-Clark, 2018).

Results

The results of this study integrate findings from both contextual analysis of qualitative data and quantitative analyses were represented below in line with the research questions. This dual perspective offers a comprehensive understanding of pre-service teachers' experiences and perceptions of digital writing. Quantitative findings indicate the relationship between demographics (gender, age, GPA, department, technology usage level, or Internet usage) and digital writing skills, while qualitative data provide depth and illustrate the various challenges and strategies related to digital translating and reviewing. Hence, in addition to the state of pre-service teachers' readiness for digital writing, these findings highlight systemic gaps within teacher education programs and provide hued insights to address the disconnect between theory and practice with respect to digital literacy development.

Demographic Influences

The findings reveal notable demographic influences on pre-service teachers' perspectives on digital writing. Quantitative analysis identified significant differences between academic departments in overall digital writing perspectives. However, no significant differences were found in digital writing perspectives or its subcomponents—digital translating and digital reviewing—across other demographic variables such as gender, age, GPA, department, technology usage level, or Internet usage. For all variables, the distribution was deviated from normality ($p < .05$). As the assumptions for parametric testing are violated, a non-parametric test was used to compare the groups.

Department: The Kruskal-Wallis H test was conducted to

determine whether there were statistically significant differences in digital writing, digital translating, and digital reviewing scores across department groups. The results indicated that there was a significant difference in digital writing across department groups (H (2) =11.32, p = .023). Regarding digital translating, the results indicated no statistically significant differences among department groups (H (2) =7.04, p = .134). For digital reviewing, the results indicated no statistically significant differences among the department groups (H (2) =9.03, p = .60).

The qualitative findings align with the quantitative results, showing significant differences in digital writing perspectives across academic departments, particularly between STEM (science and mathematics) and language-focused disciplines. Participants from STEM fields frequently emphasized the technical complexity of their tasks and the lack of specific training for tools essential to their disciplines. Participant 10 shared that "In mathematics, digital writing is about accuracy. Tools like LaTeX are essential, but we don't get any training on how to use them, which makes it frustrating…".

Similarly, Participant 2 highlighted that "…For lab reports, inserting graphs or formulas into a document takes so much time, and we're not taught how to do it efficiently...".

In contrast, participants from language-focused disciplines expressed a more positive outlook on digital writing, often linking it to creativity and enhanced student engagement. For example, Participant 9 noted that "…In English teaching, digital writing enables me to design interactive and engaging lesson materials, like digital storybooks or presentations...". Similarly, Participant 3 highlighted "…Digital writing offers an opportunity to incorporate storytelling into my teaching, making the material more accessible and interesting for students...".

These distinctions underscore the diverse requirements across academic fields, indicating that students in math and science faced specific obstacles when developing proficiency in digital writing. Conversely, students teaching on language-related field find an advantage in their disciplines' inherent incorporation of imaginative writing exercises.

Gender: A Mann-Whitney U test was conducted for digital writing total scores and there was no statistically significant difference between males (n=38) and females (n=80), U= 1447.0, p= .672. Additionally, the test was employed to examine whether there were significant differences in digital translating scores by gender. The results indicated no statistically significant difference between males (n=38) and females (n=80), U=1422.5, p= .568. For digital recognition scores, there was no statistically significant difference between males (n=38) and females (n= 80), U=1383.5, p = .418.

Conversely, male participants frequently mentioned a preference for manual or traditional methods of reviewing. One of the male participants named as Participant 5 noted that "I find it difficult to catch errors on a screen, so I usually print my work and review it manually. It's just easier for me to focus that way…". This preference for manual proofreading was highlighted by Participant 4, who shared "…Screen reviewing feels overwhelming for me. I often lose track of what I've already checked, so printing it out feels more reliable…". However, female participants may feel more comfortable leveraging digital tools for accuracy and efficiency. Participant 9 summarized this divide as "I think it's about what you trust more. Some of my male classmates find digital tools unnecessary or complicated, but I see them as essential for catching small details…".

Age: A Mann-Whitney U test was conducted to examine whether there were significant differences in digital translating, digital reviewing, and digital writing scores between age groups (under 20 vs. 20 and above). These results suggest that the age group under 20 (n=49) and 20 or above (n=69) does not significantly affect participants' scores across the dimensions of the digital writing total score (U=1730, p=.829) and the digital translating (U=1787.5, p= .590) or digital reviewing (U=1625.5, p= .716) subscales. This consistency highlights the similar perceptions of digital capabilities across the age groups.

The qualitative findings support the quantitative results that age does not significantly influence digital writing skills. The participants frequently pointed out that digital writing proficiency depends more on training and access than on age differences. Participant 7 remarked that "…I don't think age matters much. Even younger people struggle with digital tools if they haven't been properly introduced to them in an educational setting…". Similarly, Participant 8 noted that "…Even older students can learn digital tools quickly if they're given proper training. It's not about age; it's about access and opportunities…". These insights suggest that digital writing skills are shaped more by structural factors than by individual age-related differences.

GPA: A Mann-Whitney U test was conducted to determine whether there were statistically significant differences in digital translating, digital reviewing, and digital writing scores across students' grouped by GPA. The results indicate no statistically significant differences between students' GPA grades below 3 (n=47) and those with grades 3 or above (n=71) across the digital writing total score (U=1531.5, p=.446) and the digital translating (U=1542, p=.479) or digital reviewing (U=1574, p= .593) subscales.

The qualitative findings align with the quantitative results, indicating that GPA does not significantly influence digital writing skills. The participants emphasized that academic success does not necessarily equate to proficiency in digital writing, as these skills require specific training and practice. Participant 4 stated that "…Whether you have high grades or not, it doesn't make a difference if you're not taught how to use the tools. We're all in the same situation…". Similarly, the participant 9 noted that "…Even if you have high grades, that doesn't mean you're good at digital writing. You need to explore and practice on your own..." These perspectives further reinforce that digital writing proficiency depends on more practical opportunities than on general academic achievement.

Technology Usage Level: A Mann-Whitney U test was conducted to determine whether there were statistically significant differences in digital writing, digital translating, and digital reviewing scores across technology usage levels among three groups ("Weak to Moderate", "Good to Very Good"). The results indicate no statistically significant differences between weak to moderate technology usage (n=76) and good to very good technology usage (n=42) across the digital writing total score (U=1367.5, p=.193) and the digital translating (U=1446, p=.390) or digital reviewing (U=1359, p=.169) subscales. These findings suggest that the participants' scores on digital translating, digital reviewing, and overall digital writing are comparable regardless of their technology usage level.

The qualitative findings support the quantitative results that technology usage level does not significantly influence digital writing skills. Participants frequently highlighted that using technology in daily life does not necessarily translate into proficiency in digital writing for academic or professional purposes. Participant 7 highlighted that "It doesn't matter how often we use the internet; what we lack is proper guidance and practice with digital tools in our coursework." Similarly, Participant 6 noted that "Using technology regularly doesn't mean you know how to use it for tasks like digital writing. It's a completely different skill set.". These insights underscore that digital writing proficiency depends more on structured training and practice rather than general technology usage habits.

Internet Usage: The Kruskal-Wallis H test was conducted to examine whether there were statistically significant differences in digital writing, digital translating, and digital reviewing scores across Internet usage groups (low, moderate, high). Regarding the digital writing total score, the results indicated no statistically significant differences among low internet usage (n=20), moderate internet usage (n=59), and high internet usage (n=39), groups (H (2) = .32, p= .852). Similarly, for digital translating, the results indicated no statistically significant differences among the internet usage groups (H (2) = .98, p= .613). For digital reviewing, the results indicated no statistically significant differences among the internet usage groups (H (2)= .09, p= .956). These findings suggest that participants' perspectives on digital translating, reviewing, and writing are consistent regardless of the amount of time they spend using the Internet.

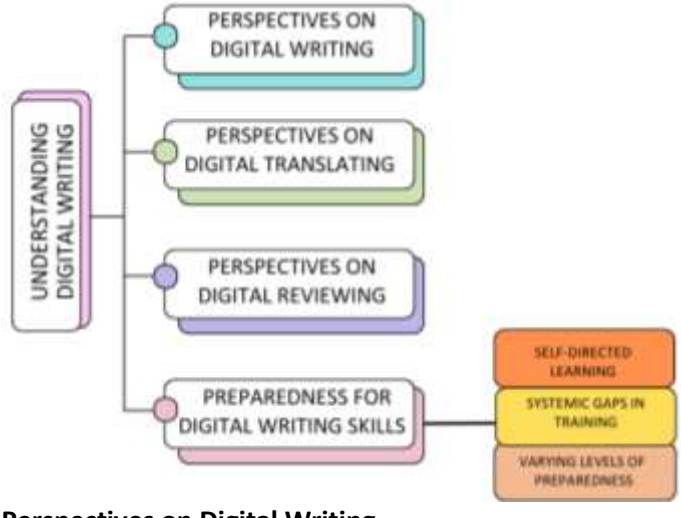
The qualitative findings align with the quantitative results, suggesting that frequent internet browsing or extensive social media engagement do not significantly influence digital writing skills. Participants often highlighted that frequent use of technology or social platforms does not equate to proficiency in academic or professional digital writing. Participant 6 stated that "Using social media every day doesn't mean you can effectively use tools for writing assignments or lesson plans…". Similarly, Participant 7 pointed out that "…It doesn't matter how much time you spend online; without structured learning, you won't develop the skills needed for digital writing…". These perspectives reinforce that digital writing proficiency is more closely tied to targeted training and educational opportunities than to general internet or social media use.

Understanding Digital Writing

This section investigates the perspectives of pre-service teachers on writing in digital formats, and whether pre-service teachers feel prepared to use skills such as digital translating and digital reviewing in academic and professional situations. As it can be seen in Figure 1, contextual analysis shows different perspectives on the importance of digital writing, its difficulties, and pre-service teachers' readiness to apply these skills in professional and academic settings.

Figure 1

Perspectives of Pre-Service Teachers on Digital Writing



Perspectives on Digital Writing

Pre-service teachers view digital writing as an evolving

practice that extends beyond traditional text production. The participants often stressed that digital writing incorporates multimedia, interactivity, and complex formatting that contributes to interesting, effective communication. For instance, Participant 9, an English teacher candidate, described the digital writing as, "Not just typing on a computer, but creating something dynamic—adding visuals, hyperlinks, and even videos to enhance communication."

Candidates from language-focused disciplines often highlighted the creative potential of digital writing. Participant 3 stated that "Digital writing allows me to prepare interactive lesson materials, like digital storybooks or presentations, that engage students more effectively."

However, the participants from technical fields, such as mathematics and science, expressed a more utilitarian perspective. Participant 10 pointed out that "…For us, digital writing isn't about creativity—it's about accuracy. Tools like LaTeX are essential, but they're hard to master, making the process frustrating…"

These differences indicate that what pre-service teachers understand about digital writing is molded by the demands of different academic frameworks. This distinction was echoed in quantitative findings, which indicated that participants in language-related programs perceived significantly higher levels of digital writing than those in technical fields.

Perspectives on Digital Translating

Turning traditional or handwritten ontent into digital formats is known as digital translating. It was an essential skill, but one that was difficult to do. The participants often described format issues and technical limitations as impediments to successful digital translating. Participant 6 explained as "Even something simple like converting handwritten notes into a Word document can be time-consuming when the formatting doesn't align..."

This challenge was particularly pronounced among participants from math and science fields. Participant 2 described their struggles as "…When I'm working on lab reports, inserting tables or graphs into a document is a struggle. It takes more time to fix formatting than to write the report itself."

Despite these difficulties, many participants acknowledged the necessity of mastering digital translating for future teaching practices. Participant 7 remarked that "…Digital translating is something we'll need in the classroom. Whether it's digitizing lesson plans or creating resources, it's unavoidable…".

Perspectives on Digital Reviewing

Digital reviewing—the process of evaluating and editing digital texts—elicited mixed responses from participants. Many expressed confidences in basic reviewing tasks, such as proofreading essays or presentations, but struggled with more advanced or technical content. Participant 8 noted that "…I find it hard to spot mistakes on a screen. I often print my work and review it manually to ensure I don't miss anything…".

Participants from language-focused fields demonstrated greater comfort with digital reviewing tools. For example, participant 1 noted this point as "Using digital tools for reviewing, like Grammarly or collaborative platforms, makes the process faster and more effective…".

However, technical challenges were more prominent among participants from math and science fields, where reviewing mathematical or scientific content digitally posed significant difficulties. Participant 10 explained that "Reviewing mathematical content digitally is tough. Even small formatting errors can disrupt the clarity of the entire document…".

Preparedness for Digital Writing Skills

Self-Directed Learning: Despite these systemic gaps, some participants demonstrated proactive efforts to improve their digital writing skills. Participant 9 shared that "I've started exploring tools like Canva and Book Creator on my own because I know I'll need them as a teacher. It's been a steep learning curve, but it's worth it…".

The findings reveal that while pre-service teachers recognize the importance of digital writing, many feel underprepared to use digital translating and reviewing skills effectively.

Systemic Gaps in Training: The participants reported feeling that their teacher education programs emphasized theory over application, leaving them without the skills they needed on the job. Participant 4 commented that "…Our coursework doesn't include enough opportunities to practice with the tools we'll need in the classroom. It's all theory, no application."

This view was highlighted by Participant 7, who emphasized the importance of hands-on training as "If we had more workshops or practice sessions, I think we'd all feel much more confident in our abilities…".

Varying Levels of Preparedness: Depending on their field of study and experience, participants had different preparedness for digital writing tasks, particularly converting and reviewing. The participants from language-related disciplines, however, expressed higher confidence rates in general, as coursework often required extensive

writing and editing tasks. Participant 9 stated that "We use digital tools for almost every assignment, so I feel more comfortable with digital writing than I did when I started university."

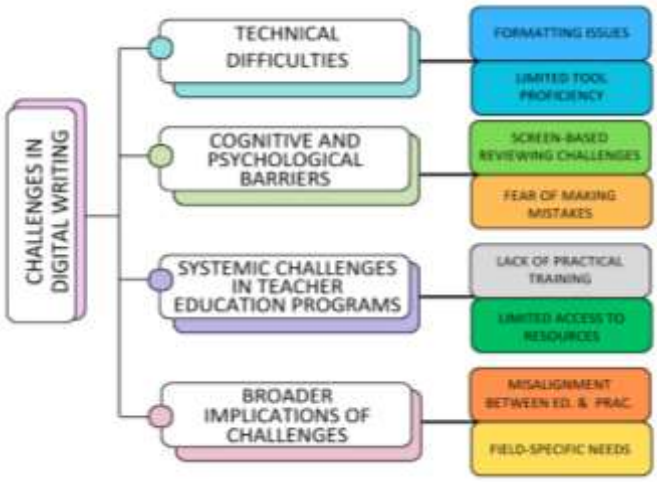
However, those from technical backgrounds tended to feel less prepared due to the lack of discipline-specific training. Participant 10 highlighted that "We've never been taught how to use tools like LaTeX or GeoGebra, which are essential for our field. I feel unprepared to use these in a professional context."

Challenges in Digital Writing

This section explores the specific challenges pre-service teachers face in digital writing, focusing on the subcomponents of digital translating and digital reviewing. The findings reveal technical, cognitive, and systemic barriers that affect participants' ability to effectively engage with digital writing tasks. As it can be seen in Figure 2, these challenges are organized into four key themes: technical difficulties, cognitive and psychological barriers, systemic challenges in teacher education programs, and broader implication of challenges.

Figure 2

Challenges for Pre-Service Teachers in Digital Writing



Technical Difficulties

Formatting Issues: Document formatting issues, especially during digital translating tasks, were the most common technical problems mentioned throughout the digital writing process. The participants frequently reported that the process of content creation was often overshadowed by the challenges associated with formatting tasks. These included aligning text, incorporating images, and organizing tables, which often demanded more effort than the writing processitself. Participant 6 noted that "Even when I copy my handwritten notes into Word, I have to spend a lot of time fixing the formatting. It's frustrating because it feels like a waste of effort."

For math and science teaching departments, this challenge was compounded by the complexity of their content. Participant 10 explained that "…Formulas and graphs are tricky to transfer into digital formats. Even small errors in alignment can make the entire document look unprofessional…"

Limited Tool Proficiency: Participants also highlighted their limited proficiency with advanced tools as a significant barrier. For instance, LaTeX was frequently mentioned by mathematics teacher candidates as a tool that was both essential and inaccessible due to its steep learning curve. Participant 2 stated that "We've never been taught how to use LaTeX, even though it's one of the most important tools for presenting mathematical content…"

Similarly, language-focused participants mentioned struggles with multimedia integration in tools like PowerPoint and Canva. Participant 9 shared that "…I love the idea of using multimedia, but I often don't know how to make it look professional. I end up spending hours on things that should be simple…"

Cognitive and Psychological Barriers

Screen-Based Reviewing Challenges: Screen-based reviewing posed significant cognitive challenges for participants. Many described difficulties focusing on digital screens for extended periods, leading to errors in proofreading and reviewing. Participant 8 noted that "I can't concentrate as well when I'm reviewing on a screen. I often miss small mistakes, which is why I prefer to print my work."

Participants working with technical content expressed additional cognitive strain, especially when reviewing charts, graphs, or complex text layouts. Participant 5 remarked that "…It's overwhelming to review documents with a lot of visual elements digitally. Even small formatting issues can make it hard to focus."

Fear of Making Mistakes: Another recurring theme was the fear of making mistakes when using unfamiliar digital tools. This anxiety often prevented participants from exploring advanced features or adopting new technologies. Participant 7 explained that "I avoid tools that seem complicated because I'm afraid I'll mess something up. It's easier to stick to what I already know…"

Systemic Challenges in Teacher Education Programs

Lack of Practical Training: A significant systemic barrier identified by participants was the lack of practical, hands-on training in their teacher education programs. Most participants noted that their coursework focused on theoretical concepts with limited opportunities to practice digital writing tasks. Participant 4 stated that "…We're told about the importance of digital tools, but we're not taught how to use them effectively. It's all theory with no application…"

For math and science teaching departments participants highlighted the absence of discipline-specific training. Participant 10 expressed frustration stating that "In mathematics, we need tools like GeoGebra and LaTeX, but our program doesn't include any training on how to use them..."

Limited Access to Resources: Participants also reported limited access to resources, such as reliable internet or up-to-date software, as a barrier to developing digital writing skills. Participant 6 shared that "...We don't have consistent access to good computers or software in the lab. How can we learn when the tools we need aren't available?" This limitation was particularly evident during the COVID-19 pandemic, which highlighted disparities in resource availability and digital readiness among participants.

Broader Implications of Challenges

Misalignment Between Education and Practice: The challenges faced by participants reflect a broader misalignment between the content of teacher education programs and the practical demands of digital writing in classrooms. Participant 7 summarized this conflict stating that "...Our program doesn't prepare us for the reality of teaching in a digital world. We're expected to figure things out on our own..."

Field-Specific Needs: Participants emphasized the need for differentiated support tailored to the unique requirements of their academic disciplines. Language-focused candidates recommended the integration of creative tools such as Canva and Book Creator into their training, while the participants from math and science teaching departments wanted to have workshops on LaTeX and mathematical formatting tools. Participant 2 proposed that "...Workshops that focus on specific tools for our field would make a huge difference. It's hard to learn these things without guidance..."

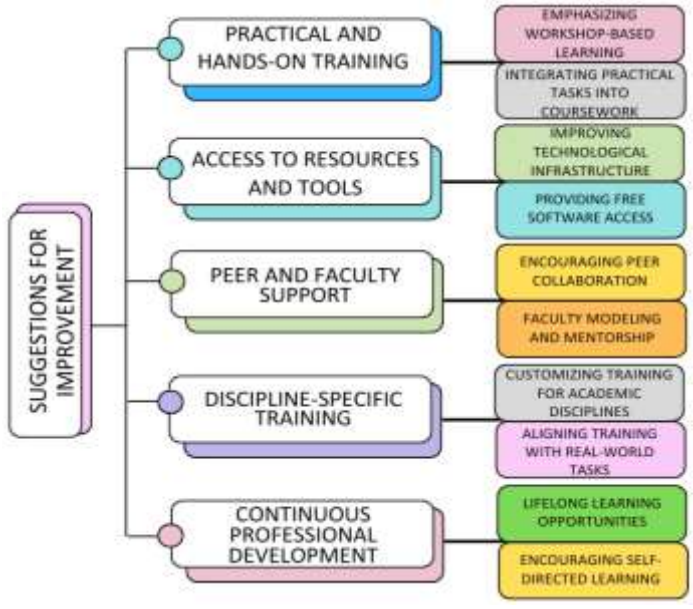
Pre-service teachers' struggles with digital writing are multi-faceted, including technical, cognitive, and systemic challenges. Addressing challenges of document formatting, tool proficiency, and reviewing a document will require targeted training and resource provision. These challenges are further compounded by systemic gaps in teacher education programs, including an absence of real-world training and limited tools access. By providing discipline-based workshops, hands-on training experiences, and improving physical access to resources, pre-service teachers could become more effectively prepared to teach digital writing in their own classrooms.

Suggestions for Improvement

This section presents strategies suggested by pre-service teachers to improve digital writing skills and highlights their recommendations for teacher education programs to effectively integrate these skills. As it can be seen in Figure 3, contextual analysis reveals five key themes: practical and hands-on training, access to resources and tools, peer and faculty support, discipline-specific training, and continuous professional development.

Figure 3

Suggestions of Pre-Service Teachers for Improvement



Practical and Hands-On Training

Emphasizing Workshop-Based Learning: Pre-service teachers consistently emphasized the need for more hands-on workshops to develop their digital writing skills. Many participants felt that their teacher education programs prioritized theoretical knowledge over practical application, leaving them unprepared for real-world digital writing tasks. Participant 7 explained that "...We need more workshops where we can actually practice using tools like Word, Canva, or GeoGebra. Just listening to lectures about digital tools isn't enough."

Workshops were particularly valued for their ability to provide structured, guided learning experiences. Participant 9 highlighted the benefit of a practice-based approach by stating that "When we have hands-on sessions, it's easier to understand how to use digital tools effectively. It also gives us the confidence to experiment with new features."

Integrating Practical Tasks into Coursework: The participants suggested embedding practical digital writing tasks into their regular coursework as a way to ensure consistent practice and skill development. Participant 3 pointed out that "Instead of just writing essays, we could be asked to create digital materials, like presentations or multimedia

lessons, that we might actually use as teachers.". This recommendation reflects a desire for task-based learning, where students can apply digital writing skills in meaningful, authentic contexts.

Access to Resources and Tools

Improving Technological Infrastructure: Limited access to up-to-date technology and software was frequently cited as a barrier to skill development. Participants recommended that teacher education programs invest in better technological infrastructure, including modern computers and software licenses. Participant 6 noted that "…The computers in our lab are outdated, and many of the tools we're expected to use aren't available. How are we supposed to learn if we don't have access to the resources we need?"

Providing Free Software Access: Participants also suggested that teacher education programs negotiate free or discounted access to essential software, such as Grammarly, LaTeX, and Canva. Participant 10 reflected that "…Some of the tools we need are too expensive for students. If the university provided licenses, it would make a big difference."

Peer and Faculty Support

Encouraging Peer Collaboration: Several participants highlighted the value of learning from their peers, suggesting that programs could formalize peer collaboration opportunities to share knowledge and skills. Participant 4 stated that "When I don't know how to use a tool, I often ask my classmates for help. It would be great if we had more structured opportunities to work together and share what we've learned…"

Peer-led workshops or mentoring programs were proposed as potential strategies. Participant 8 suggested that "Students who are already good at using certain tools could lead workshops or mentoring sessions for their peers. This would create a supportive learning environment."

Faculty Modeling and Mentorship: Participants also expressed a desire for faculty members to model the use of digital tools in their teaching and offer one-on-one mentorship. Participant 5 highlighted that "…It would be helpful if our professors showed us how they use digital tools in their own teaching. That way, we could learn by example." This recommendation underscores the importance of faculty serving as role models and providing personalized guidance to pre-service teachers.

Discipline-Specific Training

Customizing Training for Academic Disciplines: The participants noted that digital writing requirements vary across academic disciplines and suggested that teacher education programs provide discipline-specific training. For instance, the participants from math and science teaching departments emphasized the need for technical training in tools like LaTeX, GeoGebra, and Excel, while language-focused participants recommended more creative tools, such as Canva and Book Creator. Participant 2 explained that "As a science teacher candidate, I need to learn how to use tools like Excel for lab reports and GeoGebra for teaching concepts. But our program doesn't offer any training on these…"

Language-focused participants echoed similar concerns. Participant 9 shared that "It would be helpful if we had sessions on creating digital storybooks or interactive presentations for language classes."

Aligning Training with Real-World Tasks: The participants emphasized the importance of aligning digital writing training with the tasks they are likely to encounter in their future teaching practices. Participant 7 noted that "We need to learn how to create lesson plans, slides, and materials that we can actually use in the classroom. The training should be practical and focused on real-life applications."

Continuous Professional Development

Lifelong Learning Opportunities: Pre-service teachers acknowledged that digital writing skills evolve over time and suggested that universities offer lifelong learning opportunities, such as refresher courses and professional development workshops. Participant 10 stated that "…Even after we graduate, we'll need to keep updating our digital skills. The university could offer online courses or resources for alumni to stay up-to-date."

Encouraging Self-Directed Learning: Some participants highlighted the importance of fostering self-directed learning and curiosity. Participant 9 shared that "I've started exploring tools like Canva on my own because I know I'll need them in my teaching. Programs could encourage this kind of independent learning."

It is notable that the overall recommendations by pre-service teachers point to the importance of practice-oriented training and increased access to resources and supportive environments in their learning. These recommendations, if implemented, will better pre-service teachers for digital writing skills that will be useful for both academic and professional settings. Participant 7 summarized this vision as "…If we had more opportunities to practice with the right tools and guidance from both peers and faculty, we would feel much more confident and prepared."

These results highlight the importance of reforming teacher education programs so that they incorporate content providing future teachers with the knowledge necessary to work in digitally infused classrooms.

Discussion

The findings of this study provide nuanced insights into pre-service teachers' perspectives on digital writing, highlighting key themes such as demographic influences, understanding of digital writing, challenges encountered, and suggestions for improvement. This section discusses each theme in light of the existing literature, pinpointing both the alignments and points of contrast.

Demographic Influences on Digital Writing Perspectives

The results indicate that perspectives on digital writing vary significantly across academic disciplines, whereas factors such as gender, age, GPA, and internet usage do not exert a statistically significant influence. These findings align with prior research that emphasizes discipline-specific needs in digital tool adoption (Tondeur et al., 2017).

One salient pattern is the contrast between language-focused pre-service teachers—who generally express more confidence and view digital writing as a creative medium—and those in technical fields—who report more self-criticism and greater demand for additional support. This difference aligns with Jenkins et al. (2016), who underscore the participatory and multimedia-rich potential of digital writing within language education. Conversely, math and science participants tend to perceive digital writing as utilitarian, focusing on “getting the right answer” rather than creativity (Graham, 2019).

The gender-related observations, with female participants reporting greater comfort with digital review tools, are consistent with Cochran-Smith et al. (2016). Nevertheless, this difference may stem less from inherent gender-based preferences. Instead, it could be influenced by contextual or structural factors, such as varying degrees of prior exposure or training.

The relatively small differences across major variables such as internet usage and GPA indicate that these differences must stem from structural rather than individual factors. Having workshops that address specific problems, increasing access to resources, and incorporating practical digital writing activity in composition-based classes can close the gap between theory and practice. These findings are in line with Applebee and Langer’s (2013) call for task-based learning in teacher education.

In sum, these findings emphasize the need for teacher education programs to offer targeted resources and training that accommodate diverse disciplinary requirements. Such efforts could include digital writing workshops focused on math- or science-specific needs, or advanced tutorials on digital writing processes for language majors. By doing so, programs can help pre-service teachers narrow the gap between theory and practice, ultimately enhancing their confidence and competence in digital writing environments.

Understanding Digital Writing

Digital writing refers to the process of composing and producing text using digital tools and platforms, such as word processors, online collaboration tools, and multimedia applications. The pre-service teachers understood digital writing primarily as an evolving practice that incorporated elements of multimedia, interactivity, and sophisticated formatting. However, participants studying math and science in particular described seeing this as a matter of a utilitarian process, prioritizing accuracy over creativity. This two-sided approach highlights the necessity of discipline-specific digital writing training, as Graham (2019) points out, and adds to the development of clear and practical tools relevant to academia and the career which embody theoretical input and possible indirect benefits.

The participants recognized the importance and relevance of digital translating and reviewing in their upcoming teaching practices but expressed differing degrees of preparedness. The emphasis on multimedia and interactivity aligns with Jenkins et al.'s (2016) assertion that digital writing fosters participatory culture, enabling teachers to engage diverse audiences effectively.

Challenges in Digital Writing

The transition to digital writing has also raised a number of new challenges for students and teachers. The challenges can be grouped into four interlinked themes: technical limitations, cognitive and psychological limitations, systemic difficulties in teacher education programmes, and the implications of these challenges on organisations in education.

The technical problems of digital writing are not limited to the difficulties of mastering the tools and software for digital writing, they also include issues of accessibility (Ching, 2018). Although the majority of writing tools that participants used were digital, such writing tools and technologies mediated their sense of the text grounded firmly in a material reality to some extent (Ching, 2018).

Cognitive and psychological barriers are the leap from paper to screen. These include challenges such as controlling distractions, loss of focus, and trouble with mental pictures of text structure (Baker & Lastrapes, 2019). While studies showed that digital writing could influence an increase in learners' motivation, it can also lead them to the belief that they could not write or fear of failure of writing (Baker & Lastrapes, 2019). It is also harder for writers to coordinate and integrate digital writing (e.g.,

make presentations and change them iteratively) (Pigg et al., 2013).

Systemic challenges in teacher education programs are the core concern in the ongoing research revolves around teacher education programs failing to adequately prepare/pre-train their respective teachers on digital writing skills, which compromises their potential effectiveness as lead instructors of those skills (Deiniatur, 2024). Scholars have also stressed the importance of academic institutions in providing access to online databases and reference management software, and other relevant digital tools, together with support and training in order to develop the digital literacy of novice teachers (Nabhan, 2021).

After completing the process, technical, cognitive, and systemic barriers, Math and science participants experienced this in even greater magnitude with formatting compatibility problems and limited acces to tools (Kessler, 2018) suggesting that certain tools come with steep challenges inherent to the technical writing process. Braun and Clarke (2006) noted cognitive overload occurs in digital environments evidenced by cognitive challenges and difficulty focusing on screen-based review. These challenges have broader implications concerning equitable access to digital tools, the digital divide, and students' academic performance (Akoto, 2021; Kalir & Garcia, 2019). While research indicates that digital multimodal writing offers emergent bilingual students new opportunities for navigating and expressing complex and abstract dimensions of their lives and identities, the inaccessibility of digital tools and the broader digital divide can constrain these opportunities, leading to educational inequities (Akoto, 2021; Kalir & Garcia, 2019).

Broader Implications of Challenges: These challenges are compounded by systemic gaps in teacher education programs, such as a lack of practical training or access to resources. These conclusions correspond with Selwyn's (2011) work that describes a gap between the workings of educational theory and the practices of technology. It is imperative to facilitate these systemic changes to prepare our pre-service teachers with the skills necessary to thrive in digitally rich classrooms.

In conclusion, these challenges suggest that the challenges of writing skills in a digital environment needs to be addressed in a holistic way through investments in technological infrastructure, professional development for teachers, and a better understanding of the cognitive and psychological processes that characterize writing (Castillo-Martinez & Ramirez-Montoya, 2021; Ramadhanti, 2023). Adopting this approach could help better prepare students for the writing demands of a more connected, digital world.

Suggestions for Improvement

Improving digital writing skills is a crucial aspect of professional development for individuals across various disciplines. A comprehensive approach can be addressed through five key themes: practical and hands-on training, access to resources and tools, peer and faculty support, discipline-specific training, and continuous professional development.

Practical and hands-on training is essential for developing effective digital writing skills. This can include workshops or seminars that focus on specific components of scientific writing, such as literature review, data analysis, or scientific argumentation (Rahim et al., 2023). Collaborative writing projects, where teachers or professionals work together to co-author papers, can also provide valuable opportunities for knowledge sharing and professional networking (Rahim et al., 2023).

Providing access to relevant resources and tools is another crucial element in enhancing digital writing skills. This can involve the use of computer-assisted language learning tools or computer-assisted translation (CAT) systems, which offer access to external resources like dictionaries, terminologies, or bilingual concordancers to support the writing process (Crego et al., 2023). Additionally, fostering professional learning communities among writers can facilitate ongoing professional dialogue and the exchange of best practices (Lee, 2014).

Peer and faculty support is essential for the development of digital writing skills. Schools or institutions can bring in outside experts to stimulate new ideas and help professionals with their continuing professional development in the teaching of writing (Lee, 2014). Furthermore, creating writing communities or peer support groups can provide a space for writers to engage in constructive feedback and collaborative learning (Kempenaar & Murray, 2018).

Discipline-specific training is crucial for ensuring that digital writing skills are tailored to the unique needs and conventions of different fields. For example, in technical writing courses, explicit instruction on various genres and the level of detail required can help students develop their writing skills (Boettger, 2014). This targeted approach can address the specific challenges and expectations within different disciplines

Continuous professional development is a key component in maintaining and enhancing digital writing skills. This can involve access to online platforms or courses that cover topics such as lesson planning, resource management, professional responsibility, and literature review writing

(Samoylenko, 2019). Engaging in regular writing practice, seeking feedback, and participating in writing retreats or workshops can also contribute to ongoing professional development (Kempenaar & Murray, 2018)

By incorporating these five key themes into a comprehensive approach, individuals can effectively improve their digital writing skills and enhance their professional competence. This multifaceted strategy can empower writers across various disciplines to communicate effectively, collaborate with peers, and contribute to the advancement of their respective fields.

Conclusion and Recommendations

This study underscores how writing digitally is an important practice in the teaching of teachers, specifically how it has the capacity to effect change, as well as the systematic barriers that hinder its realizaton. Given these insights into the varied preparedness of pre-service teachers and the existing systemic barriers, teacher education programs should consider the following recommendations to enhance digital writing instruction and foster continuous learning:

- Discipline-specific workshops: Teacher education programs should provide workshops on discipline-specific tools for math/science fields, for multimedia integration (e.g., GoogleDocs) to support language disciplines. The focus of these workshops must be around practical, hands-on experience to build competence and confidence.
- Integration of Practical Tasks: Embed digital writing tasks into the students` regular coursework to provide continuous skill practice and uptake information. For instance, in developing lesson plans, students might develop a digital lesson plan, multimedia presentation, or interactive storybook to complete their assignment.
- Improved Access to Resources: Educational institutions must commit the resources to building modern digital infrastructure and negotiate access to critical software tools (free or at reduced costs). Such a system would mitigate existing disparities in resources and ensure equitable opportunities for learning.
- Supporting Peer Collaboration and Faculty Mentorship: Introduce research peer groups and peer-faculty mentorship programs. Teaching staff need to demonstrate good use of digital tools and give personalized guidance to pre-service teachers.
- Supporting Continuous Professional Development: By providing access to online refresher courses and professional development workshops, graduates can be kept up to date with new digital tools and practices.

Therefore, future studies might like to follow up on the long-term effect of targeted digital writing training on professional practices of pre-service teachers. Furthermore, investigating the timely the role of emerging technologies, particularly artificial intelligence and augmented reality, in the enhancing digital writing skills can inform the next generation of teacher education programs.

If teacher education programs can work to solve the challenges identified and implement some of these recommendations, pre-service teachers may be better equipped with the knowledge needed to teach effectively in a classroom heavily integrated with digital technology, ultimately contributing to higher quality teaching and improved student learning outcomes.

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Handwriting Anxiety Scale for Turkish as a Foreign Language Learners: Validity and Reliability

Ayşegül TAKKAÇ TULGAR[1]
Bahadır GÜCÜYETER[2]
M. Ezgi İSKENDER TOPALOĞLU[2]
Nihal Elif GÜRBÜZ[2]

[1] Ataturk University, Faculty of Education, English Language Education Department, Erzurum, Türkiye.

[2] Ataturk University, Faculty of Education, Turkish Language and Literature Education Department, Erzurum, Türkiye.

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Corresponding author:
M. Ezgi İSKENDER TOPALOĞLU
E-mail: ezgi.iskender@atauni.edu.tr

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ABSTRACT

This research aimed to develop a handwriting anxiety scale for students learning Turkish as a foreign language. Validity and reliability analyses were conducted on the scale developed for this purpose. At the beginning of the scale development process, an item pool consisting of 13 items was formed. In the next stage, data were collected with these items from 448 foreign students learning Turkish in the provinces of Istanbul, Erzurum, Sivas and Erzincan. The collected data underwent Exploratory Factor Analysis (EFA) using a statistical software package. Three items with factor loadings below .45 were removed. Confirmatory Factor Analysis was applied to verify the structure consisting of 10 items, which had 55.06% explained variance in a single factor. As a result of the Confirmatory Factor Analysis, fit index values were found as $\chi 2$ / sd = 2.069, SRMR = .03, RMSEA = .69, GFI = .94, AGFI = .90, CFI = .94, NFI = .95, TLI = .96. CR=.92 and AVE=.54 values were reached. In the analyses conducted for the scale's reliability, the Cronbach Alpha coefficient was .91, and with the split-half reliability method, this value was found to be .80 and .87. As a result of the analysis, it was determined that the handwriting anxiety scale for students learning Turkish as a foreign language has a high level of validity and reliability compared to the criteria values given in the literature. Therefore, this scale can be utilized in future research on handwriting anxiety in foreign language learners.

Keywords: Teaching Turkish as a foreign language, anxiety, scale development, handwriting.

Introduction

Among language skills, writing holds its unique place as a tool facilitating communication among language users for such various purposes as interacting on social media or conducting academic studies. Given its role in facilitating communication, writing is a fundamental component of overall language proficiency (Karatay, 2020), and it is to be developed at different levels of language education. Yet, the multi-dimensional nature of writing development brings the consideration of various psychomotor, cognitive, metacognitive and affective variables to the front (Olivares-Cuhat, 2010).

Koksal (2001) explains that the psychomotor aspects of writing mainly cover the development of the effective use of fine motor skills directing muscle activation and coordination, while cognitive and metacognitive dimensions require mental processing, interpretation and implementation of the language input into written output. When these processes do not work properly, students have problems with consistency of letter size, legibility, word/letter spacing, writing speed and left margin alignment (Ghaleb, 2024). Among these variables, the affective dimension includes emotional factors such as motivation, self-efficacy, and anxiety. Within this scope, the psychomotor and affective domains are considered to be closely connected particularly at the initial stages of writing development (Al-Sawalha & Chow, 2012). In other words, successful development of the psychomotor dimension of writing is to increase motivation while problems with the beauty and legibility of writing are to increase anxiety in the process of developing writing skills.

Anxiety closely associated with and experienced in the context of language education is specified as foreign/second language learning anxiety which is under the effects of various dynamics in the process (Horwitz, 2001). The particular consideration of the complex nature of the writing skill reveals that learners may experience hesitations to express themselves in writing because of the slow progress of writing development and possible concern regarding their writing quality (Zhang, 2001). Thus, understanding learner anxiety experienced in writing development in the foreign language learning process is thought to contribute significantly to the efficiency of writing development, which is to stimulate learner motivation and writing quality.

Horwitz et al. (1986) suggest that writing anxiety mainly develops in examination contexts, which possibly creates a sense of uneasiness for learners because of being evaluated and receiving feedback regarding problematic productions. Cheng (2004) explained foreign language writing anxiety in three dimensions: Somatic anxiety (physiological effect), cognitive anxiety (cognitive aspect of anxiety experience) and avoidance behavior (avoidance of writing). These three types of writing anxiety affect students' writing processes and their behaviors in foreign language development. Though some studies proposed that a certain level of anxiety has the potential to stimulate learners' production and concentration in writing (Al-Saraj, 2011; Brown, 2000), a majority of studies pointed to the negative correlation between anxiety and writing performance (Frantzen & Magnan, 2005; Horwitz, et al., 1986; MacIntyre & Gardner, 1991; Rezaei & Jafari, 2014). These studies indicated that learners suffering from writing anxiety may experience challenges in putting their ideas effectively in writing and using appropriate language structure at the cognitive and metacognitive levels and challenges such as having illegible handwriting at the psychomotor level.

As this study is concerned with the development of a handwriting anxiety scale, it is expected to contribute to research on scale development. The perusal of the relevant literature shows that scale development regarding the anxiety variable in writing development mainly started towards the late 1990s (Cheng et al., 1999; Saito et al., 1999; Vogely, 1998). Daly and Miller (1975) developed the Writing Comprehension Test (WAT), which was adapted and developed by Young (1999) into the 26-item Foreign Language Writing Scale (FLWAS). The adapted version of the instrument has been utilized in many studies (Al-Sawalha & Chow, 2012; Huwari & Abd Aziz, 2011; Liu & Ni, 2015). Centering on the relationship between learners' foreign language writing anxiety and various aspects of learner differences, Cheng (2004) implemented the Second Language Writing Anxiety Inventory (SLWAI) to a sample of 421 Taiwanese students. This instrument has also been adapted to different languages and adopted in many studies (Ekmekci, 2018; Jebreil et al., 2015; Kirmizi & Kirmizi, 2015; Rabadi & Rabadi, 2020; Rasool et al., 2023; Sabti et al., 2019; Syarifudin, 2020; Tsiriotakis et al., 2017; Yastibas & Yastibas, 2015).

In the particular context of Turkish as a foreign language, the relevant literature also presents research on writing anxiety experienced by foreign learners of Turkish. In his study, İscan (2015) used Cheng's (2004) 22-item SLWAS (Second Language Writing Anxiety Scale) and found that foreign students learning Turkish in Jordan had high levels of somatic and social anxiety and low levels of cognitive anxiety regarding their writing skills. As a result of the interviews, it was determined that the anxiety was caused by the students' fear of negative evaluation by their teachers, lack of self-confidence and feeling under pressure due to time limitations. To assess the writing anxiety and attitudes of a group of foreign learners of Turkish, Akbulut (2016) utilized the anxiety scale in foreign language learning developed by Daly and Miller (1975) and adapted into Turkish by Ozbay and Zorbaz (2011). The results of the analysis showed that gender and class level did not cause significant differences in the students' levels of writing anxiety and attitudes towards writing, but there were significant differences arising from the differences in their mother tongue. The results of the interviews revealed that alphabet-syntax differences and difficulty in grammar rules were the sources of the anxiety.

There are also some examples of scale development on writing anxiety in the Turkish context. One of the first writing scales to measure anxiety in teaching Turkish as a foreign language was developed by Maden et al. (2015). In the scale consisting of 26 items, the sub-dimensions were determined as individual-oriented anxiety, environment-oriented anxiety, anxiety related to the rules of written expression, anxiety related to the writing tool and form, and anxiety related to the psychology of writing. As a result of the study, it was found that the anxiety of learners of Turkish as a foreign language varies depending on their nationality, the alphabet they use and their writing habits. To measure the writing anxiety of learners of Turkish as a foreign language, Aytan and Tuncel (2015) also developed a scale which has an explained variance of 67% in 4 dimensions. Karakus-Taysi (2018) developed a 19-item scale, the Writing Anxiety Scale for Turkish as a Foreign Language, with 44.6% of the total variance explained in 3 factors. The total Cronbach Alpha reliability coefficient of the scale was calculated as .834. Taking such different variables as gender, country, length of stay in Turkey and writing habits into account, Ozdemir (2019) used this scale to examine the writing anxiety of foreign learners of Turkish. The results indicated that country differences had diverse levels of effect on the participants' writing anxiety. Sen and Boylu (2017) also developed a Writing Anxiety Scale, consisting of 3 dimensions and 13 items with an internal consistency value of .84 and an explained variance of 46.8%. Baris (2019) used this scale in their study and stated that gender and frequency of reading Turkish books did not have a significant effect on foreign students' writing anxiety while there was a significant difference in the frequency of writing in Turkish.

Given the content and scope of the existing writing scales, it can be concluded that they mostly include items related to anxiety experienced in the development of writing skills or writing production. However, foreign language learners may

also have problems with elements such as letter size consistency, legibility, word and letter spacing in handwriting (Ghaleb, 2024). In this context, it was determined that there is a need to develop a scale for the anxiety experienced in the early stages of writing development in relation to the psychomotor dimension.

In the study conducted by Yaman (2010), an analysis was conducted of the scores obtained by students in relation to their writing anxiety. This analysis was undertaken using a one-way analysis of variance (ANOVA), with the results indicating a significant difference at the 0.05 level, according to the legibility of the students' handwriting. The results revealed that students with poor handwriting had more writing anxiety than students with neat handwriting. Thus, on the results of Yaman (2010) study, it can be concluded that the quality of handwriting in terms of its legibility is a point of consideration in writing anxiety scales. In a similar vein, Maden et al. (2015) and Ozdemir (2019) found that Turkish students had less writing anxiety than their peers from other countries using a different alphabet than the Latin script. These studies indicate that alphabetical differences between the mother tongue and the target language can turn into a source of anxiety in writing development, particularly considering its psychomotor dimension. These considerations have paved the way for this study aiming to develop a handwriting anxiety scale that basically covers the psychomotor dimension of writing. Thus, with an aim to contribute to the literature, the developed scale is thought to help instructors/researchers understand initial sources of anxiety experienced by foreign learners of Turkish.

Purpose of the Study

The aim of this research is to develop a handwriting anxiety scale for Turkish as a foreign language learners.

Method

Research Model

This is a scale development study. In this context, this section presents information about the stages of the scale development. The measures and analyses followed for validity and reliability in the scale development process are explained step by step.

Study Group

The study group of the research consists of foreign students who learn Turkish at TÖMER's (Turkish Teaching and Application Center) in İstanbul, Erzurum, Sivas and Erzincan provinces, in Turkey. A total of 448 students were reached during the data collection process. According to Tabachnick and Fidell (2015), an ideal sample size for scale development studies ranges between 300 and 500 participants. Comrey and Lee (1992) consider 100 participants as poor, 200 as average, 300 as good, 500 as very good and 1000 as excellent for scale development. On the number of participants, Bryman and Cramer (2001) suggest that the number of participants should be at least five times the number of the items in the prepared scale while Nunnally (1978) stated that it should be ten times. In the draft form of the scale, 13 items were included in the sample. In the extant literature, scales comprising a limited number of items are reported to provide practical measures and to be valid and reliable instruments (Jansen 2024; Rammstedt & Beierlein 2014). Thus, according to the criteria referred in the literature, it can be said that the study group consisting of 448 students is sufficient for 13 items.

In sample selection, maximum diversity sampling, one of the purposive sampling methods, was utilized. The maximum diversity sampling method is used when providing sample diversity representing the problem or the main variable is necessary. In this study, diversity in terms of gender, age, and the alphabet used in the mother tongue was the criteria for participant selection. Maden et al. (2015) reported that alphabet differences affected writing anxiety and the gender variable was found to be insignificant. On the other hand, in the review study of Polatcan (2019), it was reported that there were different results regarding the gender and age variables being significant and insignificant in studies on anxiety in teaching Turkish as a foreign language. Thus, in line with the literature, the sample was selected according to the variables examined in general writing anxiety studies. Information about the sample is given in the table 1.

Table 1.

Demographic Characteristics of the Study Sample (EFA and CFA Groups)

Categorical Variables		EFA (n)	CFA (n)
Gender	Woman	75	85
	Male	145	143
Age	18-25	188	201
	25-30	23	18
	30-35	8	7
	40+	1	2
Alphabet used in the mother tongue	Latin	59	53
	Cyrillic	41	31
	Georgian	1	-
	Arabic	118	143
	Burmese	1	1

The data collected for exploratory and confirmatory factor analyses were divided into two. The data collected according to the categorical variables were tried to be divided equally. The data were collected from 75 female and 145 male students for EFA and 85 female and 143 male students for CFA. The ages of the students were selected in the range of 18-25, 25-30, 30-35 and 40+, and students using the Latin alphabet, Cyrillic alphabet, Georgian alphabet, Arabic alphabet and Burmese alphabet in their mother tongue were included.

Data Collection Tool

The study describes the process of developing a data collection tool. In this context, permission was obtained from the ethics committee to collect data from students. The ethical process in the study was as follows:

- Ethics committee approval was obtained from Atatürk University Education Sciences Ethics Committee (Date: 13.04.2021, 2021, Number: E-56785782-050.02.04-2100107254)
- Informed consent has been obtained from the participants.

Scale Development and Analysis Phase

Before writing the items of the scale, a literature review on foreign language anxiety and writing skills was conducted, and a pool of 17 items was created. The scale items were revised by taking the opinions of 5 experts from the Departments of Turkish Language and Literature Education, Turkish Language Education and Measurement and Evaluation. These experts consisted of academicians with at least a PhD degree. 4 items were removed in line with the expert opinions, and the other items were revised and made ready for pilot application. The 13-item scale form was organized as a seven-point Likert-type scale form to increase the sensitive range. A pilot application was conducted with 10 students at A2 level to evaluate the comprehensibility of the scale by the students. After the pilot application, 3 items were simplified and the expression was shortened. In the pilot application, the process lasted for 36 minutes for the participant who responded to the items the slowest and 10 minutes for the fastest participant. Thus, an average of 23 minutes was reported to be the response time of the scale.

After the pilot application, the 13-item scale form was sent to TÖMER's in İstanbul, Erzurum, Sivas and Erzincan and applied to foreign learners of Turkish on a voluntary basis. The data collected from 448 students were divided into two parts for EFA and CFA analyses. Exploratory Factor Analysis was conducted on 220 students. Referred to by Pallant (2017) as a data reduction process, factor analysis is based on the principle of identifying related variables and reducing them to more general structures or dimensions (Aksu et al. 2017). According to Buyukozturk (2002), exploratory factor analysis is an analysis aiming at finding factors and generating theories based on the relationships between variables (Buyukozturk, 2002). Thus, used in the first stage of scale development, exploratory factor analysis is followed to determine many features that cannot be observed or measured directly. In this scale development study, exploratory factor analysis was performed using the statistical package program (SPSS 27.0) to identify the factors of the 13-item scale. Based on the outputs obtained as a result of the analysis, the processes of item extraction and determining the number of dimensions of the scale are explained in detail in the findings section.

To test/verify the factor structures discovered in the exploratory factor analysis, confirmatory factor analysis was applied. Confirmatory Factor Analysis is based on the verification of models whose factorial structure is already known and testing the assumed relationships in a different data set (Gurbuz, 2021). To test and verify the scale model that emerged in EFA using different samples with similar characteristics, the analysis was performed using SPSS AMOS 20.00 software. The interpretation of the models tested at the end of confirmatory factor analysis and the outputs obtained from the models, fit indices and explanations regarding the modifications applied are presented in the findings section.

Results

In this section of the study, the results of the validity and reliability analyses conducted with SPSS and AMOS programs are given.

Construct Validity Analysis

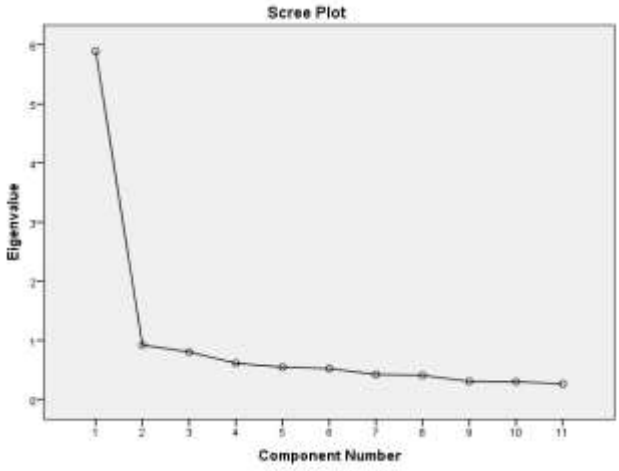
Before the analysis, it was determined that the items in the data set showed normal distribution. Since there were no reversed items in the scale, no item reversal process was applied. Before the analysis, the correlation matrix was examined and it was seen that the lowest correlation between the items was .35 and the highest was .67. In factor analysis, a good level of relationship between variables is expected (Karagoz, 2021). The current values show that the relationship between the items is at a sufficient level.

The results of the KMO (Kaiser Mayer Olkin) and Barlett Sphericity Test, which are prerequisites for exploratory factor analysis, indicated that the data set was suitable for factor analysis. A KMO value of more than 60 indicates that the sample size is suitable for factor analysis (Tabachnick & Fidell, 2015). The KMO value obtained as a result of the analysis was 0.91. The results of Barlett's test of sphericity were significant at a 99% confidence interval ($\chi^2_{(45)} = 1121.86$, $p < .001$). In line with the results obtained from the Barlett Sphericity Test, the exploratory factor analysis was conducted.

According to the principal component analysis, it was found that the handwriting anxiety scale for learners of Turkish as a foreign language has only one factor with eigenvalues above 1. According to the Kaiser criterion, factors with values of 1.0 and above are considered as dimensions of the scale (Pallant, 2017). According to these results, the scale has 55.06% explained variance in a single

factor. A total explained variance value between 40% and 60% is considered sufficient in social sciences studies (Scherer et al., 1988). The 10-item scale exceeded the value specified in the literature in a single dimension.

Figure 1.
Scree Plot Graphic



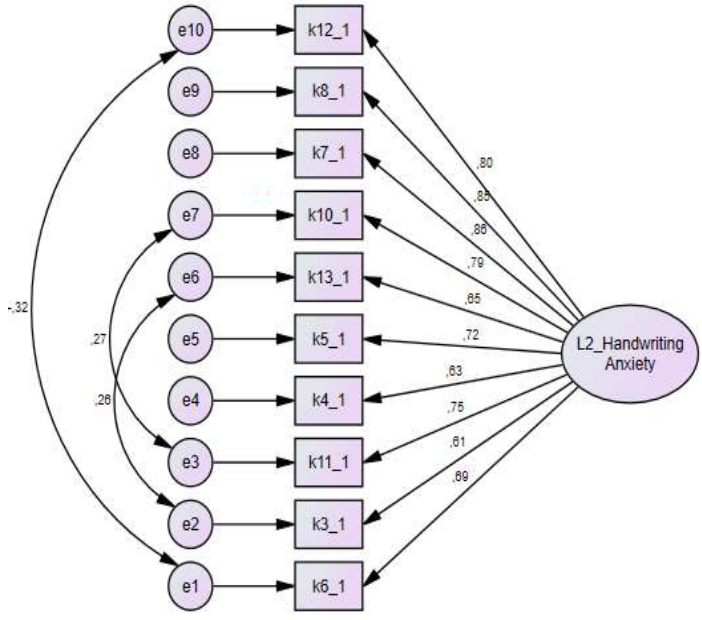
Another method used to infer the number of dimensions of the scale is the scree plot. Sencan (2014) explains that the dimensions are accepted to the point where the break is horizontal and stationary in the scree plot. Fields (2005) states that factors with low and high eigenvalues have a characteristic shape in the graph. When the scree plot in Figure 1 is analyzed, it is seen that the break ends at the first dimension and accordingly, the scale has a one-factor/dimensional structure. The factor loadings of the items in a single dimension in the scale are given in Table 2.

Table 2.
Exploratory Factor Analysis Factor Loadings

Item No	Factor Load
k12	.817
k8	.799
k7	.757
k10	.739
k5	.731
k11	.731
k13	.725
k4	.717
k6	.709
k3	.686

Table 2 shows the factor loadings of the items of the scale. Buyukozturk (2019) states that factor loadings should not fall below .45. According to Comrey and Lee (1992), factor loadings above .63 (40% overlapping variance) are considered very good, and loadings exceeding 71 (50% overlapping variance) are considered excellent. In this context, items 1, 2 and 9, which were below .45, were removed from the draft scale form consisting of 13 items, leaving 10 items. When the factor loadings of the items in Table 3 are analyzed, it can be stated that they are between .68 and .81 and the values are at very good and excellent levels. As a result of the exploratory factor analysis, a structure consisting of 10 items and a single dimension was obtained for the handwriting anxiety scale for learners of Turkish as a foreign language. This structure was checked with confirmatory factor analysis in the next step. Figure 2 shows the path diagram obtained as a result of the confirmatory factor analysis.

Figure 2.
Path Diagram



In the normality assumption before the analysis, it was determined that there was no violation of the normal distribution since the kurtosis and skewness values were in the range of -1 + 1 and the critical values were in the range of -3 + 3 (Gurbuz, 2021). As a result of confirmatory factor analysis, it is seen in Figure 1 that the factor loadings of the items are between .61 - .86. In this context, there was no need to remove any item depending on the factor loadings. In the CFA analysis, the recommended fit indices are examined to determine the suitability of the established model (Ozdamar, 2017). The general values for fit indices are χ2/sd, GFI, CFI, RMSEA, but there are also studies that include other values (Karagoz, 2021). Table 4 shows the fit indices based on the suggestions of Erkorkmaz et al. (2013) and Schermelleh-Engel and Moosbrugger (2003) and the values obtained from the model.

Table 3.

The Fit Indexes of the Confirmatory Factor Analysis

Indexes	Reference Values		Measurement	Conclusion
	Good fit	Acceptable Compliance		
χ2/sd	>3	>5	2.069	Good Fit
GFI	> .90	> .85	.94	Good Fit
AGFI	> .90	> .85	.90	Good Fit
CFI	> .95	> .90	.94	Good Fit
RMSEA	> .05	> .10	.69	Acceptable Compliance
SRMR	> .05	> .10	.03	Good Fit
NFI	> .95	> .90	.95	Good Fit
TLI	> .95	> .90	.96	Good Fit
AVE= .54 (> .50)				
CR= .92 (Composite Reliability > .70)				

As a result of the CFA analysis, fit indices values were found to be "χ2 / sd= 2.069 SRMR= .03, RMSEA= .69, GFI= .94, AGFI= .90, CFI= .94, NFI= .95, TLI= .96". It was determined that the values for the fit indices of the tested model were in accordance with the criteria in the literature. The composite reliability (CR) value is used as an alternative to Cronbach's alpha value and is expected to be above 0.70. The value obtained from the average variance explained (AVE) is expected to be less than the CR value and greater than .50 (Yaslioglu, 2017). It is seen that the CR and AVE values meet these criteria. In line with the outputs obtained from the CFA, it can be stated that the construct validity of the scale is supported and the findings obtained from the EFA are confirmed.

Reliability Analysis

Cronbach Alpha coefficient was used to analyze the internal consistency of the scale items. The split-half method, one of the reliability analyses, was also used. The values obtained are given in Table 4.

Table 4.

Reliability Values

	Handwriting Anxiety Scale
Cronbach's Alpha	.91
Split Half	.80 (part 1) .87 (part 2)

Cronbach's Alpha coefficient was calculated to assess the internal consistency of the scale items, yielding a value of .91, which indicates excellent reliability (DeVellis, 2012). When the scale was divided into two, the reliability level did not fall below .70. Hence, it can be stated that the reliability of the scale is at a sufficient level according to the threshold value in the literature.

Item analysis was performed to determine whether the items of the scale were distinguishing or not. The extent to which the items function in line with the objectives of the scale is tried to be determined by item analysis, and the distinctiveness of the items is tried to be measured by item analysis based on sub-upper groups (Karagoz, 2021). Item-total correlations and item analysis based on sub-superior groups are given in Table 5.

Table 5.

Item Total Correlations and Item Analysis Based on Lower-Upper Groups

Item	X̄	sd	r	a (if item deleted)	t
k3	3.45	2.19	.589**	.907	-19.639**
k4	3.15	2.08	.625**	.905	-18.342**
k5	3.05	1.95	.616**	.905	-20.357**
k6	3.35	2.11	.636**	.904	-22.246*
k7	2.96	1.92	.698**	.901	-21.091*
k8	3.15	2.02	.698**	.900	-24.423*
k10	2.99	1.98	.736**	.898	-22.114*
k11	3.12	2.02	.724**	.899	-24.485*
k12	3.25	2.07	.744**	.897	-27.808*
k13	3.03	2.09	.696**	.900	-24.448*

In the item-total correlation analysis, the low correlation with the total of the items indicates that the contribution of the item to the composite scale is low (Ozdamar, 2017). When Table 5 was analyzed, it was decided that it was appropriate to keep the items in the scale since the correlation coefficients were higher than .20 and did not take negative values (Karagoz, 2021). In this context, since item removal would decrease Cronbach's alpha coefficient, it was concluded that each of the scale items was necessary for the scale. In addition, a significant level of difference was found for the lower and upper groups of items k3, k4, k5, k6, k7, k8, k10, k11, k12 and k13 (p= .00). The significant difference obtained from the item distinctiveness analysis indicates that the items are distinguishing. According to the above findings, all items used have distinguishing properties.

Discussion

Within the scope of this study, a handwriting anxiety scale was developed for learners of Turkish as a foreign language. EFA and CFA analyses were used for the construct validity of the measurement tool. As a result of Exploratory Factor Analysis, a unidimensional structure with 10 items was obtained. The KMO value was .91 and Barlett test was found to be significant at a 95% confidence interval. The scale has an explained variance rate of 55.06% in one dimension. To test the model obtained in the EFA,

Confirmatory Factor Analysis was applied with similar characteristics but with data collected from a different sample. In the CFA model, item factor loadings were between 0.61-0.86. The fit indices χ2/sd= 2.069 SRMR= 0.03, RMSEA= 0.69, GFI= .94, AGFI= .90, CFI= .94, NFI=0.95, TLI= 0.96 were found to be of good fit and acceptable fit. In the reliability analysis, Cronbach Alpha internal consistency coefficient of the scale was found to be .90. The data obtained from item-total correlations and item analyses based on sub-superior groups showed that the discrimination of the items and the contribution of the items to the composite scale were high. Finally, as a result of the Tukey test to determine whether the scale could be analyzed with a total score, the significance was obtained at the .00 level. Although the anxiety level is scored between 1-7, the maximum score that can be obtained in the final scale form resulting from the analyses is 70.

The relevant literature presents examples of scale development studies on foreign language writing anxiety and different sub-dimensions have been reached. Cheng (2004) classified writing anxiety as somatic anxiety (physiological effect), cognitive anxiety (cognitive aspect of anxiety experience) and avoidance behavior (avoidance of writing) in his inventory. Maden et al. (2015) found sub-dimensions such as individual- oriented anxiety, environment-oriented anxiety, anxiety related to the rules of written expression, anxiety related to the writing tool and form, and anxiety related to the psychology of writing. In Cheng's (2004) study, the physiological and cognitive aspects of anxiety were separated, and the avoidance behavior developed as a result of anxiety was also included in the sub-dimensions, while Maden et al. (2015) identified the internal and external sources of anxiety as the dimensions of writing anxiety in teaching Turkish as a foreign language. In Maden et al.'s (2015) study, one of the dimensions of the writing tool is related to handwriting in terms of form-related anxiety, which can be considered similar to the scope of this study. However, the detailed perusal of the literature on scale development reveals the need for a handwriting scale with a particular focus on the psychomotor dimension of writing development in language education. This study contributes to the literature by introducing a handwriting anxiety scale that specifically addresses the psychomotor aspects of writing development in foreign language learners.

Conclusion and Recommendations

The handwriting anxiety scale, developed to measure the handwriting anxiety of students learning Turkish as a foreign language, has a high level of validity and reliability according to the criterion values given in the literature. Future research can use this scale in longitudinal studies to monitor changes in handwriting anxiety over time and at different proficiency levels. In addition, the scale can be used as a measurement tool in descriptive, correlational and experimental studies in the field of teaching Turkish to foreigners.

Ethics Committee Approval: Ethics committee approval was obtained from Ataturk University Education Sciences Ethics Committee (Date: 13.04.2021, E-56785782-050.02.04-2100107254)
Informed Consent: Written informed consent was obtained from the students participating in this study.
Peer-review: Externally peer-reviewed.
Author Contributions: Literature – A.T.T., N.E.G.; Writing Introduction - A.T.T., B.G., N.E.G.; Writing Scale Items- A.T.T., B.G., M.E.İ.T., N.E.G.; Data Collection and/or Processing-B.G., M.E.İ.T.; Analysis and/or Interpretation-M.E.İ.T.; Discussion and Conclusion-A.T.T., B.G., M.E.İ.T., N.E.G.; Sources B.G., M.E.İ.T.
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Appendix 1. Handwriting Anxiety Scale for Turkish as a Foreign Language Learners

Yabancı Dil Olarak Türkçe El Yazısı Kaygı Ölçeği							
Sevgili Katılımcılar, Bu ölçek yabancı dil olarak Türkçe öğrenenlerin el yazısına ilişkin kaygı düzeylerini ölçmek amacıyla oluşturulmuştur. Lütfen cümlenin size uygunluğuna göre 1-7 arasında puan veriniz. Puanlamada 1 (kesinlikle katılmıyorum) en düşük, 7 (kesinlikle katılıyorum) en yüksek puandır. Lütfen maddeleri içtenlikle ve size en uygun gelen şekilde yanıtlayınız. Katılımınız için teşekkür ederiz.							
1. El yazımın kıyaslanması beni rahatsız eder.	①	②	③	④	⑤	⑥	⑦
2. El yazımın eleştirilmesi beni tedirgin eder.	①	②	③	④	⑤	⑥	⑦
3. El yazımın değerlendirilmesi beni panikletir.	①	②	③	④	⑤	⑥	⑦
4. Türkçe harflerle yazmak beni endişelendirir.	①	②	③	④	⑤	⑥	⑦
5. Türkçe alfabeyle yazmaktan çekinirim.	①	②	③	④	⑤	⑥	⑦
6. Sınavlarda el yazısı kullanacağım zaman paniklerim.	①	②	③	④	⑤	⑥	⑦
7. El yazımın okunamaması beni rahatsız eder.	①	②	③	④	⑤	⑥	⑦
8. Türkçe karakterleri yanlış yazmaktan korkarım.	①	②	③	④	⑤	⑥	⑦
9. Tahtaya el yazısı ile yazmaktan çekinirim.	①	②	③	④	⑤	⑥	⑦
10. Türkçede büyük-küçük harfleri yanlış yazmaktan korkarım.	①	②	③	④	⑤	⑥	⑦

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Examining the Mediating Role of Doomscrolling in the Association between Earthquake Fear and Mental Well-being

Sinan OKUR[1]

[1] National Defense University, Turkish Air Force Academy, Department of Educational Sciences, İstanbul, Türkiye

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Corresponding author:
Sinan Okur
E-mail: sinan.okur@msu.edu.tr

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ABSTRACT

This study examines the mediating role of doomscrolling behavior in the relationship between earthquake fear and mental well-being among adults. It is hypothesized that earthquake fear increases uncertainty and anxiety, triggering doomscrolling behavior, which in turn negatively affects mental well-being. Digital media use may be interrelated with psychological effects following disasters, and doomscrolling behavior can have a detrimental impact on individuals' well-being. In this context, the study was conducted with a total of 378 adult participants (313 female, 82.8%; 65 male, 17.2%), with a mean age of 22.44 (*SD* = 5.45). The Earthquake Fear Scale, Doomscrolling Scale, and Warwick-Edinburgh Mental Well-Being Scale were conducted in the study. The research data were collected online, and the analysis was carried out using structural equation modeling (SEM). Additionally, the bootstrapping method was employed to test the significance of the mediating variable. Correlation analysis revealed that earthquake fear was significantly and negatively associated with mental well-being and positively associated with doomscrolling. Furthermore, the relationship between doomscrolling and mental well-being was found to be significantly negative. Structural equation modeling confirmed that doomscrolling played a full mediating role in the relationship between earthquake fear and mental well-being. The study demonstrates that earthquake fear leads individuals to engage in doomscrolling behavior, which in turn negatively impacts their mental well-being. The findings highlight the need for intervention programs promoting mindful media consumption during disaster periods. Regulating digital media consumption during crises may serve as a crucial strategy for enhancing individuals' well-being.

Keywords: Earthquake fear, doomscrolling, mental well-being, structural equation modeling.

Introduction

Mankind has witnessed many natural disasters throughout history. The devastation caused by these disasters has not only resulted in physiological effects but has also significantly impacted individuals' psychological well-beings. Among various natural disasters, earthquakes stand out due to their potential to profoundly affect individuals. As sudden and unpredictable events, earthquakes pose a direct threat to human life. They can cause individuals to experience high levels of stress, anxiety and trauma reactions (Bonanno et al., 2007). Therefore, negative emotions and psychological distress can be observed especially in individuals who have experienced an earthquake (Sümer et al., 2005). Studies on the psychological effects of earthquake commonly focus on mood problems such as post-traumatic stress disorder, anxiety and depression (Kiye et al., 2024; Norris et al., 2002). However, with the advancement of positive psychology, there has been an increase in research on the well-being of individuals after disasters. For instance, Fredrickson et al. (2003) conducted research on strengthening the well-being of individuals after the earthquake by focusing on issues such as well-being and posttraumatic growth.

Earthquake disaster is a natural event that can cause physical injuries, deaths and various psychological distress (Nakajima, 2012). Studies conducted on earthquake victims have identified fear as the most frequently reported emotional symptom among affected individuals. Several studies including Prati et al. (2012) in Italy, Khachadourian et al. (2016) in Armenia, O'Toole (2017) in New Zealand, and Salcıoğlu et al. (2018) in Türkiye, emphasized that people experience a serious sense of fear after an earthquake. Related literature emphasize that the effects of earthquakes can make individuals more psychologically fragile and vulnerable. For instance, Ahorsu et al. (2022) state that people may often experience emotions such as anger, sadness or fear in the face of unexpected situations. Terpstra (2011) emphasizes that individuals often show fear reactions in situations of threat or danger. Based on all these research results, it can be concluded that earthquakes evoke fear in individuals and have a negative impact on their well-being.

Many studies show that earthquake seriously affects the mental well-being of individuals. For instance, Rowney et al. (2014) emphasize that earthquake survivors have higher levels of anxiety and fear. In a recent study conducted by Prizmić-Larsen et al. (2023), it was stated that individuals affected by the earthquake were more likely to show depressive symptoms. Similarly, recent studies by Okur et al. (2024) and Usta et al. (2024) also reveal that earthquake victims are more likely to experience mental problems. These findings collectively suggest that the mental well-being of individuals experiencing earthquake-related fear is at risk. While earthquake fear itself is a significant predictor of mental well-being, additional factors may also mediate this relationship. One such factor is doomscrolling behavior, which refers to the compulsive consumption of negative news or distressing content through digital media during periods of crisis or fear. Continuously following news about traumatic events such as earthquakes may negatively affect mental well-being by increasing the fear level of individuals.

The Mediating Role of Doomscrolling

Doomscrolling is a concept that emerged due to the development of technology and the ease of access to news through social media tools. This concept is defined as the excessive exposure of individuals to negative news content during periods of fear, and entering into a cycle that will drag them emotionally worse by switching between negative news (Ytre-Arne & Moe, 2021). Sharma et al. (2022) also define doomscrolling as the obsessive engagement with distressing or depressing news content. This concept can be manifested by individuals' increased interest in negative content in online environments, especially during periods of crisis and disaster (Öksüz et al., 2023). Natural disasters such as earthquakes can cause intense fear and anxiety, and individuals may find themselves in search of information.

Purpose of the Study

In natural disasters, people may follow more news in order to keep up with the agenda and be aware of the changes and their surroundings. This may cause them to get caught in the doomscrolling cycle without realizing it. In the study conducted by Kartol et al. (2023), it was emphasized that individuals who are victims of earthquakes and who experience fear of earthquakes can show doomscrolling behavior. In the same study, it was also stated that doomscrolling behavior reinforces feelings of pessimism and negatively affects well-being. Anand et al. (2022) emphasized that the doomscrolling cycle is an important factor that seriously threatens well-being of individuals. When the literature is examined, it is found that individuals who are constantly exposed to bad news, thus those who fall into the doomscrolling cycle, experience problems such as stress, burnout and intolerance to uncertainty (e.g., Buchanan et al., 2024; Kaya & Griffiths, 2024; Nguyen et al., 2021; Taşkın et al., 2024; Türk-Kurtça & Kocatürk, 2025). Based on all these research results, this study aims to examine the mediating role of the concept of doomscrolling in the relationship between earthquake fear and mental well-being. All the above mentioned studies played an important role in establishing the rationality of this study. According to this rationality, it is thought that the fear of earthquakes can lead individuals to consume negative news uncontrollably and this can play a determining role on mental well-being. Although studies focusing on the binary relationships between concepts were encountered in the related literature, the scarcity of studies examining all three variables highlights a gap in the literature. This study seeks to bridge that gap by contributing growing body of research on mental well-being. In addition, it is important to use the concept of doomscrolling, which has been recently discussed in the psychology and educational sciences literature, in the hypothetical model. In this study, the following hypothesis will be tested:

- Doomscrolling mediates the relationship between earthquake fear and mental well-being.

Method

Research Model

This study aims to examine the mediating role of

doomscrolling in the relationship between earthquake fear and mental well-being. For this purpose, this study was designed as a quantitative study based on the correlational survey design. The independent variable of the study is earthquake fear, the mediating variable is doomscrolling and the dependent variable is mental well-being.

Participants

The study group consisted of Turkish adult participants. A total of 378 participants were included in the study, the majority of whom were female (*n* = 313, 82.8%). The study group was between the ages of 18 and 52, and the average age of the participants was 22.44. Most participants reported their socioeconomic status as medium (*n* = 265, 70.1%). Others reported being at low (*n* = 65, 17.2%), very low (*n* = 14, 3.7%), high (*n* = 32, 8.5%), or very high (*n* = 2, 0.5%) levels.

Data Collection Tool

Earthquake Fear Scale: This scale was developed by Satıcı et al. (2024) to determine individuals' fear of earthquakes. There are seven items in the scale (e.g., "*I'm very afraid of losing my life in an earthquake*"). There are no reverse items among the items of this one-dimensional scale. In the scale, 1 means strongly disagree and 5 means strongly agree. Possible high scores that can be obtained from the scale mean that individuals experience more fear of earthquakes. The construct validity of the scale was ensured by confirmatory factor analysis (CFI = .922, NFI = .914, IFI = .922, GFI = .900, SRMR = .053). In terms of reliability, Cronbach's alpha coefficient was calculated as .89. In this study, the Cronbach alpha value of the scale was calculated as .88.

Doomscrolling Scale-Short Form: This scale, developed by Sharma et al. (2022), was adapted to Turkish culture by Satıcı et al. (2023). The main purpose of this scale is to determine the behavior of engaging with negative news through digital media. In this study, the four-item short form of the scale was used (e.g., "*I find myself constantly looking at negative news.*"). In the scale, 1 means strongly disagree and 7 means strongly agree. The scale consists of a single dimension. There is no reverse item in the scale, and the possible high scores that can be obtained from the scale indicate that doomscrolling behavior is high. It was reported that the scale had sufficient construct validity as a result of confirmatory factor analysis (CFI = .95, NFI = .94, IFI = .95, SRMR = .044). In the reliability analysis, the Cronbach alpha internal consistency value was reported as .81. In this study, the Cronbach alpha reliability value was .80.

Warwick-Edinburgh Mental Well-Being Scale: This scale was developed by Tennant et al. (2007). The short form of the scale was originally adapted to Turkish culture by Keldal (2015), and later a shortened version was developed by Demirtaş and Baytemir (2019). The seven-item scale consists of a single dimension (e.g., "*I can make my own decisions*"). In the scale, 1 means never and 5 means always. There are no reverse items in the scale, and it has been reported that as the scores that can be obtained from the scale increase, the mental well-being of individual's increases. The fit index values of the scale are at a sufficient level (CFI = .99, NFI = .97, GFI = .97, AGFI = .94, SRMR = .033), and the Cronbach alpha coefficient is stated to be .86 in terms of reliability. The Cronbach alpha internal consistency coefficient of the scale in this study was found to be .83

Data Collection Process

Ethics committee approval was obtained from the National Defense University Social and Human Sciences Ethics Committee with the letter numbered E-35592990-050.04-4566311 dated March 7, 2025. In addition, the 1964 Helsinki Declaration and subsequent updates were complied with throughout the research. The target group of the study consisted of adults residing in Türkiye, and participants were recruited via e-mail and social media platforms (e.g. WhatsApp, Instagram, and Facebook). Data were collected from participants using an online form in March 2025. The form was prepared via Google Forms and includes an introduction section explaining the purpose of the study, ethical principles, estimated completion time, and contact information of the researchers. This form was designed so that participants could leave if they wished and could be completed when they answered all questions. All participants gave informed consent before participating in the research. The purpose of the research and voluntary participation were mentioned in this consent form. No fee was paid to the participants.

Data Analysis

In the data analysis process, firstly preliminary analyses were carried out. Within the scope of these analyses, descriptive statistics of the variables, normality values, reliability coefficient and correlation findings were calculated. Then, direct and indirect relationships between the variables were tested with structural equation modeling. In this context, a two-step modeling approach recommended by Anderson and Gerbing (1988) was followed. First, the measurement model was tested to evaluate whether the observed variables adequately represented the latent constructs. After achieving an acceptable level of fit, the structural model was analyzed to assess the hypothesized paths. In the established model,

demographic variables of age, gender and perceived socioeconomic level were added as covariance variables. The fit index values were examined for the verifiability of this model. The model fit was evaluated using several goodness-of-fit indices, including the Comparative Fit Index (CFI), Goodness of Fit Index (GFI), Tucker-Lewis Index (TLI), Incremental Fit Index (IFI), and Root Mean Square Error of Approximation (RMSEA). In accordance with established guidelines (e.g., Hu & Bentler, 1999), CFI, GFI, TLI, and IFI values of .90 or above are generally considered acceptable, while values above .95 indicate excellent fit. For RMSEA, values below .08 suggest reasonable fit, and values below .05 indicate good fit. Lastly, the significance of the mediator variable was determined by the bootstrapping method. SPSS 26 and AMOS 24 statistical programs were used within the scope of the research.

Results

After preliminary analyses including descriptive statistics of variables, normality values, and reliability coefficient and correlation findings, it was determined that all variables showed normal distribution and were reliable. In the correlation analysis, it was determined that there was a negative significant relationship between earthquake fear and mental well-being (r = -.136, p < .01) and a positive significant relationship between doomscrolling and mental well-being (r = .427, p < .01). In addition, doomscrolling was negatively significantly related to mental well-being (r = -.185, p < .01) (see Table 1).

Table 1.

Mean, Standard Deviation, and Correlation Values of the Study Variables (n = 378)

Variable	X̄	*df*	1	2	3
1. Earthquake fear	26.06	6.53	–		
2. Doomscrolling	12.66	6.25	.427*	–	
3. Mental well-being	24.87	5.49	-.136*	-.185*	–
Skewness			-.445	.311	-.312
Kurtosis			-.713	-1.059	-.037
Cronbach's alpha			.88	.80	.83

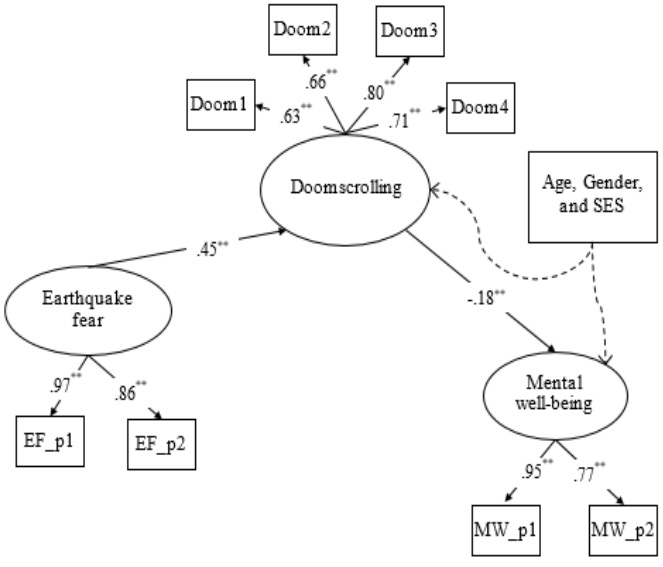
*p < .01

After the completion of the preliminary analyses, the model established with structural equation modeling was tested in line with the main purpose of the research. In this direction, firstly the measurement model and then the structural model were examined.

The measurement model consists of three latent constructs, namely fear of earthquake, doomscrolling and mental well-being, and eight observed variables. After analyzing the measurement model, it was determined that all factor loadings were significant. In addition, it was determined that the fit index values were at a good level (χ^2 (17, N = 378) = 35.65, p < .01, CFI = .98, GFI = .97, TLI = .97, IFI = .95, RMSEA = .05). This result proves that the observed variables are strong representatives of the latent constructs. In the structural model, the mediating role of doomscrolling in the relationship between fear of earthquake and mental well-being was examined. As a result of the analysis, it was determined that the fit index values were at a good level (χ^2 (35, N = 378) = 93.66, p < .01, CFI = .96, GFI = .95, TLI = .93, IFI = .96, RMSEA = .07). However, it was determined that the path from earthquake fear to mental well-being was not significant in the model. For this reason, this path was deleted and the analysis was repeated. As a result of the new analysis performed as a full mediator, it was determined that all paths were significant and the fit indices were at a good level (χ^2 (36, N = 378) = 93.70, p < .01, CFI = .96, GFI = .96, TLI = .96, IFI = .95, RMSEA = .06). The visual related to the model is given in Figure 1:

Figure 1.

*Full Mediating Role of Doomscrolling in the Relationship between Earthquake Fear and Mental Well-being, ** p < .01*



Note. SES = Socioeconomic Status, EF_p = Parcels of Earthquake Fear, MW_p = Parcels of Mental Well-being.

Finally, bootstrapping method was used to determine the

significance of doomscrolling in this relationship. Statistical significance of the mediator variable was achieved in the analysis performed by performing 5000 resamples (bootstrapping value = -.097 95% CI [-.182, -.022]). All these findings revealed that doomscrolling plays a full mediator role in the relationship between earthquake fear and mental well-being (see Table 2).

Table 2.

Standardized Bootstrapping Coefficients for the Model

Model pathways	Coefficient*	95% CI	
		Lower	Upper
Direct effect			
EF → Doom	.45	.34	.55
Doom → MW	-.18	-.31	-.05
Indirect effect			
EF → Doom → MW	-.097	-.182	-.022

* Because the CIs do not cover zero, all the coefficients are significant, *Note. EF = Earthquake fear, Doom = Doomscrolling, MW = Mental Well-being*.

Discussion

Earthquakes, one of the natural disasters, can have devastating effects on individuals. It is known that earthquake victims can later develop anxiety, stress, and fear reactions (Khachadourian et al., 2016; Salcıoğlu et al., 2018). The fear that individuals experience regarding earthquakes can negatively affect their mental health. Studies emphasize the destructive effect of earthquake fear on mental well-being (Prizmić-Larsen et al., 2023; Satıcı et al., 2024). This study examined the mediating role of doomscrolling behavior in the relationship between earthquake fear and mental well-being. Individuals experiencing earthquake fear may engage in doomscrolling behavior in order to follow the agenda and be aware of their surroundings. The doomscrolling cycle that begins to take place in the individual's daily life can further deteriorate mental well-being. The findings obtained from the study support this prediction. The findings obtained as a result of the study are discussed in detail below.

The first finding of the study emphasizes the direct relationship between earthquake fear and mental well-being. The results obtained show that individuals who fear earthquakes have lower levels of mental well-being. When the studies are examined, it is possible to come across research results that support the findings. For example, in the study conducted by Usta et al. (2024), it is emphasized that the fear of earthquakes threatens the well-being of individuals. The research by Satıcı et al. (2024) also revealed that mental well-being decreases in individuals who fear earthquakes. Similarly, Prizmić-Larsen et al. (2023), who worked on the Croatian context, also supports the negative relationship reached in this study. Moreover, previous research has also identified that individuals who fear earthquakes experience various mood problems (Nakajima, 2012; Norris et al., 2002). All these findings are consistent with the finding of our study that individuals who fear earthquakes have low levels of mental well-being. Fears related to earthquakes can trigger individuals' concerns about losing their loved ones or their assets. This situation can negatively affect the mental well-being of individuals by leading to a more pessimistic and depressed mood. In addition, it is important to consider that earthquake fear may not only stem from the anticipation of physical destruction but also from a perceived lack of control and uncertainty about the future. These psychological components can amplify stress responses and disrupt individuals' emotional regulation processes. Therefore, beyond the direct impact of fear itself, the cognitive and emotional interpretations of threat may serve as key mechanisms that undermine mental well-being. This perspective highlights the need for interventions that foster emotional resilience and cognitive reframing among individuals living in earthquake-prone regions.

The second finding obtained from the study is about the relationship between earthquake fear and doomscrolling. It was concluded that individuals experiencing earthquake fear exhibit more doomscrolling behavior. Several studies have showed that doomscrolling increases in individuals showing fear and anxiety reactions (Kaya & Griffiths, 2024; Nguyen et al., 2021; Sharma et al., 2022). In addition, Kartol et al. (2023) reached the conclusion that earthquake fear increases doomscrolling behavior. Individuals may prefer to follow developments more and be informed about what is happening as a coping mechanism in order to overcome the feeling of fear. However, constantly engaging with negative news can cause individuals to get caught up in the doomscrolling cycle. This behavior, although initially perceived as a way to gain control, may paradoxically intensify feelings of helplessness and anxiety. Thus, doomscrolling in the context of earthquake fear may reflect a maladaptive coping strategy that perpetuates distress rather than alleviating it.

Another finding from the study is that doomscrolling behavior negatively predicts mental well-being. The well-being of individuals caught in the doomscrolling cycle tends to be negatively impacted. A review of the existing literature reveals several studies that support this finding. For instance, Anand et al. (2022) emphasize that doomscrolling behavior has a negative effect on mental

well-being. In the recent study by Taşkın et al. (2024), it was stated that people who exhibit doomscrolling behavior can reduce their mental well-being by showing symptoms such as stress and burnout. Kaya et al. (2024) also reported that doomscrolling has a detrimental influence on psychological well-being. Based on the results of all these studies, it can be said that doomscrolling behavior negatively predicts mental well-being.

The last and most important finding obtained from the study is related to the fact that doomscrolling behavior plays a full mediating role in the relationship between earthquake fear and mental well-being. This means that the negative effect of earthquake fear on mental well-being is not direct, but occurs entirely through the increase in doomscrolling behaviors. Individuals experiencing earthquake fear show an increase in the frequency of following negative news. This causes individuals to get caught up in the doomscrolling cycle. In this regard, doomscrolling functions as a cognitive-emotional bridge that transforms fear into psychological distress. Increased doomscrolling behaviors cause individuals to feel worse and as a result, experience problems such as anxiety, stress, and burnout, which decreases mental well-being. A review of the literature revealed a lack of studies examining the relationship between these concepts from this perspective. However, the literature findings regarding the bilateral relations summarized above can also serve as a reference for this finding reached in the study. This mediating mechanism highlights how modern digital behaviors can exacerbate psychological vulnerability during times of crisis, making the mental health impact of natural disasters more complex and multifaceted. The lack of comparable studies in the existing literature highlights the originality of the present research and its potential to make a unique scholarly contribution. Therefore, the findings can fill an important gap in understanding how earthquake fear affects individuals' mental well-being and emphasize the decisive role of doomscrolling behavior in this process. In conclusion, the full mediating role of doomscrolling behavior on mental well-being in individuals experiencing earthquake fear can be considered as one of the most important findings of this study. This underscores the need to develop digital hygiene strategies as part of psychosocial support efforts for individuals exposed to disaster-related fear and uncertainty.

Limitations and Suggestions

There are some limitations in this study. The first one is that the study was designed in a cross-sectional design. It is recommended that longitudinal or experimental studies be conducted to better understand the causal effect between variables. Longitudinal analyses can be used in future studies, especially to understand long-term effects. Another limitation can be said to be the sample group. This study represents an adult sample. Including studies covering different age groups in future studies can increase the generalizability of the findings. Conducting similar studies especially on adolescents, elderly individuals or culturally different groups is important in terms of understanding the effects of variables in different contexts. Another limitation of the study can be said to be that the scales used are based on self-assessment. Participants may have given biased or prejudiced answers to the scales. Therefore, it is recommended that qualitative assessment methods be included in future studies. In-depth interviews, focus group studies and observational methods in particular can help understand the experiences of the participants more comprehensively. In addition, using biological or behavioral data collection methods can reduce bias caused by self-reporting and provide more reliable results. In addition, mixed method studies, in which different methodological approaches are used together, can contribute to addressing the subject from a multi-faceted perspective.

Implications

The findings of this study have important implications for both mental health practitioners and researchers working in the fields of disaster psychology, digital media, and mental well-being. The results highlight the need to address doomscrolling behaviors as a critical factor influencing the relationship between earthquake fear and mental well-being. For mental health professionals, the findings suggest that addressing doomscrolling behaviors in therapy and intervention programs may be crucial for individuals experiencing high levels of earthquake fear. Practitioners should incorporate psychoeducation about healthy media consumption habits into their therapeutic approaches, as doomscrolling serves as a maladaptive coping strategy that worsens rather than relieves distress. Cognitive-behavioral strategies can be used to help individuals recognize and modify doomscrolling tendencies and replace them with more adaptive coping mechanisms such as mindfulness, social media detox techniques, or structured information consumption routines. Additionally, crisis counseling programs, especially for communities in earthquake-prone areas, should include media literacy components that educate individuals about the psychological effects of excessive negative media exposure. Guided interventions

that encourage controlled exposure to disaster-related news, along with strategies to manage uncertainty and anxiety, may help reduce the negative impact of doomscrolling on mental well-being. Additionally, mental health practitioners working in disaster response teams should be aware of the digital behaviors of earthquake-affected individuals and consider providing support programs that moderate social media and news consumption. Incorporating strategies such as digital well-being coaching, self-regulation techniques, and encouraging resilience-building activities may reduce the harmful effects of doomscrolling and thus improve individuals' overall psychological well-being.

For researchers, these findings provide a basis for further investigation on digital media consumption patterns in the context of disaster-related psychological distress. Future research should investigate whether interventions targeting doomscrolling behaviors can buffer the decline in mental well-being caused by earthquake fear. Longitudinal studies examining the long-term psychological consequences of excessive disaster-related media exposure may provide valuable insights into how doomscrolling behaviors evolve over time and how they impact mental health resilience. Furthermore, investigating individual differences in susceptibility to doomscrolling may be another valuable research direction. Variables such as personality traits, cognitive biases, and prior trauma experiences may influence the extent to which individuals engage in doomscrolling. Investigating these factors may enhance the development of personalized intervention strategies. Additionally, comparative studies examining doomscrolling behaviors across different types of crises may provide a broader understanding of its psychological mechanisms and effects. Identifying patterns across crises may contribute to a more generalizable framework for reducing the negative impact of excessive negative media consumption on mental well-being. Finally, the study highlights the need for interdisciplinary collaboration between psychology, digital media studies, and disaster management to develop holistic strategies that integrate psychological insights into media policies. Researchers can work with policymakers and media organizations to design ethical guidelines and digital tools that encourage balanced information consumption, thereby reducing the harmful effects of doomscrolling on mental health. By integrating these insights, both practitioners and researchers can contribute to developing more effective strategies to protect mental health in the face of earthquake-related fears and digital media exposure.

Conclusion

This study shows that individuals with high earthquake fear are more likely to engage in the doomscrolling cycle, which in turn has a negative impact on their mental well-being. Since doomscrolling plays a full mediating role in the relationship between earthquake fear and mental well-being, implementing strategies to mitigate doomscrolling may play a crucial role in alleviating the adverse psychological effects associated with earthquake-related fear. The results revealed that digital media use should also be considered in post-disaster psychological support processes.

Ethics Committee Approval: Ethics committee approval was obtained from National Defense University Social and Humanitarian Ethics Committee (Date: 07.04.2025, Number: E-35592990-050.04-4566311)
Informed Consent: All participants in the study gave informed consent.
Peer-review: Externally peer-reviewed.
Author Contributions: Concept-SO; Design-SO; Supervision-SO; Resources-SO; Data Collection and/or Processing-SO; Analysis and/or Interpretation-SO; Literature Search-SO; Writing Manuscript-SO.
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Comparison of Gifted Students and Anatolian High School Students' Perspectives on Errors in Mathematics Lesson

Zekiye MORKOYUNLU[1]

Gülşah SALTIK AYHANÖZ[2]

[1] Kırşehir Ahi Evran University, Faculty of Education, Mathematics Education Department, Kırşehir, Türkiye

[2] Akşemseddin Science and Art Center, Niğde, Türkiye

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Corresponding author:
Zekiye Morkoyunlu
E-mail:
zekiye.morkoyunlu@ahievran.edu.tr

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ABSTRACT

In this study, it is aimed to compare the perspectives of gifted students and students studying at Anatolian High School towards errors in mathematics lessons. The research was conducted with 30 students, including 15 gifted students studying in the project program at the Science and Art Center in Niğde, and 15 high school students studying at Anatolian High School during the 2020-2021 academic year. A semi-structured interview form consisting of 6 questions was used as a data collection tool. Content analysis was used in the analysis of the obtained data. In the interviews, the students were asked questions that would enable them to determine how often they made errors in the mathematics lesson, their fear of making errors, the expression of their errors by others, and their perspectives on the discussion of errors. Based of the findings, it is seen that Anatolian High School students avoid, fear and make errors more than gifted students in mathematics lessons. The Anatolian High School students were more likely to leave the questions unsolved or blank not to make errors, they make errors more frequently, they are more emotionally affected by the errors they make. It can be said that Anatolian High School students are more afraid of making errors in mathematics lessons. All of the gifted students and the majority of Anatolian High School students see the errors "instructive".

Keywords: Error, gifted students, mathematics education, high school students

Introduction

Errors made by students in mathematics lessons are quite common. Errors play a more fundamental role in the growth of a discipline than is thought (Kuhn, 1970; Lakatos, 1976). Errors are a common phenomenon in mathematics education worldwide (Boaler, 2016; Heinze, 2018; Santagata, 2005). Mathematical errors, on the other hand, arise as a result of generalizing students' productions for problems in an incorrect way when they encounter new topics (Önal & Aydın, 2018). Error is on of the most frequently studied topics by mathematics education researchers. Errors are mostly more informative than correct answers in terms of learning (Lannin et al., 2007; Rushton, 2018). Errors create opportunities for students to evaluate how well they grasp mathematical concepts, and to provide feedback in order to develop and awaken students' ideas (Gardner & Wood, 2009; Metcalfe, 2017).

If students see errors as failures and avoid them, their brains will miss out on opportunities for improvement. Therefore, teachers should see errors as an opportunity for students' brain development and learning. Thus, students will not see the error as a failure and will be able to benefit from the tutorial part. In the study by Parviainen and Eriksson (2006), negative and positive knowledge have been compared.

In this study, correct knowledge shaped by belief is positive knowledge; the knowledge that is not learned and thrown into the background is defined as negative knowledge. Additionaly, research has been showen that individuals' knowing what they should not do or what they do not know emerges with the use of positive and negative knowledge together. In the definition given in the study of Gartmeier et al. (2008), individuals' knowing what to avoid and knowing what they do not know is defined as only negative knowledge. Furthermore, Bickhard (2004) expresses negative knowledge as being able to us error in learning. Errors in providing negative knowledge should be considered as potential opportunities (Lakatos, 1976; Kline, 1980). Studies have shown that errors and difficulties are the best opportunity for the development of the brain

(Boaler, 2016; Moser et al., 2011; Tall, 1990). Such studies on the brain and errors are quite important for teachers and parents (Boaler, 2016). Additionally, other studies aim to reveal errors in a concept (Billi et al., 2020; Movshovitz-Hadar et al., 1987; Radatz, 1979; Şimşek, 2018; White, 2005). Students encountering new problems and making misgeneralizations during their production constitute mathematical errors. Besides, errors occur due to many reasons such as a momentary slip of the pencil, carelessness, misinterpretation of texts and symbols, understanding about the learned target, mathematical concept and subject, lack of knowledge and inability to control the answer given by experience, lack of awareness. (Burns, 2007; Hansen, 2014; Ryan & Williams, 2007). New knowledge in students is formed by using previous knowledge. Borasi (1988) states in his study that errors are a starting point in the process of enabling individuals to learn. Errors are generally more informative than 'correct' answers in terms of learning. Errors provide opportunities to give feedback to awaken and develop students' ideas, and to evaluate how well mathematical concepts are grasped by students (Heinze, 2018; Ingram et al., 2015; Santagata, 2005).

Teachers are encouraged to choose errors as a starting point in teaching a subject. The reason is for that students do not acquire common misconceptions about the subject to be taught (Ingram et al. , 2015). Santagata (2005) recommends that teachers and students should attach importance to errors and see them as learning achievements rather than as learning failures. If students see errors as failures and avoid them, both their brains will not develop and they will miss opportunities for improvement. For this reason, teachers should consider errors as an opportunity for students' brain development and learning new knowledge. To this end, studies that result in errors should be made to students by teachers.

Heemsoth and Heinze (2018) state that errors can be a powerful tool that can be used to diagnose learning difficulties and direct correction. Studies dealing with this function of errors emphasize the importance of inadequacy in terms of increasing awareness of difficulties in learning mathematics and individual differences and correcting errors by constantly explaining the same issues (Mathan & Koedinger, 2018; Wijaya et al., 2019). Errors are an opportunity to learn. If teachers do not take advantage of these opportunities, the error becomes permanent (Berman, 2006; Ryan & Williams, 2007). Teachers should take into account various variables when determining the cause of the error. Errors should not be thought as just learner-centered. Many variables play role in the environment where errors occur (Cockburn, 2005; Hansen, 2014; Ryan & Williams, 2007).

Errors are significant in terms of instructive quality in mathematics education. It is of crucial that the errors are used by the teachers as an instructive element in the lessons. Some teachers, realizing the importance of errors, see errors as a sign of students' need to restructure their knowledge (Santagata, 2005). Rach et al. (2013) emphasized that teachers should consider errors in their lessons as learning opportunities. In the study, it was determined that the fear of making errors in the students of the teachers who support the errors as an opportunity to learn in their lessons decreased. Borasi (1989) states that individuals realize their errors when they encounter error-based activities, their questioning skills develop and they gain new ideas. Experimental studies to determine this situation are found in the literature. Heinze and Reiss (2007) pointed out in their quasi-experimental study that error-based activities applied to seventh grade students achieved a much better level of reasoning and proof performance in the applied group.

Understanding the knowledge needed for teaching mathematics is a prominent domain in terms of teaching and learning mathematics (Peng & Luo, 2009). For learning and teaching in schools, especially in mathematics classes, errors are crucial for the learning process (Rach et al., 2013). In the process of mathematics education, it is significant to examine the students' perspectives on errors, their knowledge, awareness and perceptions about errors, while teachers' perspectives on errors and their orientation in this direction are important. Regarding that students are classified according to their success and they receive different education in this direction, it might be a matter of curiosity whether there are similarities or differences between the perspectives of gifted and non-gifted students. Even, the gifted students can be expected to see the errors as the opportunity for learning process. Being giftedness may be related to the error perception. Here, the study conducted can give results to see the error perception of gifted students and non-gifted Anatolian high school students. In the literature it is easy to see the studies conducted with non gifted students. However, gifted students' perceptions and perspectives about the errors in mathematics has not researched yet. That is why this study can give an entry idea about the gifted students' perception and perspectives by comparing them with non gifted Anatolian High School students.

There are many studies contributing to the literature on errors and learning from errors in mathematics education (Bilgili et.al., 2020; Oflaz & Polat, 2022; Önal & Aydın, 2018 Özkaya & Konyalıoğlu, 2019). However, there are no studies on gifted students' perceptions of and perspectives on errors in mathematics learning. However, the

perceptions and perspectives of gifted students about errors in mathematics have not been investigated yet. Therefore, by making a comparison, it is possible to have an idea about gifted students' perspectives on errors in mathematics. It is thought that this comparison of errors can also bring a suggestion to the literature on why and why both student groups show similarities and differences. When the literature is examined, by considering that any error study involving gifted students in mathematics education is confronted and that the ideas of the students in both groups may have an impact on the literature and the teaching plans of the teachers, it is aimed to compare the perspectives of the students studying at Anatolian High School and the gifted students about the errors in the mathematics lesson. In addition, in this research, " What are the differences and similarities in the perspectives of students studying at Anatolian High School and gifted students towards errors in mathematics?" search for an answer to the question.

Purpose of the Study

The purpose of the study is to compare the perspectives of gifted students and students studying at Anatolian High School towards errors in mathematics lessons. The research question is;

- "What are the differences and similarities in the perspectives of students studying at Anatolian High School and gifted students towards errors in mathematics?"

Method

Research Model

The phenomenology design, one of the qualitative research methods, was used in the study. The phenomenology study is based on the examination of phenomena that are known but not in-depth knowledge (Yıldırım & Şimşek, 2013). The aim in phenomenology is to reveal the opinions and thoughts of the participants to reach the underlying meanings of the phenomenon to be investigated (Oiler, 1982). The data collection tool in phenomenological studies is mostly face-to-face interviews with participants (Christensen et al., 2011; Creswell, 2007). The steps used in the analysis of phenomenological studies; to record in the minutes, to reveal the meaning of the explanation, to form the meanings; clusters of themes, detailed description, fundamental structure (Colaizzi, 1978).

In this study, reveal how the errors made in the mathematics lesson were perceived by the Gifted students and Anatolian High School students. A semi-structured interview form was used as a data collection tool. While analysing the data, recording the minutes of Colaizzi (1978) for the analysis of phenomenological studies revealing the meaning of the explanation, forming the meanings; clusters of themes, detailed definition steps were followed. The thoughts of the Gifted Students and Anatolian High School Students towards the errors was determined as phenomenology study (Yıldırım & Şimşek, 2013) because of the examination of the students' opinions about the errors in order to reach students' thoughts about the errors made in the mathematics course, which is observed to be noticed in the literature but it is understood that the opinions of the individuals are not examined in depth (Oiler, 1982), using the semi-structured interview form as a data collection tool (Christensen et al., 2011; Creswell, 2007) and following the steps that Colaizzi (1978) put forward for the analysis of phenomenology studies.

Study Group of the Research

The sample of the research consists of 30 studnets who are studying in a city in Central Anatolia, who comply with the study criteria, volunteer to participate in the research and have parental permission. The study was carried out with a total of 30 students, 15 high school students studying in the project programme at the Science and Art Centre in the same city in the 2020-2021 academic year, and 15 high school students studying at an Anatolian High School in the same city who were not identified as gifted individuals who had previously taken the Science and Art Centre exam. The criterion sampling method, one of the purposeful sampling methods, was used as a sampling method. The basic understanding in this sampling method is to study all situations that meet a set of predetermined criteria. The criteria or criteria mentioned here can be created by the researcher or a pre-prepared criterion can be used (Yıldırım & Şimşek, 2005). The main criterion determined by the researcher in determining the participants is that the students included in the sample are diagnosed as gifted and non-special gifted individuals.

Data Collection Tool

A semi-structured interview form consisting of 8 questions was used as a data collection tool. After the necessary literature review was done, the questions were prepared by the researchers. Prepared interview The questions were analysed by three faculty members, two of whom are experts in the field of gifted education and one in the field of measurement and evaluation. With the suggestion of one of the faculty members, the first two questions were changed. While the question of "How do you act when you make an error in math class?" was converted in to the form of "How often do you make errors while solving questions in math class? How do you realize your errors? Can you give

examples from your experience?", the question of "Is there any question that you left unsolved or blank in order not to make errors in your mathematics lesson? Can you explain with an example?" was presented as a suggestion by the same faculty member. Additionaly, "What is the reason for leaving the questions blank in order not to make errors in the math lesson?" was suggested by one of the experts. After the relevant changes were made, the final version of the semi-structured interview form was obtained. The interview questions are presented in the appendix. Each question was asked seperately to the students. Fourth question was asked seperately as three question. That's why there are eleven questions in the results findings section.

The ethical process in the study was as follows:

- Ethics committee approval was obtained from Kırşehir Ahi Evran University Social Sciences and Humanities Scientific Research and Publication Ethics Committee (Date: 03.02.2022, Number: 2021/6)
- Informed consent has been obtained from the participants and their parents.

Data Analysis

Content analysis was used in the analysis of the obtained data. Due to the pandemic, students were contacted via remote interview tools. In the interviews with the students, questions were asked to determine how often they made errors in mathematics lessons, what they did when they were afraid of making errors, what they did when they were afraid of making errors, how their errors were expressed by others (teachers, friends, etc.), and their perspectives on the discussion of errors.

Content analysis was used in the analysis of transcribed data. Since the data was transferred to prose, the record was taken on the minutes. The answers received from the students were read one by one by the researchers. Therefore, the step of recording Clolaizzi (1978) to the minutes has been fulfilled. The answers given by the students to each question were read by the researchers and the expressions related to the concepts in the questions were determined. The meanings of the explanations were tried to be revealed by removing the unnecessary explanations (Colaizzi, 1978). Similar statements were noted. For the expressions noted by the researchers, codes were created with keywords and thus the meanings were formed (Colaizzi, 1978). The categories for the questions were created by using the expressions in the question statements. The resulting codes and categories are presented as a concept map. Categories, codes, frequencies showing the number of participants for the code and category are specified in the concept map. Following the concept map, examples are given. Necessary explanations are provided by associating the sample expressions with the category and code (Colaizzi, 1978).

Validity and Reliability

The validity of this research has been tried to be ensured by the detailed reporting of the data obtained from the interviews. One of the ways to ensure validity in qualitative studies is to report the data in detail (Yıldırım & Şimşek, 2016). In order to ensure internal validity, a conceptual framework was created by reviewing the relevant literature during the preparation of interview questions. In this way, while descriptive analysis was made on the data obtained, it was tried to provide a scope to include the relevant concepts. Regarding the research process in order to ensure external validity in the research; the subjects of determining the participants, interview environment, conducting the interviews, conveying the participant's views one-to-one and data analysis were explained in detail. Personal information of the students was kept confidential in the presentation of the findings. In this qualitative research, expert opinion was sought in order to ensure the internal validity, credibility and consistency of the interview form. The reliability and validity of the prepared interview questions were also determined using the formula developed by Miles and Huberman (1994). The percentage of agreement between the experts was realized at the rate of 90%, and the validity and reliability of the interview questions were tried to be ensured.

Comparisons made by the researchers were checked for consistency. The reliability of the research was determined by determining the number of consensus and disagreement in the comparisons. Miles and Huberman's (1994) Reliability=consensus/(consensus+disagreement) formula was used. According to Miles and Huberman (1994), the consensus among coders is expected to be at least 80%. A consensus (reliability) of 90% was achieved in this study.

Results

The findings obtained from the interviews with gifted students and Anatolian High School students are presented through diagrams. In the given diagrams, the answers on the right (green) belong to the gifted students, and the answers on the left (orange) belong to the Anatolian High School students.

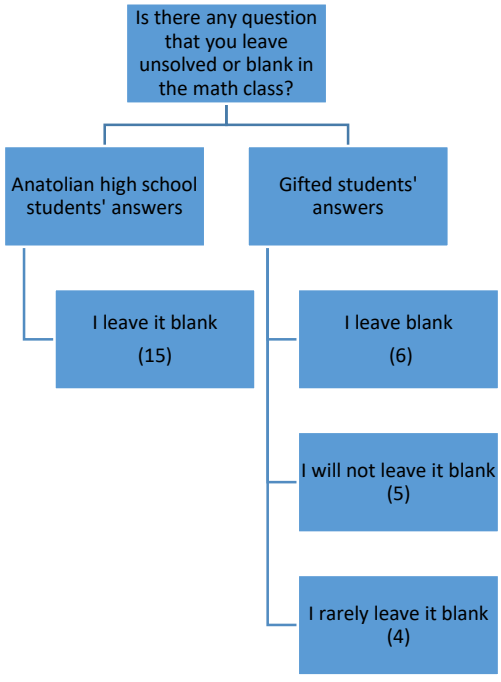
Gifted Students and Anatolian High School Students' Opinions on Making Errors

The codes for the students' answers to the question of "Is there any question that you leave unsolved or blank in order not to make errors in the math lesson?" are presented in Figure 1.

In Figure 1, it is seen that the answers of the gifted students consist of 3 different categories, and the answers of the Anatolian High School students consist of 1 category. While 6 of the gifted students were answering as “I leave it blank”, 5 of them “I do not leave it blank” and 4 “I rarely leave it blank.”, all of the Anatolian High School students answered as “I leave it blank.”.

In the interview, G1 said, “No, it never happens because I am not afraid of making errors. I think that I will definitely learn the result of my error in every test and every exam. He can get out by doing the right thing in another way. The questions I left blank are only questions that I could not generate ideas for, that I did not know at all, and that I did not see such a question in my life ”, and G5 said “I try to do all of them. I ca n't leave it blank ” and G9 “ No, I try to do all of them .” found in the statement.
Also, A2 " Yes, sir ." , A6 “Yes, there can be several.” and A10 replied “ Of course it does ”.

Figure 1.
Codes Related to “Making Errors” Category



Opinions of Gifted Students and Anatolian High School Students on Leaving the Questions Blank in order not to Make Errors

The codes for the answers of the students, who stated that they left the questions blank in order not to make errors, to the question that "What is the reason for leaving the questions blank in order not to make errors in the math lesson?" are presented in Figure 2.

As seen in Figure 2, it is seen that the answers of the gifted students consist of 3 different categories, and the answers of the Anatolian High School students consist of 5 different categories. On the process of listing the reasons for leaving blanks in the mathematics lesson,while 6 of the gifted students were stating as "Preventing making errors, 1 of whom "In the case of have not learnt the topic" and 2 of whom "Because I am not sure", 5 of the Anatolian High School students answering as "Because the wrong answers take the correct answers", 2 of whom answering as “To solve it later”, 1 of whom answering as “Because I could not solve the question”, 2 of whom answering as “For not giving wrong answers” and 1 of whom answered “Because I was depressed”.

G4 of the students said that “Leaving blank takes less correct answers, that's why. In order not to take risks”, G8 “If I am not sure at all, of course I leave it blank” and G7 found in the statement. “If I have not learnt the subject of the question, I leave it blank.” In addition, A13 replied as “I sometimes leave it blank in order not to reduce my motivation for questions that I have difficulty or think I cannot do”, and A14 “So when I make an error, I cannot correct that error again, so when I leave it blank, at least I do not take the risk of that error. When I make an error, something will go away, but when I leave it blank, nothing will go away from me” and A6 “That's why I'm doing it to return to them later.

Figure 2. 1
Codes Related to the Category of “Reasons for Leaving Questions Blank”

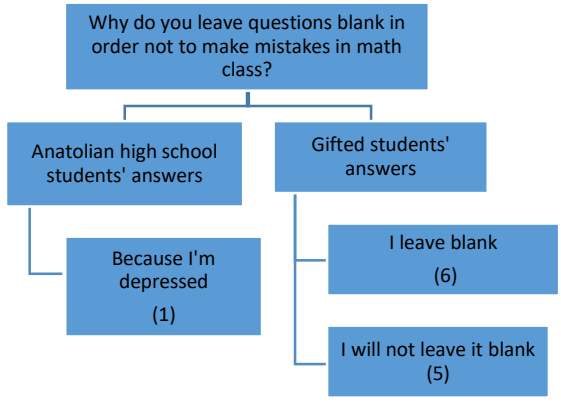
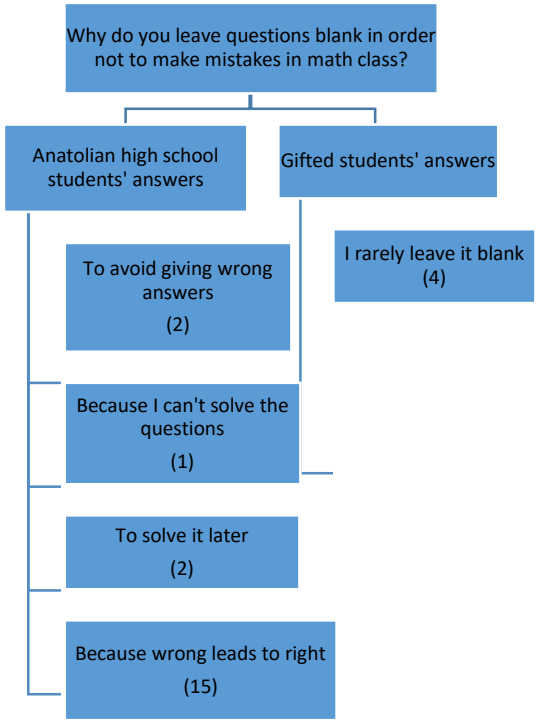


Figure 2. 2

Codes Related to the Category of "Reasons for Leaving Questions Blank"

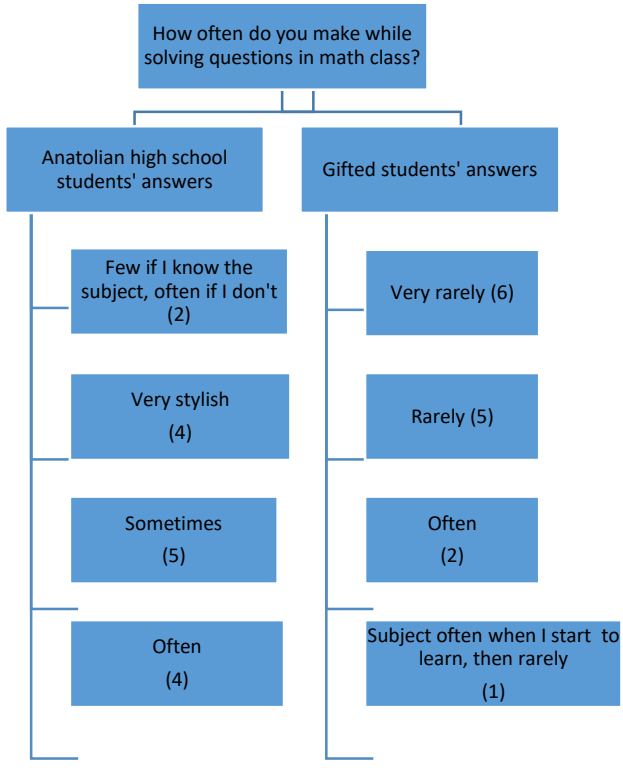


Opinions of Gifted Students and Anatolian High School Students on the Frequency of Making Errors

The codes for students' answers to the question that "How often do you make errors while solving questions in math class?" are presented in Figure 3. In Figure 3, it is seen that the answers of the gifted students consist of 4 different categories, and the answers of the Anatolian High School students consist of 5 different categories. When the students were asked about the frequency of making errors in mathematics lessons, 3 of the gifted students said "Very rarely", 9 "Rarely", 2 "Frequently" and 1 "Frequently at the beginning of the subject, it decreases over time." gave the answer. In addition, 4 of the Anatolian High School students stated "Often", 5 "Sometimes", 4 "Very often", and 2 "If I know the subject little, if I don't know very often" found. In the interview, G7 said, " My teacher, I leave it blank mostly because I couldn't solve it, not to avoid making errors, because when I solve it, I act by thinking that I have solved it correctly. Therefore, there is no question that I left blank in order not to make anerror. I rarely make errors .", G10 " Rarely ." and G2 " My teacher, I often make errors at the math is not good at all, my teacher. " and A7 stated as " I make errors very often ." and G2 " My teacher, I often make errors at the beginning of the subject, but it decreases over time ." gave the answer. In addition to this, A4 of the students said " I am doing quite less errors right now because I am studying as I am preparing for the exam ", and A3 stated that " I often make errors while solving questions because my math is not good at all, my teacher. " and A7 stated as " I make errors very often ."

Figure 3.

Codes Related to the Category of "Frequency of Error"



Opinions of Gifted Students and Anatolian High School Students on How They Feel When They Make Error

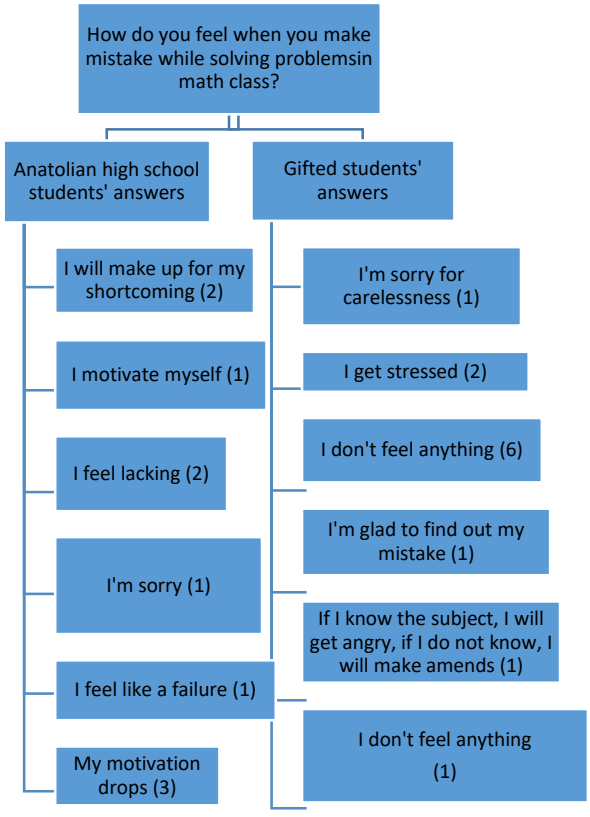
The codes for students' answers to the question of "How do you feel when you make an error while solving questions in the math lesson?" are given in Figure 4. In Figure 4, it is seen that the answers of the gifted students consist of 6 different categories, and the answers of the Anatolian High School students are again 6 different categories. When the students were asked how they felt when they made an error, 1 of the gifted students said, "I feel sad rather than carelessness", 2 of them "I get stressed", 6 of them "I don't feel anything", 1 of them "I am glad to learn about my error.", 1 of them "If I know the subject, I will get angry, if I do not know, I will make amends." and 1 of them gave answer as "I am ashamed of myself.". In addition, 3 of the Anatolian High School students said that "My motivation drops", 1 of them "I feel unsuccessful", 7 of them "I feel sad", 1 of them "I motivate myself" and 2 of them expressed their opinion as stating "I make up for what I lack."

During the interview, among students G3 replied as "I think I need to work harder", G5 " Frankly, I get very upset when

I'm careless. Because being careless about the questions I've worked so hard for makes me feel bad. But I don't get upset at all when I don't know or know my error, I learn in a different way just because it's like this. If there are two ways, I even learn two ways. I don't just learn the easy way to me." and G1 said, "If I know the subject, I will get angry, if I do not know, I will make up for it. ". In addition to this, A8 "I'm bored ", A11 "I mean, my teacher, the score goes away, even in the university exam, you know 40 questions in mathematics. People feel up set ." and A6 found in the statement that " I try to make up for what I lack ."

Figure 4.

Codes Related to the Category of "Feelings When Errors are Made"



Opinions of Gifted Students and Anatolian High School Students on Fear of Making Errors

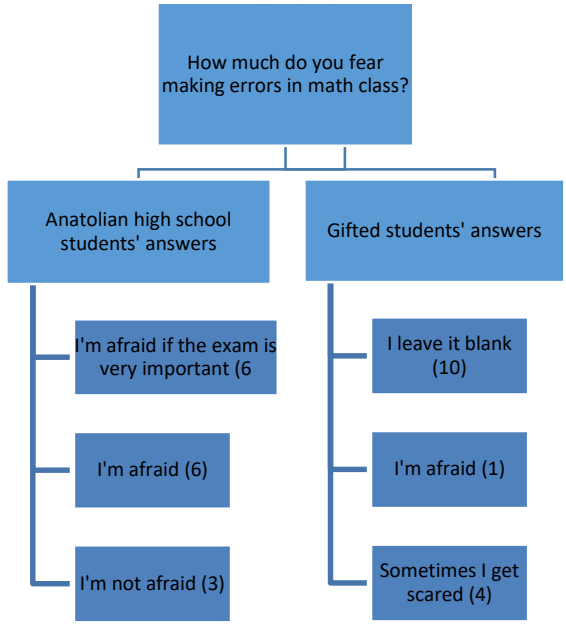
The codes for students' answers to the question that "How much do you fear making errors in math class?" are given in Figure 5. In Figure 5, it is seen that both the answers of the gifted students and the answers of the Anatolian High School students consist of 3 different categories. In the interview, While10 of the gifted students giving their answers as "I'm not afraid", 1 of them "I'm afraid." and 4 of them "Sometimes I get scared.", 3 of the Anatolian High School students expressed their opinions as "I am not *ambitious*.", G8 "Making *errors does not scare me* ." and G12 " *Maybe it will scare me if I make a lot of errors, but usually I am not afraid because I don't make many errors* .". From Anatolian High School students A7 found in the statement that "*If the exam is important, of course I am afraid* .", A2 said " I am *afraid, teacher because I do not want to fail* ." and A10 stated that "I am not *afraid, I choose to try harder instead* ." afraid.", 6 of them "I am afraid." and 6 of them "I'm afraid if the exam is very important.".

The codes for students' answers to the question that "How much do you fear making errors in math class?" are given in Figure 5. In Figure 5, it is seen that both the answers of the gifted students and the answers of the Anatolian High School students consist of 3 different categories. In the interview, While10 of the gifted students giving their answers as "I'm not afraid", 1 of them "I'm afraid." and 4 of them "Sometimes I get scared.", 3 of the Anatolian High School students expressed their opinions as "I am not afraid.", 6 of them "I am afraid." and 6 of them "I'm afraid if the exam is very important.".

In the interview, among the students G5 gave the answer as " No, it doesn't scare. Making errors makes me more ambitious.", G8 "Making errors does not scare me ." and G12 " Maybe it will scare me if I make a lot of errors, but usually I am not afraid because I don't make many errors .". From Anatolian High School students A7found in the statement that "If the exam is important, of course I am afraid .", A2 said " I am afraid, teacher because I do not want to fail ." and A10 stated that "I am not afraid, I choose to try harder instead ."

Figure 5.

Codes Related to the Category of "Fear When Error Made"



Opinions of Gifted Students and Anatolian High School Students on What They Do When They Are Afraid of Making an Error

The codes for the answers given to the question of "What do you do when you are afraid of making errors in math class?" are given in Figure 6. In Figure 6, it is seen that the answers of the gifted students consist of 5 different categories, and the answers of the Anatolian High School students consist of 8 different categories. In the interview, 2 of the gifted students said "I leave it blank", 3 of them "I take a break", 2 of them "I think that I need to study more", 5 of them "I try different methods." and 3 of them expressed their opinion as "I increase my attention level". In addition, 4 of the Anatolian High School students gave answer as "I try not to make errors", 2 of them "I will make up for the part where I was wrong", 1 of them "I will skip that question", 1 of them "I don't know", 1 of them "Lesson from error" I remove it.", 1 "I do not reflect on my behaviour", 2 of them "I go over my errors." and 1 of them "I increase my attention level."

During the interview, students *G2 "Maybe I will read the question once again.", G9 "When I am afraid of making anerror, I leave the question blank* ." and G10 " I will solve the *question once again* ." A8, from Anatolian High School students, said that "*I will try harder. I try to calm down*.", A2 stated that" *I work on the topics of the questions I made errors* ." and A14 expressed opinion as " *I learn from my error*."

Opinions of Gifted Students and Anatolian High School Students on Whether Making Errors Is Instructive

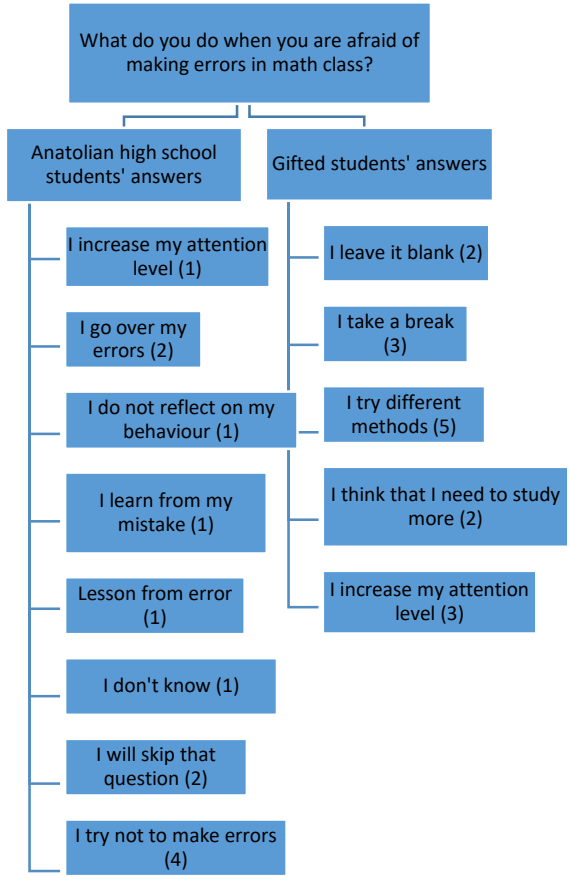
The codes for students' answers to the question of "What do you think about the instructivity of the errors you made in the math lesson for you?" are given in Figure 7.

In Figure 7, it is seen that the answers of the gifted students consist of 1 category and the answers of the Anatolian High School students consist of 2 different categories. In the interview, all of the gifted students found making errors instructive, 14 of the Anatolian High School students stated that they found it instructive, and 1 of them did not find it instructive.

One of the students G7 said, "*I definitely think it is instructive because the errors we make show us the part of the subject that we do not understand. Here we take it to the teachers and they show us the correct. That's why they actually teach us the correct, just like in all other lessons. "*,

Figure 6.

Codes Regarding What to Do in Case of Fear When Error Made



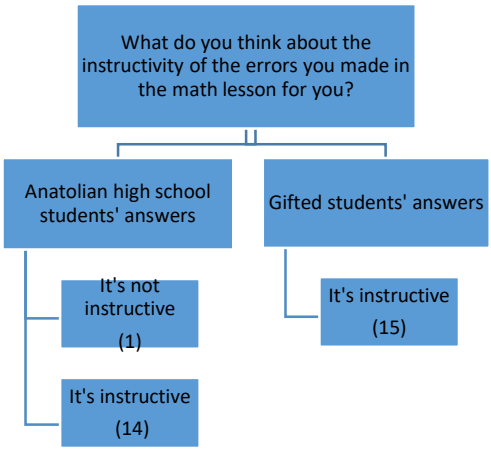
G2 stated "*When I make an error, when I correct that error, I do not repeat the same error again. So it stays clearer in my mind*." and G8 expressed opinion as "*If I made an error in that question before solving the other questions and if I really found the correct answer, it allows me to solve the other questions correctly using that method*". Also, about the instructivity of making errors A5 expressed that " So *I don't do it again about that question about similar questions ... In fact, making errors and making errors are both good things, but it is not good if it is done too much. At least we can see our errors and learn a lesson*." and A14 expressed opinion as "*It is definitely instr*
productive, teacher, we learn the truth after making errors."

Opinions of Gifted Students and Anatolian High School Students on Expressing Their Teachers' Errors

The codes for students' answers to the question of "How do you respond to your teacher expressing your errors when you get a question wrong in the math class?" are presented in Figure 8.

Figure 7.

Codes Related to the Category of "Instructivity of Error"



In Figure 8, it is seen that the answers of the gifted students consist of 7 different categories, and the answers of the Anatolian High School students consist of 8 different categories. In the interview, 9 of the gifted students "I find it normal", 1 of them "It raises awareness", 1 of them "I like it", 1 of them "I find it positive." I benefit from the teacher's experience." 1 of them "I don't like it." and 1 of them expressed opinion as "I get mad at myself.". In addition, 1 of the Anatolian High School students was found in the statement that "This is what I want", 1 of them "It is very valuable", 3 of them "Good, important, good", 4 of them" helpful", 1 of them "I am hurt and ambitious.", 1 of them "Motivates.", 1 of them "I am happy." and 3 of them stated that "I find it normal."

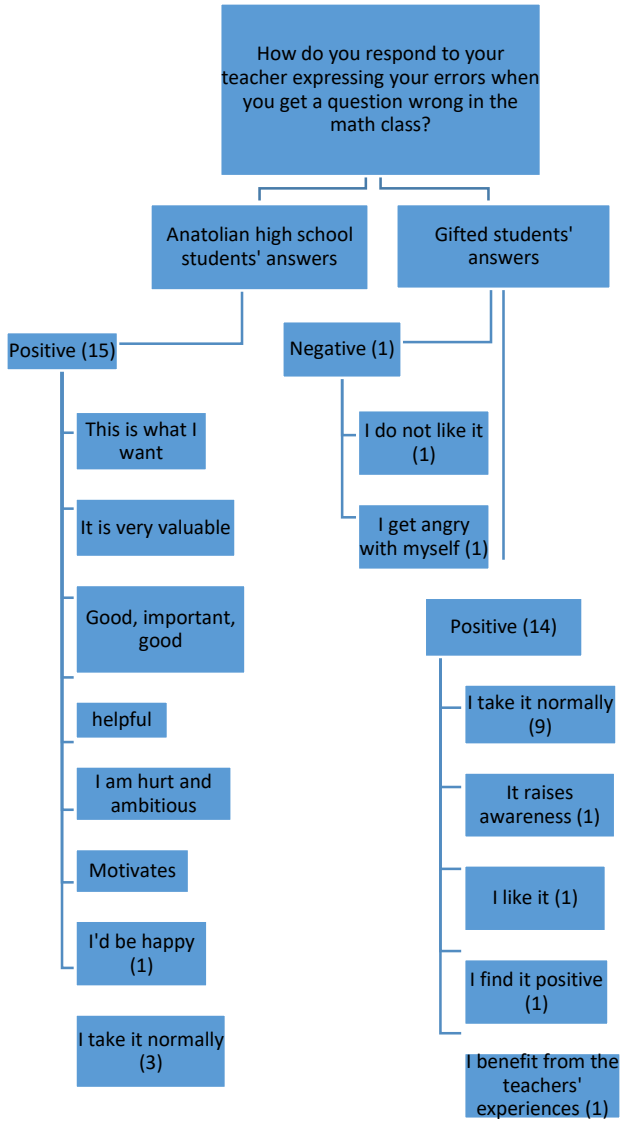
While gifted students G14 "*Isn't this the way it should be*?", G1 "It *is very instructive for my teacher to express my error. It shows me over and over again that I'm usually careless* ." and G13, " *I don't like it, teacher* .", A9 who is from Anatolian High School students expressed opinion as " *Helps* .", A10 stated that" *So...it's a good thing because when I make an error, I want to learn the truth. I understand when my teacher tells me*." and A12 said "*I feel happy when my teacher tells me about my error, I think my teacher cares about me*."

Opinions of Gifted Students and Anatolian High School Students on Expressing Their Friends' Errors

The codes for students' answers to the question that "How do you respond to your friends expressing your errors when you get a question wrong in math class?" are presented in Figure 9.

Figure 8.

Codes Related to the Category of "Teacher's Expression of Error"

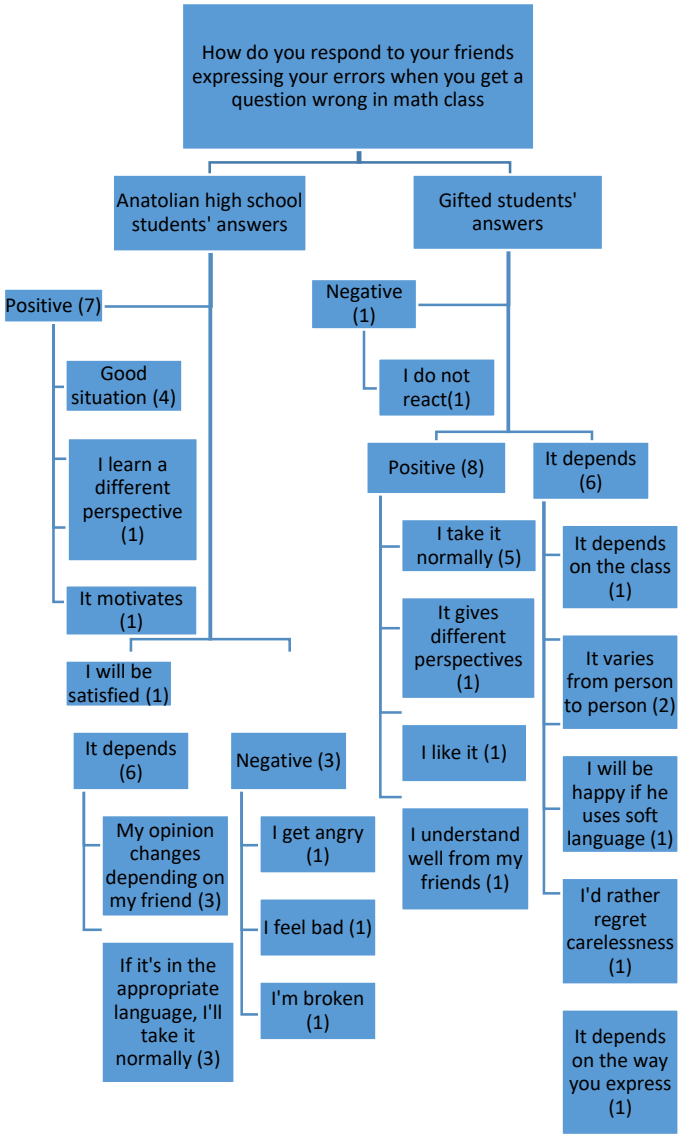


In Figure 9, it is seen that the answers of the gifted students consist of 10 different categories, and the answers of the Anatolian High School students consist of 9 different categories. In the interview, 5 of the gifted students were "Normal", 1 of them "Gives different perspectives", 1 of them "I understand well from my friends", 1 of them "I am happy if I learn new information." , 1of them "Depends on the class I'm in.", 1 of them "I get upset rather than carelessness.", 2 of them "It depends on the person.", 1 of them "I will be happy if he uses soft language.", 1 of them "Depending on the way of expression changes." and 1 of them expressed opinion as "I don't react.". In addition, 4 of the Anatolian High School students said "It's a good situation", 1 of them "I learn a different point of view", 1 of them "Motivates", 1 of them "I am satisfied", 3 of them "My opinion according to my friend". changes.", 3 of them "If it

is in the appropriate language, I will accept it normally.", 1 of them "I get angry.", "I feel bad." and 1 of them expressedas "I break." While one of the gifted students, G4 giving answer a "Everything I did in the old class was making fun of everyone. That's why I was bad. The current class is good so there is no problem. ", G10 "I don't like him either. If he did it himself, let him fix it himself, I don't need someone else to come and fix his error." and G12 "I don't react at all." A 10 from Anatolian High School students said, "I welcome it naturally, my teacher. Where I make errors, they can make it right and correct me. I'd be happy with that. In the same way, I can do this too.", A6 stated "I welcome it, my teacher, so it is something that can happen to everyone, I see it as normal. " and A3 expressed opinion as " I would feel bad in such a situation."

Figure 9.

Codes Related to the Category of *"Friends' Expressing Errors"*



Gifted Students and Anatolian High School Students' Opinions on What They Do When They See Their Friends' Errors

The codes for students' answers to the question of "What do you do when you see your friends' errors in math class?" are presented in Figure 10.

In Figure 10, it is seen that the answers of the gifted students consist of 7 different categories, while the answers of the Anatolian High School students consist of 6 different categories. In the interview," about the reaction given when they see the error of their friends in the mathematics lesson 2 of the gifted students gave answer as "I express their error", 7 of them "I will help", 1 of them "I warn", 2 of them "Express with an empathetic and soft language I would say it.", 2 "It varies from person to person.", 1 "I say it when alone." and 1 is "I don't react.". In addition, 2 of the Anatolian High School students expressed views as "I convey the information I know", 5 of them "I will tell without being offensive", 1 of them "I will tell when I am alone", 4 of them "I will help", 1 of them "I will inform the teacher" and 2 of them "I wouldn't say it's wrong.".

While one of the gifted students G9 gave answer as "I can explain if they want . Of course, if he wants to.", G7 " I mean, if we are actively teaching at that moment, I don't say much because the teacher will solve the problem in a minute or two.

If we are in recess or something, I often say that the solution to this problem was like this ." and G15 " I do not prefer to tell my friend's error in the classroom environment. I say it when I find him alone. I don't want your pride hurt .",A5 replied that " I try to help as much as I can, if I thought that I would help what I understood as well as help.

They replied that " I try to help as much as I can, if I thought that I would help what I understood as well as help. I try to be supportive as much as I can.", A1 stated " I usually try not to offend them. I'm showing you the way, so if you solve it like this, you will reach the result like this, so without hurting . " and A11 expressed opinion as "I don't often tell my friends about my error."

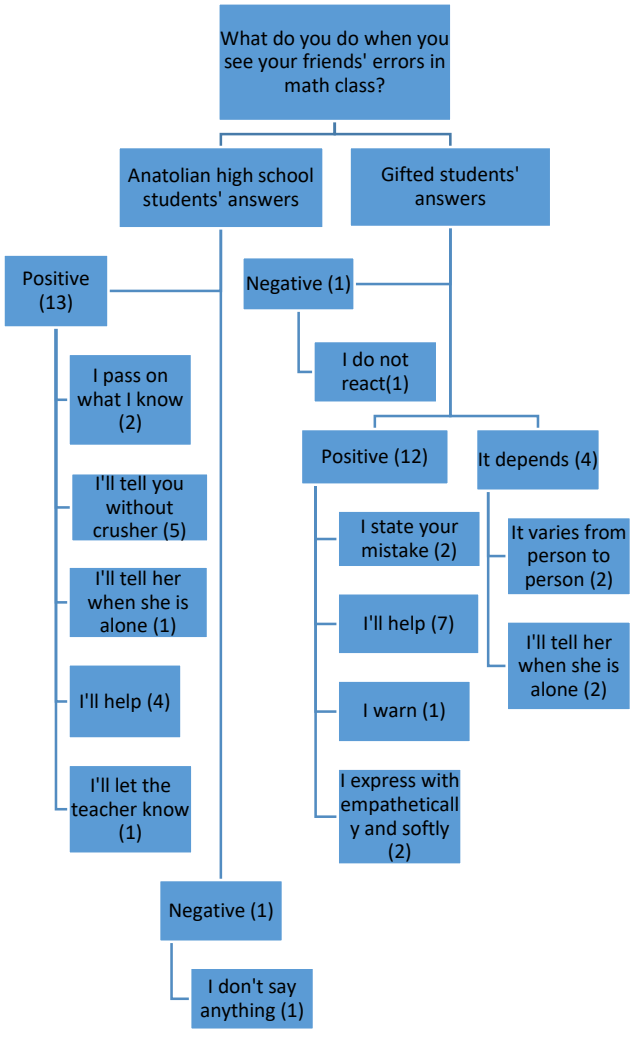
Gifted Students and Anatolian High School Students' Opinions on Discussion on Errors

The codes for students' answers to the question of "How is your perspective on discussing?" are as follow.

The answers of the gifted students consist of 4 different categories, while the answers of the Anatolian High School students consist of 2 different categories. In the interview, while 2 of the gifted students said "It should definitely be

Figure 10.

Codes Related to the Category of "Friends' Reaction to Error"



discussed", 1 of them "must be discussed", 1 of them "I am undecided." and 1 of them "Not required.", 14 of the Anatolian High School students answered as "It should be discussed on the situation."

While G5 who is among from gifted students, stating that "I can say it's my favourite thing, I like to discuss the errors I made the most. For example, I turned out to be wrong, I don't like comparing my error with my friend, I like to proceed by thinking why we did this. Maybe I'll change my working style. I can change my reading style, decoding technique. For example, in high school entrance exam, for example, last year, some people start from science and some people from mathematics. I compared the number of wrong answered questions. I was doing it starting from science. My friend had more unanswered questions. He said that he could not read any more mathematics questions, when he started from mathematics and compared to mathematics, although he did not have a science education, compared to mathematics .", G9 " I think errors can be discussed because, as I said, each person has a different point of view and solving errors from different perspectives can be discussed ." and G8 " I don't think it's necessary to discuss errors .", A8 replied, " So, normal, normal .", A9 " This is a very good thing, actually.. It increases our determination to work with each other." and A1 expressed opinion as "*I think bugs are something we should discuss.*"

Discussion

Although the teaching of mathematics operations and activities at an early age, mathematics is a science for abstract thinking as a mental system (Umay, 1996). The abstractness of mathematics is one of the sources of error in mathematics. Inaccurate and incomplete knowledge learned in the primary education creates a problem for students when transitioning to secondary education. It also causes a decrease in the success rate. Teachers have a great role in preventing the problems that may arise in the education chain. If teachers consider errors as a powerful tool that reveals students' "learning difficulties" (Borasi, 1987), they can also reveal students' thoughts about mathematics (Ingram et al., 2015). Including errors in the teaching process by taking into account provides great benefits in terms of mathematics education.

In the research, When the students were asked the question of "Is there any question that you leave unsolved or blank not to make errors in mathematics lesson?", all of the Anatolian High School students remarked that they left it blank, while 6 of the gifted students said "I leave it blank" and 5 of them "I do not leave it blank" and 4 "I rarely leave it blank." gave the answer. Furthermore, when the students who indicated that they left the questions blank in order not to make errors were asked the question of "What is the reason for leaving the questions blank in order not to make errors in the mathematics lesson?", the majority of the gifted students gave the answer "Preventing the error", while the majority of the Anatolian High School students said "Because it takes the wrong truth". Based on the findings, the Anatolian High School students were more likely to leave the questions unsolved or blank not to make errors. It is thought that some of the anxiety and prejudices of the students caused the students to leave the questions

blank in order not to make errors. Identifying the prejudices of students in terms of education is important in building new knowledge on existing knowledge (Bransford et al., 2000). Additionaly, it can be said that the parents, as models, express that people are afraid of mathematics and that mathematics is difficult (Thomas, 1998), which causes

students to leave some questions unsolved or blank not to make errors. In addition, Keklikçi and Yılmazer (2013) stated that the stress created by the exams students take in order to pass to higher education institutions and the results of these exams triggers the fear of mathematics.

In the interviews, when the question of “How often do you make errors while solving questions in the mathematics lesson?” was asked to students, the majority of gifted students answered "Very rarely" and "Rarely", while the majority of Anatolian High School students answered "Often", "Sometimes" and "Very often". In the scope of the findings, Anatolian High School students make errors more frequently. Ingram et al., (2015) emphasized that errors and misconceptions are important for both students and teachers in learning mathematics in the literature. It is thought that students' learning from their errors and turning to the benefits of making errors in learning mathematics will positively affect their success. In addition, many researchers stated that errors also develop higher-order thinking skills (Dweck, 2012; Moser et al., 2011; Melis 2004). Soncini et al., (2021) also stated that teaching strategies related to error have a positive impact on students' thinking differently. Moreover, Janet (2017) emphasized that instead of preventing errors in learning, encouraging students will contribute positively to examining questions and solutions.

In the interviews, when the question of “How do you feel when you make anerror while solving questions in the mathematics lesson?” was asked to the students, 6 of the gifted students said “I don't feel anything.”, 2 of them said "I get stressed." 1 of them “I feel sad rather than carelessness”, 1 of them “I will be glad to learn about my error”, 1 of them “I will get angry if I know the subject, if I do not know, I will make up for it.” and 1 of them gave answer as “I am ashamed of myself.”. Additionally, 7 of the Anatolian High School students answered as “I feel sad”, 3 of them “I lose my motivation”, 2 of them “I make up for my deficiency”, 1 of them “I feel unsuccessful”, 1 of them “I feel incomplete.” and 1 of them stated “I motivate myself”. It is observed that Anatolian High School students are more emotionally affected by the errors they make. Şahin (2004) emphasized that although math anxiety is a multidimensional anxiety, it is intertwined with the concepts of fear, tension, uneasiness and anxiety.

Furthermore, Ufuktepe (2009) expressed the fear of mathematics as people's tension in solving mathematical problems they encounter in real life, interruption of thinking process, stress or fear in operations with figures or numbers. Civelek et al. (2001) stated that this fear is an important factor affecting the development and emergence of human mathematical abilities. Considering the fears in students from this point of view, teachers have great duties in the occurring of students' mathematical abilities.

In the interviews with the students, when the question of “How much does it frighten you to make an error in the mathematics lesson?” was asked, the majority of gifted students stated that they were not afraid, while the majority of Anatolian high school students stated that they were afraid. In addition, when the students were asked the question of “What do you do when you are afraid of making errors in math class?”, it was seen that the answers of the students in both groups varied greatly. Based on the findings, it can be said that Anatolian High School students are more afraid of making errors in mathematics lessons. Some of the students stay away from mathematical activities for fear of making errors. In studies on mathematics anxiety and fear, it was stated that with the increase in students' negative experiences about mathematics, their positive attitudes towards mathematics decreased. Although the role of the teacher and the school in the formation of this change is great, it will not be possible to increase the success of mathematics unless this negative attitude is eliminated (Altun, 2001). It is emphasized that one of the most important reasons behind the failure of students in mathematics lessons is the negative attitude towards the lesson (Altun, 2001; Çiftçi, 2010; Dursun & Bindak, 2011; Yenihayat, 2007; Şentürk, 2010). In some studies, it has been determined that developing a positive attitude towards mathematics is seen as one of the rules that must be followed in order for mathematics teaching to reach its goal (Altun, 2001; Arı et al., 2010; Koca, 2011; Mirasyedioğlu & Peker, 2008; Şentürk, 2010;Yenilmez & Özabacı, 2003).

In the interviews, when the students were asked the question of “What do you think about the instructiveness of the errors you made in the mathematics lesson for you?”, all of the gifted students and the majority of Anatolian High School students are found in the statement of "instructive." In parallel with these statements of the students, it has been stated in many researches in the field of mathematics that errors are a guide for efficient teaching for teachers and for students in terms of instruction. (Borasi, 1987; Brown & Callahan, 1985; Dede & Peker, 2007; Fisher & Lipson, 1986; Yıldız et al., 2015).

In addition, during the interviews, when the students were asked the question of “How do you respond to your friends expressing your errors when you get a question wrong in the math lesson?”, the answers were received from gifted students and Anatolian High School students in the form of positive, negative and it could change according to the

situation. The answers of the majority of the students in both groups were positive and varied according to the situation. These statements reveal that students allow their friends to express their errors. If individuals are provided with the opportunity to identify errors, and they are supported in the subject thatthe error made, an improvement in the level of conceptual knowledge can be seen (Borasi, 1986; Özkaya, 2015). Besides, Janet (2017) stated that encouraging instead of preventing errors in learning would contribute positively to students' questions and solution.

During the interviews, the students were asked the question of, “What do you do when you see the errors of your friends in the math class?”. The majority of both Anatolian High School students and gifted students positively answered this question. Borasi (1994) thought that in order for learning to be meaningful, it is necessary to interpret the thinking processes during the detection and verification of errors, which supports students' views. It is thought that students' questioning each other's answers will also benefit students. Konyalıoğlu, Kaplan, Selvitopu et al., (2011) emphasized that someone who can correctly question the error internalizes that concept. Moreover, errors play a key role in understanding the correct solution (Ginat, 2003).

During the interviews, the students were asked the question of, “What do you do when you see the errors of your friends in the math class?”. The majority of both Anatolian High School students and gifted students positively answered this question. Borasi (1994) thought that in order for learning to be meaningful, it is necessary to interpret the thinking processes during the detection and verification of errors, which supports students' views. It is thought that students' questioning each other's answers will also benefit students. Konyalıoğlu, Kaplan, Selvitopu et al., (2011) emphasized that someone who can correctly question the error internalizes that concept. Moreover, errors play a key role in understanding the (1989) stated that the knowledge learned through errors gained permanence, and the interest and curiosity in this knowledge was much higher. In addition, in studies on learning from errors, it was observed that students began to question questions more and approached the given question-solutions with a critical perspective (Booth, Begolli & McCann, 2016). These statements reveal the discussing the errors in mathematics education.

Conclusion and Recommendations

Based on the findings, the Anatolian High School students were more likely to leave the questions unsolved or blank not to make errors. In the scope of the findings, Anatolian High School students make errors more frequently. It is observed that Anatolian High School students are more emotionally affected by the errors they make. it can be said that Anatolian High School students are more afraid of making errors in mathematics lessons. all of the gifted students and the majority of Anatolian High School students see the errors "instructive”.Each group of the students respond positively to their teachers' expressing their errors. The answers of the majority of the students to the responding to friends’ answers in both groups were positive and varied according to the situation. These statements reveal that students allow their friends to express their errors. Each group of students aggree with the idea that errors should be discussed in the class.

In the study, it was seen that students' avoidance of making errors prevented them from gaining some knowledge that they could learn in mathematics. In this context, it is thought that it would be appropriate for teachers to encourage students not to be afraid of making errors, based on the idea that if students see errors as failures and avoid them, their brains will not develop and they will miss development opportunities. Thus, it is thought that students' perspectives on errors will change in a positive way. The lack of sufficient research on this subject in the literature suggests that the subject should be examined among teacher candidates, students and teachers. If the study is conducted with more student participation, it can become more effective. And also, it is thought that it would be beneficial to include seminars on the importance of errors in mathematics education for teachers through in-service training.

Ethics Committee Approval: Ethics committee approval was obtained from Kırşehir Ahi Evran University Social and Humanitarian Ethics Committee (Tarih: 03.02.2022, Sayı: 2021/6)
Informed Consent: Written informed consent was obtained from participants and their parents in this study.
Peer-review: Externally peer-reviewed.
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~~A~~Appendix

The interview questions are as follows:

1. Is there any question that you leave unsolved or blank in order not to make errors in your math lesson? Can you explain with an example?
2. How often do you make errors while solving questions in math class? How do you realize your errors? Can you give examples from your experience?
3. How do you feel when you make an error while solving questions in the math class? How much does making an error scare you? What do you do when you are afraid of making errors? Can you give an example from your experience?
4. What do you think about the instructiveness of your errors? Can you explain?
5. How do you respond to your teacher expressing your errors when you get a question wrong in the math class? What do your teacher's statements mean to you?
6. How would you respond to your friends expressing your errors in math class? What do your friends' statements mean to you?
7. How do you act when you see your friends' errors in math class? What is your perspective on discussing errors?

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The Impact of Authentic Learning Practices on Students' Financial Attitude, Financial Literacy and Financial Behavior in the 5th Grade Social Studies Course

Şenol PALA[1]
Hüseyin BAYRAM[2]

[1] Erzincan Binali Yıldırım University, Refahiye Bahar Yıldırım Health Services Vocational School, Department of Child Development, Erzincan, Türkiye

[2] Ağrı İbrahim Çeçen University, Faculty of Education, Department of Social Studies Education, Ağrı, Türkiye

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Corresponding author:
Şenol Mail PALA
E-mail: senol.pala@erzincan.edu.tr
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ABSTRACT

In this research, it was hypothesized that authentic learning, which has been shown by various studies that it provides students with qualities related to daily life, could be used effectively in the social studies course. Based on this hypothesis, it was investigated how authentic learning practices in the 5th-grade social studies course affect students' financial attitude, financial literacy and financial behavior levels. The sample of the research, which was carried out with the quasi-experimental model with pretest-post test control group, one of the quantitative research methods, was formed with the convenience sampling technique. A total of 53 5th grade students took part in the research which was conducted in a middle school in Erzincan province of Türkiye. The research data were collected through the Financial Attitude Scale, Financial Literacy Behaviour Scale and Marmara Financial Literacy Attitude and behavior scale and analyzed with an independent samples t-test and mixed model ANOVA test. Consequently, it was determined that social studies education based on authentic learning practices improved students' financial attitude, financial literacy and financial behavior levels. Depending on the results obtained in the research, recommendations were made to researchers on the use of authentic learning practices in studies conducted at different grade levels and for the acquisition of different skills, and to the Ministry of National Education on the use of authentic learning in social studies coursebooks.

Keywords: Social studies education, authentic learning, financial attitude, financial literacy, financial behavior.

Introduction

Social studies is a course based on the teaching of information compiled from a wide range of social sciences, organized in accordance with the pedagogical levels of students studying in primary and secondary schools (Barr et al., 1978). This is the case both in Türkiye (MoNE, 2024) and in many other countries such as the United States of America (USA) (et al., 2008), South Korea (Lee et al., 2018), China (Zhao-Doppen et al., 2007), On the other hand, in countries such as Germany, social studies is also taught in grades 8-12 (Blankenship & Moffit, 2002). The aim of the social studies course is to provide students at the mentioned levels with skills, knowledge and values which they can use in solving the problem situations they may face in daily life (Deveci & Bayram, 2022). Considering 21st century living conditions, it can be said that financial problems are among the problem situations that students may face in daily life (Lusardi, 2015). The social studies course teaches knowledge from economics in a way that is appropriate to the level of the students in order to make them competent in solving financial problems (Nelson, 2001). Being able to solve financial problems is associated with high levels of financial attitude, financial literacy and financial behavior (Hershey & Walsh, 2000).

Financial attitude refers to an individual's approach to financial matters (Maison, 2019). Financial attitude is shaped within the scope of the individual's personality characteristics and future goals. A financial attitude that is in line with financial doctrines both enables individuals to use the resources they have in the most efficient way and increases the resources (Hira, 1997). On the other hand, an inappropriate financial attitude may cause inconsiderate spending of resources and lead to impoverishment in the future (Wang, 2013). In terms of primary and middle school students, financial attitude can be expressed as students' thoughts about evaluating their budgets and achieving the financial power they aim to have in the future.

Financial literacy is based on individuals' knowledge on financial matters (Saeedi & Hamedi, 2018). It includes

having the knowledge to solve financial problems, being able to make a budget and taking financial precautions. The one with financial literacy quality can increase his welfare level as an individual who knows how to act against financial problems (Nicolini, 2019). Students at primary and middle school level should also have financial literacy quality as they may face financial problems in their daily lives (Durband & Britt, 2012). Financial literacy is one of the qualities that the social studies course aims to provide students directly as it is among the parameters of daily life (Kottler & Gallavan, 2007).

Financial behavior is the practice of attitudes, skills and knowledge on finance related issues (Baker, et al., 2017). Positive financial behavior contributes to financial gains. It depends on being financially literate and having a financial attitude. An individual gains by transforming the knowledge he learns about financial issues into behaviors in his daily life (Van-Raaij, 2016). Primary and middle school students, like adults, need to demonstrate positive financial behaviors in their daily lives and make gains. In countries such as the USA, South Korea, Finland and Türkiye, financial content is taught to primary and middle school students through social studies courses. As a matter of fact, it can be said that social studies aims to teach students about financial issues and help them exhibit positive financial behaviors (Ameliawati & Setiyani, 2018).

Financial attitude, financial literacy and financial behavior are interrelated and complementary parameters (Aprea et al., 2016). Since these parameters are related to daily life, they are taught to primary and middle school students through the social studies course (Kochhar, 2000). Moreover, the National Council for the Social Studies (NCSS) emphasizes that students should gain financial knowledge and skills in order to take part in society as conscious and effective citizens. Indeed, financial attitude, literacy and behaviors are among the qualities that NCSS aims to provide students with in the "Production, Distribution and Consumption" learning area recommended for implementation in the social studies course (NCSS, 2024). Financial attitude, literacy and behaviors are also the qualities that the social studies course taught in Turkey aims to provide students with (MoNE, 2005, 2018, 2024). The social studies curricula of 1968 (Yalçınkaya & Er, 2019), 1998 (Taş, 2019), 2005 (MoNE, 2005), 2018 (Eker, 2020), and 2024 (MoNE, 2024) emphasised raising students as individuals who are competent in financial matters. Considering the aim of the social studies course to raise well-equipped and successful citizens in every aspect of individual and social life through activities suitable for daily life, it can be said that financial issues are one of the essentials of the social studies course.

While financial attitude enables individuals to develop a conscious and responsible approach towards material resources, financial literacy aims to facilitate making decisions based on accurate information. In addition, financial behaviors enable individuals to apply the knowledge they have learned and create a sustainable economic life. Therefore, financial literacy and financial behaviors in the social studies course enable students to be aware of financial issues in both their individual and social lives. In order to equip students with financial attitudes, financial literacy and financial behaviors, it can be said that active learning approaches in which students are at the center of the education process should be applied. Actually, active learning approaches allow students to construct knowledge on their own under the guidance of the teacher (Brito, 2019). One of the active learning approaches is authentic learning. This research was conducted assuming that authentic learning in a social studies course would be effective in providing students with financial attitude, financial literacy and financial behavior.

Authentic learning is an approach that aims to provide students with qualities suitable for real life by preparing learning environments suitable for real life conditions (Stanley, 2021). The essence of authentic learning is to provide students with skills that can be used in financial matters, such as cooperation, research, problem solving and entrepreneurship by exposing them to daily life problems (Herrington, 2005). In authentic learning processes, many activities like drama, problem solving and project development can be used in which students are actively involved in the learning process (Haynes, 2007). There are some generally accepted parameters in authentic learning processes. These parameters are as follows:

Reality: The design of learning processes in accordance with real life and the targeted outcomes in learning processes are intended to provide benefits in real life (Slavkin, 2004).

Appropriate activity: The activities applied in learning processes should include problem situations that students may face in daily life, be appropriate to the students' level of readiness and also put the student at the center of the learning process (Laur, 2013).

Learning outcomes that are transferable to daily life: The qualities gained in authentic learning processes should be transferable to daily life (Haynes, 2007).

Multidimensionality: In order to provide students with real-life qualities in authentic learning processes, education should be provided in accordance with multidimensional

situations that can be faced in daily life (Bhagat & Huang, 2018).

Cooperation: For authentic learning to take place, students need to be led to work in groups (Herrington, 2005).

Evaluation: Since authentic learning processes are multidimensional, process evaluation and general evaluation should be conducted. At the same time, students should be given the opportunity to evaluate themselves, their teachers, their friends and the process (Burke, 2009).

Authentic learning aims to provide qualities for daily life, like social studies lessons (Pitchford et al., 2020). In this context, authentic learning practices can be effectively utilized to provide individuals with financial attitude (Marinam, 2018; Ornellas et al., 2019; Saur-Amaral & Filipe, 2023), financial literacy (Cua et al., 2013; Hui & Koplin, 2011; William et al., 2022) and financial behavior (Filipe & Saur-Amaral, 2022; Henry et al., 2019; Lee et al., 2020) Authentic learning also provides effective results in a wide range of subjects (Balcı, 2021; Baştürk, 2019; Bolat, 2023; İneç, 2017; Önger, 2019; Yıldırım, 2020) in social studies education. Considering that the parameters of financial attitude, financial literacy and financial behavior are related to daily life, it can be said that both the social studies course and authentic learning aim to provide students with these parameters in educational processes. In fact, both the course (Evans, 2004) and the approach (Stanley, 2021) aim to raise individuals who can solve daily life problems. The idea of using the authentic learning approach in this research, which aims to provide middle school students with financial attitudes, financial literacy and financial behaviors in the social studies course, arose from this similarity between the social studies course and the authentic learning approach.

Previous Studies and Significance of the Research

Various research examining the effect of authentic learning on financial attitude (Marinam, 2018; Ornellas et al., 2019; Saur Amaral & Filipe, 2023), financial literacy (Cua et al., 2013; Hui & Koplin, 2011; William et al., 2022) and financial behavior (Filipe & Saur Amaral, 2022; Henry et al., 2019; Lee et al., Nichol, 2020) were found in the literature. Although the aforementioned research showed that authentic learning provides individuals with qualities related to financial issues, they did not examine the effect of authentic learning on the simultaneous gain of financial attitude, financial literacy and financial behavior qualities in middle school students.

Finance is directly related to the welfare level of individuals. Accordingly, the knowledge of individuals on how to use and increase their financial resources is effective in increasing or decreasing their level of welfare (Lazarus et al., 2020). Financial issues are taught to primary and middle school students through the social studies course, as the issues are related to daily life. By teaching financial issues to students, it is aimed to develop students' financial attitudes, financial literacy and financial behaviors (Van Kessel & Edmondson, 2004). The realization of the aim of the social studies course to provide students with financial attitudes, financial literacy, and financial behaviors is possible through the use of effective learning practices. It was hypothesized that authentic learning, which has been shown by various researches (Banas, 2014; Chin, et al., 2015; Murphy, et al., 2006; Nachtigall & Firstein, 2023; Valtonen et al., 2015) to equip students with qualities related to daily life, could be used effectively in the social studies course. It was predicted that education on finance, which impacts students' daily life quality, through the course in question based on authentic learning activities would provide students with financial attitudes, financial literacy and financial behaviors. However, there is no research in the literature that examines whether authentic learning is an effective model for teaching financial concepts to students in social studies course. Considering that both the social studies course and the authentic learning model aim to provide students with skills related to daily life, the scarce of any related previous research was seen as a deficiency. Therefore, this research was conducted. It is thought that this research will serve as a source for further research examining the effective teaching of financial issues to students both in social studies courses and in other courses and qualifying students with qualities related to financial issues.

Purpose of the Research

In this research, it was aimed to examine the impact of authentic learning practices on students' financial attitudes, financial literacy and financial behaviors in 5th 5th-grade social studies course. Three hypotheses were established and tested. The hypotheses are as follows:

Social studies education based on authentic learning practices is effective in increasing 5th-grade students';

- h1: financial attitude levels.
- h2: financial literacy levels
- h3: financial behavior levels.

Method

Research Model

A quasi-experimental quantitative model with a pretest-posttest control group was adopted to conduct the research. This model aims to reveal the impact of at least one independent variable on at least one dependent variable (Büyüköztürk, 2020). The reason for using the

quasi-experimental model to conduct this research is that the research focuses on whether authentic learning practices in social studies courses affect students' financial attitude, financial literacy and financial behavior levels.

Sample

The sample consists of students studying in two 5th-grade classes of a middle school in Erzincan province of Türkiye. The convenience sampling technique was utilized to determine the sample. Convenience sampling is based on the inclusion of the nearest subjects due to time and other limitations (Büyüköztürk, 2020). The reason why the convenience sampling technique was used in the research was that one of the researchers had to conduct the research in the province where he lived due to time limitation. In this regard, a middle school with two 5th grade classes with close populations in the province was determined and the research was conducted. The sample including a total of 53 students (26 in experimental, 27 in control).

Data Collection Tool

Three scales were used to collect the data. The details about the scales in question is as follows.

Financial attitude scale (FAS)

The FAS developed by Kılcan and Ergür (2019) was used to collect the data related to financial attitude. The three point Likert type FAS includes 29 items and five sub factors. Kılcan and Ergür (2019) calculated α as .80. The α calculated as .82 for this research (Field, 2017).

Financial literacy behavior scale (FLBS)

The FLBS developed by Arıkan (2021) was used to collect the data related to financial literacy. The four-point Likert-type FLBS includes 21 items and five sub-factors. Arıkan (2021) calculated α as .84. The α calculated as .81 for this research (Field, 2017).

Marmara financial literacy attitude and behavior scale (MFLBS)

The MFLBS developed by Çelikten and Doğan (2020) was used to collect the data related to financial behavior. The five-point Likert-type FLBS includes 21 items and five sub-factors. Çelikten and Doğan (2020) calculated α as .83. The α calculated as .81 for this research (Field, 2017). Since the scale was developed with 4th-grade students and this research was conducted with 5th-grade students, confirmatory factor analysis (CFA) was conducted. The values obtained in the CFA of the scale are as follows: CFI=.93 > .90; TLI= .92 >.90; RMSEA=.07 < .80; SRMR=.05 < .80; $X^2/df=3.5 < 4.0$ (Kline, 2011). Therefore, it was determined that the MFLBS could be used in this research. The reliability was found to be .85.

The ethical process in the research was as follows:

- Ethics committee approval was obtained from Erzincan Binali Yıldırım University Educational Sciences Ethics Committee (Date: 29.04.2024, Number: E-88012460-050.04-354193)
- Informed consent has been obtained from the participants.

Data Analysis

To determine the statistical tests for the analysis, the skewness (SKW), kurtosis (KRT) values, and the Shapiro-Wilk (SW) test results of the data collected were determined. SKW, KRT values are given in Table 1.

Table 1.

Skewness, Kurtosis and Shapiro Wilk Values

Group	FAS					
	Pretest			Posttest		
	SKW	KRT	SW	SKW	KRT	SW
Experimental	.52	.71	.12	.69	.41	.09
Control	.89	.63	.08	.92	.51	.14
Group	**FLBS**					
	Pretest			Posttest		
	SKW	KRT	SW	SKW	KRT	SW
Experimental	-.13	-.72	.21	.42	.16	.11
Control	.39	.41	.06	.33	.52	.22
Group	**MFLBS**					
	Pretest			Posttest		
	SKW	KRT	SW	SKW	KRT	SW
Experimental	-.17	-.34	.09	-.64	-.82	.10
Control	.44	.52	.17	.46	-.58	.24

Table 1 shows that the SKW and KRT values of the FAS, FLBS and MFLBS were between -1.5 and 1.5. Table 1 also shows that the SW test's p values obtained from the data collected with the FAS, FLBS and MFLBS were greater than .05.

As the SKW and KRT values of the pretests and posttests were between -1.5 - 1.5, and the S-W test p-values were greater than .05, it was determined that the data were normally distributed (Tabachnik & Fidel, 2019).

Levene's test was also applied to check the homogeneity. The values obtained are given in Table 2.

Table 2.

Homogeneity Test Results

Scale	Pretest		Posttest	
	Levene statistic	*p*	Levene statistic	*p*
FAS	1.82	.19	.98	.68
FLBS	1.95	.11	1.27	.32
MFLBS	1.49	.22	.88	.71

Table 2 shows that the p values of the homogeneity were greater than .05. As the homogeneity test p values were greater than .05, it was determined that the data were homogeneous (Tabachnik & Fidel, 2019).

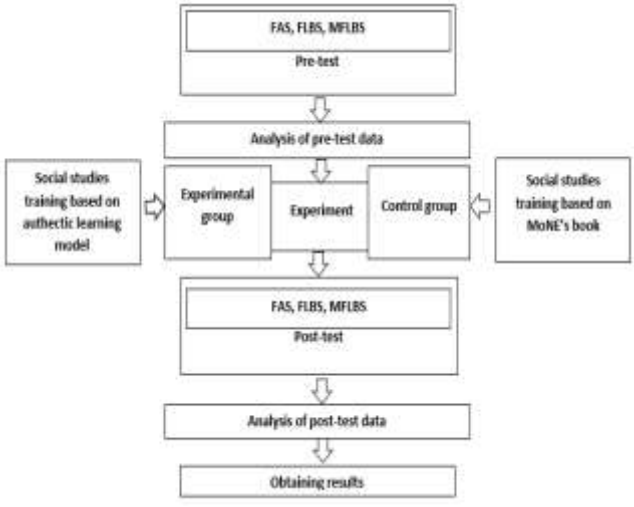
Various preconditions were investigated to determine which parametric tests would be used in the analysis. Since the two groups in the experiment were unrelated, each research hypothesis had one dependent variable, and the measurements were made on an equal interval scale (Tabachnick & Fidel, 2019), the independent samples t-test was used to analyze the pretest data. To examine the results of the experiment, the conditions for the use of mixed model ANOVA (MMA) were investigated. Since the data collected with the scales were normally distributed and the variances were equal, and the covariances of the groups were equal for the binary combinations of the groups (Tabachnick & Fidel, 2019), MMA was used to investigate the results of the experiment.

Experimental Process

The experimental process of the research was conducted in the spring semester of 2023-2024. The process was conducted for a total of six weeks. While authentic learning practices were implemented in the experimental group, the education prescribed by the Ministry of National Education (MoNE) continued in the control group. To reduce the John Henry effect (Saretsky, 1972), the teacher of the students conducted the practices of the experiment. The experimental process of the research was conducted during the 5th-grade social studies course in the learning area of Production, Distribution and Consumption. The subjects covered in this learning area during the experimental process are as follows: The experimental process of the research was applied during the "Human and Economic Activities" unit of the "Production, Distribution and Consumption" learning area. The subjects taught during the experimental process were ''Economic Activities and Geography, My Profession, Economy and Social Life, The Story of a Product, I have a Project and Conscious Consumer''. The stages followed during the research are shown in Figure 1.

Figure 1.

The Stages Followed During the Research



As seen in Figure 1, a pretest was applied to the experimental and control groups before the experimental process. Then the experimental process was carried out. In the experimental group, activities based on the authentic learning model were used, while in the control group, activities based on the MoNE book, which the social studies teacher had always practiced, were continued. Then the post-test was conducted and the impact of the experiment was revealed. Finally, the results of the research were obtained. One of the authentic learning activities implemented in the experimental group is given in the APPENDICES section.

Validity and Reliability

The following procedures were carried out to ensure the reliability and validity of the research.

- Internal consistency coefficients of the data collection tools used were calculated.
- Expert opinion was obtained to determine the content validity of the data collection tools.
- Since MFLBS was developed with 4th grade students and this research was conducted with 5th grade students, a CFA was conducted for MFLBS.
- Expert opinion was taken on the appropriateness of the activities applied during the experimental process.

Results

The findings of the research are interpreted and presented as follows.

Results on the Financial Attitude Levels of the Students

A pretest was applied using the FAS scale. The ist test was used to analyze the pretest data. The results of Ist-test are given in Table 3.

Table 3.

The Results of the Ist-test

Group	*n*	$\bar{x}$	*Sd*	*df*	*t*	*p*
Experimental	26	54.32	1.48	51	.42	.37
Control	27	55.11	2.10			

Table 3 shows that the p value is greater than .05. The value showed that there was no significant difference ($t_{(51)}$= .42; p= .37 > .05) between groups.

To examine the results of the experiment, MMA test was applied. Before the MMA test was performed, it was investigated whether the covariances of the data were equal or not. In this regard, box's test covariance matrices were examined. Since the p value was greater than .05 (p=.13 > .05), it was determined that the groups' covariance matrices were equal.

MMA test was conducted to examine whether hypothesis h1 was confirmed or not. Table 4 shows the results.

Table 4.
MMA Test Results

Source of Variation	Sum of squares	*df*	Mean of squares	*F*	*p*	*η2*	Obsrv. power
Between-groups	2963.42	1					
Group (Exp.-cont.)	12.26	1	12.26	.21	.82	.00	.74
Error	2951.16	51	57.86				
Within-groups	748.56	53					
Measurement (Pre-post)	110.99	1	110.99	11.64	.00	.29	.96
Group * Measurement	151.37	1	151.37	15.88	.00	.34	.97
Error	486.20	51	9.53				
Total	3711.98	54					

Table 4 shows that there is a significant difference between the pretest and posttest scores ($F_{(1; 51)}$=11.64; *p*=.00 < .05). Accordingly, it was determined that hypothesis h1 was confirmed. Table 4 also shows that the partial eta squared (η2) value of the experimental procedure was (.34) large. The η2 value between .01 and .06 indicates that the effect size is low; the value between .06 and .14 indicates that it is medium, and greater one than .14 indicates that it is large (Cohen, 1988).

Table 4 shows that the effect of the experiment is calculated as .97. In order to confirm the hypotheses established in experimental research, the impact is expected to be at least 80% (Christensen et al., 2020). The results showed that the h1 hypothesis of the research was confirmed at a rate of 97%. It can be said that the procedure was effective in improving students' financial attitude levels.

Results on the Financial Literacy Levels of the Students

A pretest was applied using the FLSB scale. The ist test was used to analyze the pretest data. The results of Ist-test are given in Table 5.

Table 5.
The Results of Ist-test

Group	*n*	$\bar{x}$	*sd*	*df*	*t*	*p*
Experimental	26	64.57	.98	51	.45	.58
Control	27	64.98	1.75			

Table 5 shows that the p value is greater than .05. The value showed that there was no significant difference ($t_{(51)}$= .45; *p*=.58 > .05) between the groups.

To examine the results of the experiment, MMA test was applied. Before the MMA test was performed, it was investigated whether the covariances of the data were equal or not. In this regard, box's test covariance matrices were examined. Since the p value was greater than .05 (*p*=.09 > .05), it was determined that the groups' covariance matrices were equal.

MMA test was conducted to examine whether hypothesis h2 was confirmed or not. The results obtained are given in Table 6.

Table 6.
MMA Test Results

Source of variation	Sum of squares	*df*	Mean of squares	*F*	*p*	*η2*	Obsrv. power
Between-groups	3249.71	1					
Group (Exp.-cont.)	13.15	1	13.15	.20	.69	.00	.72
Error	3236.56	51	63.46				
Within-groups	928.92	53					
Measurement (Pre-post)	119.20	1	119.20	11.09	.00	.31	.93
Group * measurement	261.51	1	261.51	24.34	.00	.37	.94
Error	548.21	51	10.74				
Total	4178.63	54					

Table 6 shows that there is a significant difference between the pretest and posttest scores ($F_{(1; 51)}$=11.09; *p*= .00 < .05). Accordingly, it was determined that hypothesis h2 was confirmed. Table 6 also shows that the partial eta squared (η2) value of the experimental procedure was (.37) large. The η2 value between .01 and .06 indicates that the effect size is low, the value between .06 and .14 indicates that it is medium, and the one greater than .14 indicates that it is large (Cohen, 1988).

Table 6 shows that the impact of the experiment is calculated as .94. In order to confirm the hypotheses established in experimental research, the impact is expected to be at least 80% (Christensen et al., 2020). The results showed that, the h2 hypothesis of the research was confirmed at a rate of 94%. It can be said that the procedure was effective in improving students' financial literacy level.

Results on the Financial Behavior Levels of the Students

A pretest was applied using the MFLSB scale. The ist test was used to analyze the pretest data. The results of Ist-test are given in Table 7.

Table 7.

The Results of the Ist-test

Group	*n*	$\bar{x}$	*sd*	*df*	*t*	*p*
Experimental	26	82.19	1.46	51	.47	.35
Control	27	83.04	2.09			

Table 7 shows that the p value is greater than .05. The value showed that there was no significant difference ($t_{(51)}$= .47; *p*= .35 > .05) between groups.

To examine the impact of the experiment, MMA test was conducted. Before the MMA test was performed, it was investigated whether the covariances of the data were equal or not. Therefore, box's test covariance matrices were examined. Since the p value was greater than .05 (*p*= .10 > .05), it was determined that the groups' covariance matrices were equal.

MMA test was conducted to examine whether hypothesis h3 was confirmed or not. The results obtained are given in Table 8.

Table 8.

MMA Test Results

Source of variation	Sum of squares	*df*	Mean of squares	*F*	*p*	*η2*	Obsr v. pow er
Between-groups	3919.55	1					
Group (Exp.-cont.)	9.24	1	9.24	.12	.59	.00	.59
Error	3910.31	51	76.67				
Within-groups	1272.88	53					
Measure ment (Pre-post)	259.19	1	259.19	18.61	.00	.25	.91
Group * measurem ent	303.59	1	303.59	21.80	.00	.30	.95
Error	710.10	51	13.92				
Total	5192.43	54					

Table 8 shows that there is a significant difference between the pretest and posttest scores ($F_{(1; 51)}$=18.61; *p*= .00 < .05). It was determined that hypothesis h3 was confirmed. Table 8 also shows that the partial eta squared (η2) value of the experimental procedure was (.30) large. The η2 value between .01 and .06 indicates that the effect size is low, the value between .06 and .14 indicates that it is medium, and the one greater than .14 indicates that it is large (Cohen, 1988).

Table 8 shows that the effect of the experiment is calculated as .95. In order to confirm the hypotheses established in experimental research, the impact is expected to be at least 80% (Christensen et al., 2020). The results showed that the h3 hypothesis of the research was confirmed at a rate of 95%. It can be said that the experimental procedure was effective in improving students' financial behavior levels.

Discussion

It was found that authentic learning practices in social studies education increased students' financial attitude levels. Financial attitude is the thinking approach that an individual adopts in financial issues. Financial attitude is related to how an individual should use the financial values he has in daily life. In terms of secondary school students, knowing how to use financial values will determine the future welfare of developing individuals. Social studies education also aims to help individuals at the primary and middle school levels to develop financial attitudes and increase their welfare levels. Regarding the results obtained in the research, it is considered that students' financial attitude levels is improved through authentic learning practices in the social studies course. The results showed that the authentic learning model is an effective approach to improve students' financial attitudes. The authentic learning model, which includes real-life and practice-based learning activities, enables students to make informed decisions on financial issues and increases their sense of responsibility. Correspondingly, it can be said that this model helps students gain attitudes about real-life issues such as budgeting and managing their resources because in the authentic learning process, students develop a more strategic and conscious approach to managing money by developing financial attitudes on the condition of mastering financial information. In a related previous research, Marinam (2018) examined the practices of the authentic learning approach and found that authentic learning improved the level of financial management and financial attitude. Moreover, Ornellas et al. (2019) found that individuals who were trained with authentic learning practices were advantageous in terms of both employability and financial attitudes. Furthermore, Saur-Amaral and Filipe (2023) in their research with finance students, concluded that authentic learning contributed to the students' financial attitude levels.

It was found that authentic learning practices in social studies education increased students' financial literacy levels. Financial literacy includes individuals' knowledge of terminology related to finance, their ability to make cognitive decisions on financial matters, and their ability to keep pace with financial change. In today's multidimensional living conditions, it can be said that every individual should be financially literated. Countries experience financial difficulties due to the growing world

population and diminishing resources. Thus, each individual may need to develop cognitive financial plans in their daily lives. Since financial literacy is a parameter of daily life, it is a subject of the social studies course. In fact, the social studies course aims to educate students on how to use limited financial resources. The results obtained in this research show that the authentic learning model, which focuses on real life situations in the teaching process, supports students' understanding of financial concepts and using them in their daily life. In fact, teaching processes that include planning expenditures or economizing methods help students transform theoretical knowledge into practical skills. In this regard, it can be stated that the authentic learning model enables students to manage their resources more effectively by increasing their financial literacy. It is thought that the results of this research, which concluded that social studies education based on authentic learning practices improved students' financial literacy levels, will be a resource for researchers who are interested in developing effective methods to provide middle school students with financial literacy. In the related previous literature, studies that obtained similar results were discovered. William et al. (2022) concluded that authentic learning is an effective approach to provide children between the ages of 5-12 with financial literacy. In a case study, Hui and Koplin (2011) found that finance education based on authentic learning practices was effective on gaining financial literacy. Cua et al. (2013) found that the use of authentic learning practices in accounting education improved students' financial literacy levels.

It was also concluded that authentic learning practices in social studies education increased students' financial behavior levels. Financial behavior is the activation of the financial knowledge and financial attitudes of individuals and in their daily life. Social studies has the aim of teaching financial knowledge to primary and middle school students and enabling them to transform the knowledge into behaviors. This is because financial behavior includes the practice of the theoretical financial knowledge students have. Social studies aim to help students reflect their knowledge, skills and values to their behaviors. It is thought that this research has reached important results in terms of equiped students with financial behaviors through authentic learning practices in the social studies course. The results of the research revealed that the authentic learning model improves students' financial behaviors based on real life experiences. It can be said that the authentic learning model provides students with the behaviors they should exhibit in financial matters through daily life-based activities. Thus, through authentic learning, students can learn to use their financial resources more consciously and grow up as individuals who exhibit appropriate financial behaviors. In the literature review, similar research were discovered. Henry et al. (2019) concluded that students' financial behavior levels improved in simulations in which authentic learning approach was applied. Filipe and Saur Amaral (2022) examined what kind of qualities authentic learning brings to individuals and found that authentic learning provides benefits on developing suitable financial behaviors as well as many skills. Lee et al. (2020) in their research with university students, determined that authentic learning-based practices provide students with financial report creation behavior.

Conclusion and Recommendations

In this research, a quasi-experimental quantitative research model was adopted. The FAS, FLBS and MFLBS scales were used to collect the data. The data were analyzed with ist-test and MMA test.

The research found that social studies lessons based on the authentic learning model significantly improved the financial attitudes of 5th grade students. Based on this result, it can be said that student-centered teaching methods enrich students' learning processes and provide them with a wide range of qualities.

The research also concluded that authentic learning activities implemented in social studies courses helped students gain financial literacy. Since financial attitude and financial literacy are interrelated variables, it was decided that authentic learning is a successful method for teaching financial issues to students.

It has been determined that students' financial behaviors have improved after social studies lessons in which authentic learning activities were implemented. In the context of the final result of the research, it has been established that authentic learning is an effective way of providing students with financial skills and behaviors.
Based on the results, various recommendations have been developed.

- The effect the authentic learning practices in social studies education on students' financial attitude, financial literacy and financial behavior levels could be researched in different grade levels.
- The effect the authentic learning practices in social studies education on the acquisition of alternative skills can be researched.
- The effect the authentic learning practices in social studies education on acquisition of knowledge, values and affective features could be researched.
- The Council of Higher Education can teach courses on increasing financial attitude, financial literacy and

financial behaviors through the authentic learning practices in social studies teacher training programs.

- The MoNE can include a unit related to increasing financial attitude, financial literacy and financial behaviors based on the authentic learning practices in social studies coursebooks.

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Informed Consent: Written informed consent was obtained from pre-service teachers who participated in this research.
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Author Contributions: Concept-ŞMP-HB; Design- ŞMP-HB; Supervision- ŞMP-HB; Resources- ŞMP-HB; Data Collection and/or Processing- ŞMP-HB; Analysis and/or Interpretation- ŞMP-HB; Literature Search- ŞMP-HB; Writing Manuscript- ŞMP-HB; Critical Review- ŞMP-HB.
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APPENDICES

5th Grade Sample Lesson Plan for Production, Distribution and Consumption Learning Area	
Course	: Social studies
Subject	: Economy and social life
Grade	: 5th
Duration	: 40 minutes
Methods and techniques	: Authentic learning model
Equipments	: Coursebook, smart board, materials suitable for authentic learning prepared by researchers.
Acquisition	: Associates economic activities with geographical features.
Aim of the activity	: To enable students to understand economic activities in the context of real life and to experience the processes of production, consumption and trade. At the same time, to develop students' financial attitude, financial literacy and financial behaviors.
Name of the activity	: We are going to the bazaar

Preperation

1-) Introduction

The teacher explains the concept of bazaar to the students and then prepares them for the authentic activity by asking them the following questions.

- What is sold in the bazaar?
- What are the economic benefits of using products sold in the bazaar?
- How is bargaining done?

2-) Forming the groups

The teacher divides the students into groups of six to perform a theatre in the classroom. The teacher then names the groups as “Farmers”, “Middlemen”, “Salesmen” and “Customers”. The teacher assigns the following roles to the groups:

Farmers: Growing vegetables in the field.

Middlemen: Buying the vegetables from the farmers.

Salesmen: Buying vegetables from middlemen and sell them in the bazaar.

Customers: Buying vegetables from salesmen.

3-) Planning

Designing the bazaar environment: Each group is given materials appropriate to their roles. An artificial field environment is created in the classroom. In addition, for the middlemen, a shop model is created in accordance with the concept of a vegetable market. For salesmen, a wooden stall and some field products are brought to the classroom. Customers are given clothes and carrying bags suitable for the bazaar environment.

Giving the keywords: The teacher explains basic concepts such as price setting, cost analysis and negotiation techniques.

4-) Application

The teacher guides the groups of students and ensures that the following stages take place:

-Farmers' behavior in the field shows the difficulty of the production process.
-The middlemen go to the farmers and tell them that they want to buy their products.
-Bargaining between middlemen and farmers.
-Farmers are deceived by the middlemen because they are weak in bargaining.
-Middlemen carry the products they buy from farmers to their shops.
-Salesmen go to the middlemen and tell them that they want to buy products.
-Bargaining between salesmen and middlemen.
-Salesmen carry their purchases to their stalls.
-Customers entering the market.
-Customers walk among the stalls and identify the products they need.
-Customers bargaining with salesmen.
-Customers buy only the products they need and avoid buying unnecessary products.

5-) Discussion

-The teacher directs the students to define the real-life problem in the activity.

-Students evaluate the process during the activity by associating it with daily life.
-Students develop solutions to the problems they encountered during the activity and share them in the classroom environment.
-Determination of the most appropriate one among the solution proposals presented by the groups.

6-) Evaluation

-The teacher checks whether the students gain experiences in the context of real life by describing their experiences during the activities in the classroom environment
-After the implementation, the teacher had the students make self-assessments and peer-assessment. Then, the teacher verbally evaluates the students' activity in a short form.
-The teacher rewards the most successful group.

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Knowledge and Techniques of Teachers in Basic Schools in the Identification and Management of Children with Special Educational Needs

Mojisola Kemi MOSES[1]
Anthony Kwaku EDUSEI[1]
Monday Omoniyi MOSES[2]

[1]Kwame Nkrumah University of Science and Technology, College of Health Sciences, School of Public Health, Department of Health Promotion and Disability, Kumasi, Ghana

[2]Kwame Nkrumah University of Science and Technology, College of Health Sciences, Faculty of Allied Health Sciences, Department of Physiotherapy and Sports Science, Kumasi, Ghana

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Corresponding author:
Monday Omoniyi Moses
E-mail: momoses@knust.edu.gh

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ABSTRACT

The objective of this study was to investigate the knowledge and techniques of teachers from basic schools in identifying and managing of children with special educational needs. The study adopted a cross-sectional descriptive research design. Sixty-five full-time teachers in Ghana (mean age of 35.04±9.05 years; mean work experience of 7.71 ±8.20 years) were recruited. Self-structured interview guide and questionnaire were used for data collection. Data analysis showed that 86.2% of the teachers reported being aware of educational and national policies for children with SEN in Ghana. Additionally, 93.9% indicated that they had received training and held responsibilities for identifying children with SEN in their classes. Regarding the methods used, 76.9% relied on referrals from parents, 75.4% on referrals from colleague teachers, and 70.8% on students' academic progress reports. Moreover, 63.08% stated that "special attention" was the primary technique used in managing children with SEN. 86.15% agreed that "there are no resources, strategies, or interventions in schools that are particularly effective in supporting SEN children. As for support techniques, 84.6% reported collecting more detailed information from class teachers and conducting further assessments, 76.9% relied on information from parents, while 75.4% set targets for identifying children with SEN. Participants significantly conducted further assessments and arranged for assessments from other professionals as techniques of identifying children with SEN. Although the participants have a general understanding of how to identify and manage SEN children, they need more extensive exposure and practical experience in working with SEN children within the regular classroom environment.

Keywords: Special educational needs, supporting children, barriers and issues, deployment of teaching assistants, sources of knowledge

Introduction

Inclusive education is a fundamental principle that ensures all children, regardless of their abilities or disabilities, have access to quality education in mainstream schools (Li et al., 2024; Winter & Paul O'raw, 2007). The identification and management of children with special educational needs (SEN) is a critical component of inclusive education. Teachers from basic schools play a fundamental role in recognizing and addressing the learning difficulties of children with diverse educational needs (Jardinez & Natividad, 2024; Li et al., 2024). Children with SEN often experience difficulties in traditional learning environments, necessitating specialized instructional approaches.

The Salamanca Statement advocates inclusive education, emphasizing that all children should be given equal learning opportunities, regardless of their abilities (Ainscow et al., 2019; Graham et al., 2023; Jardinez & Natividad, 2024). Early identification of children with SEN is crucial for intervention, as research suggests that delayed identification can lead to academic failure, social isolation, and emotional distress (Mushtaq et al., 2024; Palfrey et al., 1987).

The knowledge of teachers about SEN is essential in fostering inclusive education. Studies indicate that many teachers have a limited understanding of the different types of special needs, including dyslexia, autism spectrum disorder (ASD), attention-deficit/hyperactivity disorder (ADHD), and intellectual disabilities (Cook et al., 2007; Florian, 2017; Forlina & Chambersb, 2011). A study by Sharma et al. revealed that teachers with prior training in special

education exhibit greater confidence and competence in managing children with SEN(Sharma & Nuttal, 2016). However, in many developing countries like Ghana, pre-service and in-service teacher training programmes often do not provide sufficient exposure to inclusive education principles (Ackah-Jnr, 2020; Nketsia, 2016).

Effective identification of SEN involves both formal and informal assessment techniques. Teachers can use observation checklists, behavior rating scales, and standardized assessments to recognize learning difficulties of children (Harrison et al., 2012; Khursheed Ahmad, 2015; Morrison et al., 2013). Informal methods, such as classroom observation and teacher-student interactions, are crucial in detecting early signs of learning disabilities (Rotschild, 2024). However, research suggests that many teachers lack the necessary skills to correctly interpret assessment results, leading to either over-identification or under-identification of SEN cases (Florian, 2017; Hutchinson et al., 2025; Tristan, 2024).

Managing children with SEN requires adaptive teaching techniques, individualized educational plans (IEPs), and collaboration with special educators and parents (Aldosiry, 2022; Bettini et al., 2020; Hutchinson et al., 2025; Mahmood et al., 2024). Differentiated instruction, assistive technologies, and peer-assisted learning have been identified as effective strategies for supporting children with SEN (Davis et al., n.d.; Strogilos et al., 2023; S. R. L. Tomlinson et al., 2017). Studies have also shown that schools that adopt a multi-tiered system of support (MTSS) provide better outcomes for children with SEN by implementing evidence-based interventions (Batsche, 2014; Cusumano et al., 2014; Marlowe, 2021).

Despite the importance of early identification and proper management, teachers often face several challenges, including inadequate training, large class sizes, lack of resources, and insufficient support from school administration (Asodike & Onyeike, 2016; Osai et al., 2021; West & Meier, 2020). Research indicates that teachers in low-resource settings struggle with implementing inclusive practices due to the absence of specialized instructional materials and limited access to expert consultation (An et al., 2020; Lee et al., 2024; McKenzie et al., 2024; Price, 2018). Given the critical role of teachers in identifying and managing children with SEN, it is imperative to assess their knowledge and techniques in this area. Understanding the level of preparedness of teachers could inform the development of training programmes and policies that promote inclusive education. In addition, the effectiveness of the role of teachers in inclusive education is largely influenced by the level of knowledge and the techniques they employ in identifying and managing SEN children. The lack of adequate knowledge and practical strategies among teachers can hinder early intervention, leading to long-term educational disadvantages for children with SEN (Florian, 2017).

Furthermore, scholars have examined school teachers responses on different concepts such as knowledge, identification, support services, attitude, and preparedness towards inclusive education in Ghana (Acheampong et al., 2019; Gyimah et al., 2009; Mprah et al., 2016; Wisdom et al., 2015). However, further research focusing specifically on the knowledge and techniques of teachers from basic schools in identifying and managing children with special educational needs would provide a deeper scientific understanding of teachers' roles and practices concerning SEN.

Purpose of the Study

This study examined the knowledge and techniques of teachers from basic schools in identifying and managing of children with SEN, while also identifying gaps and proposing practical interventions to improve their effectiveness. In line with this objective, the research questions are as follows:

1. Do teachers in KNUST Basic schools have the knowledge and techniques of how to identify children with SEN?
2. Do teachers in KNUST Basic schools have the knowledge and techniques of how to manage the children with SEN?

Method

Research Model

The study adopted a cross-sectional descriptive research design. This design involves collecting data from participants at a single time point to represent the population under investigation (Grimes & Schulz, 2002). The cross-sectional approach is particularly advantageous for assessing the prevalence of a phenomenon, characteristics of a population, or associations between variables within a defined timeframe (Levin, 2006; Wang & Cheng, 2020). This design facilitates the collection of data from a representative sample, allowing for broad generalizability while maintaining efficiency in terms of time and resources (Moutinho et al., 2014).

Participants

The study was conducted in public basic schools, which typically include primary and junior high schools. The purposive sampling technique was used to select participants who had at least three years of experience as public primary and junior high schools teachers, had administrative responsibilities, served as class teachers, were relatively healthy, and were not living with any diagnosed disability. Teachers from basic schools who were part-time, living with disabilities, serving as administrative heads of school, or having communicable diseases were excluded. The four basic schools used in the study have a total of 183 teachers. The G*Power software 3.1.9.4 was

used to calculate the required sample size based on a population size of 183, α err prob of 0.5, power (1-β err prob) = 0.95 and an effect size of 0.5 using the medium effect size (Cohen's d) where 80 were required. To cater for attrition rate, the sample was increased to 100 where the questionnaire used was given to 25 participants in each of the schools. However, only 65 (81.25%) participants duly filled and returned complete questionnaire administered without error. Data analysis was, hence, based on 65 participants.

The sampled participants were full-time teachers with a mean age of 35.04±9.05 years and a mean work experience of 7.71 ±8.20 years). Male were 21(32.3%) while 44(67.7) were female. An initial discussion was conducted with the participants, during which the confidentiality, benefits, nature, and purpose of the study was explained to both the participants and the schools. Thereafter, informed consent forms were issued to the participants before the data collection. When the instrument was administered, participants were allowed to keep it for one week, after which the researcher collected it.

Data Collection Tool

The instrument used for data collection in this study was adapted from the questionnaire developed by Johnson, Carroll and Bradley (2017). To ensure its validity and reliability, the modified instrument was pilot tested in a school that was not included in the main sample, yielding Cronbach's alpha of 0.82. The instrument had two parts under the following headings: socio-demographic data (Section A) and questions (Section B). The socio-demographic section elicited information on age, gender, marital status, training received, experience in service, leadership styles of school management, extent of teamwork among staff, availability of educational and national policies on SEN. Sections B centered on the modified instrument, which consists of five sections centered on (i) Identifying Special Educational Needs (3 items), (ii) Supporting children with Special Educational Needs (5 items), (iii) Barriers and Issues (4 items), (iv) Deployment of Teaching Assistants (4 items) and (v) Sources of knowledge (1 item).

The ethical process in the study was as follows:
Ethics committee approval was obtained from the Committee of Human Research, Publications, and Ethics at Kwame Nkrumah University of Science and Technology (our ref.: CHRPE/AP/018/21). Informed consent has been obtained from the participants.

Data Analysis

The quantitative data was analyzed using the SPSS computer analytical tool, version 23.00. Descriptive statistics such as frequency, percentages, means and standard deviations were calculated. Multivariate analysis was carried out to determine the effect of age, gender, marital status, qualification, and years in service on identification of children with SEN.

Results

According to table 1, the participants in this study were had a mean age of 35.04±9.05 years and a mean work experience of 7.71 ±8.20 years. The table also indicates that 67.7% of the participants were female, 66.2% were married, 52.3% held a BSc/BEd degree, 66.2% adopted a democratic leadership style, 52.3% described teamwork among staff as normal or good, and 86.2% reported having awareness of educational and national policies for children with SEN in Ghana.

Table 1.

Demographic Information of the Participants

Variables	Classifications	N (%)
Age (years, Mean ± SD)	35.04±9.05	
Year of working Experience (Mean ± SD)	7.71 ±8.20	
Gender	Male	21 (32.3)
	Female	44 (67.7)
Marital Status	Single	19 (29.2)
	Married	43 (66.2)
	Others	3 (4.6)
	O and A Level	4 (6.2)
Academic Qualification	Diploma	21 (32.3)
	BSc/BEd	34 (52.3)
	Masters	6 (9.2)
	Democratic	43 (66.2)
	Autocratic	6 (9.2)
Leadership Styles	Laissez-Faire	8 (12.3)
	Strategic	5 (7.7)
	Transformational	3 (4.6)
Description of Teamwork among Staff	Extremely Good	4 (6.2)
	Very Good	21 (32.3)
	Normal/Good	34 (52.3)
	Poor	6 (9.2)
Awareness of Educational and National Policies for Children with SEN in Ghana	Yes	56 (86.2)
	No	9 (13.8)

Table 2 revealed that 93.9% of the teachers reported having rceived training, and acknowledged their responsibilities to identify children with SEN in their classes.

Table 2.

Participants' Knowledge of Special Educational Needs (SEN) Children (N,%)

Knowledge Variable	Agree	Partly Agree	Disagree	Don't Know
It is parts of the training and responsibilities teachers to have the knowledge of children with Special Educational Needs in their class	57 (87.7)	4 (6.2)	2 (3.1)	2 (3.1)

From table 3, 50 teachers (76.9%) relied on referrals from parents, 49(75.4%) on referrals from colleague teachers, 46(70.8%) on students' academic progress reports, and 38(58.5%) on behaviour logs or records as tools to identify SEN children. Only 6(9.2%) and 3(4.6%) used the British Picture Vocabulary Scale and The Ravens Progressive Matrices Test, respectively.

Table 4 indicates that 55(84.6%) collected more detailed information from class teachers and conducted further assessments, 50(76.9%) gathered further evidence from parents, 49(75.4%) set targets, 41(63.1%) supported class teachers with additional teaching strategies, 40(61.5%) provided additional staff input, while 35(53.8%) also provided interventions as support techniques of identifying children with SEN.

Table 5 showed that age, gender, marital status and qualification negatively predicted SEN children's identification, while year of service had a significantly positive prediction ($p < .05$).

Table 6 shows a significant association ($p < .05$) between referrals from parents and three practices: collecting more detailed information from class teachers, preserving the initial information obtained, and arranging for assessment from Occupational Therapists. Similarly, referrals from colleague teachers were significantly associated with collecting more detailed information from class teacher, preserving the initial information obtained, arranging for assessment by other professionals such as Educational Psychologists, arranging assessment by Occupational Therapists, setting targets, and providing interventions as support ($p < .05$). The association of referrals from Speech and Language Therapists was significantly related with most of the techniques ($p < .05$) except for collecting more detailed information from class teachers and supporting class teachers with additional teaching strategies (p>.05). Likewise, the association of referrals from Medical Professionals was significantly related with most of the techniques ($p < .05$) except for collecting more detailed information from the class teacher ($p > .05$).

Table 3.

Knowledge of Participants on the tools used for SEN Children identification

Identification Variables	Yes Freq. (%)	No Freq.(%)	I don't know Freq.(%)
Referrals from parents	50 (76.9)	4(6.2)	11(16.9)
Referrals from Colleague teachers	49 (75.4)	6(9.2)	10(15.4)
Referrals from Speech and Language Therapists	17(26.2)	29(44.6)	19(29.2)
Referrals from Medical Professionals	20(30.8)	26(40.0)	19(29.2)
The Ravens Progressive Matrices Test	3(4.6)	35(53.8)	27(41.5)
British Picture Vocabulary Scale	6(9.2)	25(38.5)	34(52.3)
Neale Analysis of Reading Ability	12(18.5)	19(29.2)	34(52.3)
Cognitive Abilities Test	28(43.1)	9(13.8)	28(43.1)
York Assessment of Reading for Comprehension	12(18.5)	13(20.0)	40(61.5)
Comprehensive Test of Phonological Processing	23(35.4)	17(26.2)	25(38.5)
Academic Progress Report	46(70.8)	4(6.2)	15(23.1)
Behaviour Logs or Records	38(58.5)	4(6.2)	23(35.4)
Data which indicate a child had received exam concessions in the previous school	15(23.1)	21(32.3)	29(44.6)
Information gained through the application process	16(24.6)	22(33.8)	27(41.5)

Table 4.

Techniques of Identifying SEN Children

Techniques Variable	Yes Freq.(%)	No Freq.(%)	I don't know Freq.(%)
Gather further evidence from parents	50(76.9)	3(4.6)	12(18.5)
Collecting more detailed information from class teacher	55(84.6)	4(6.2)	6(9.2)
Conducting further assessments	55(84.6)	3(4.6)	7(10.8)
Arranging for assessment from other professionals such as Educational Psychologists	22(33.8)	25(38.5)	18(27.7)
Arranging for assessment from Speech and Language Therapists	10(15.4)	35(53.8)	20(30.8)
Arranging for assessment from Occupational Therapists	12(18.5)	30(46.2)	23(35.4)
Supporting class teachers with additional teaching strategies	41(63.1)	4(6.2)	20(30.8)
Setting of targets	49(75.4)	3(4.6)	13(20.0)
Provision of interventions as support	35(53.8)	11(16.9)	19(29.2)
Provision of additional staff input	40(61.5)	4(6.2)	21(32.3)

Table 5.

Multivariate analysis of the predictive effect of Age, Gender, Marital status, Qualification, and Year in Service on the identification of children with SEN

Predictor	Regression Coefficient (β)	aOR=Exp (β)	P-value
Constant	-20.712	0.999	.000*
Age	-0.326	0.722	.099
Gender	-1.342	0.261	.229
Marital status	-2.462	0.085	.090
Highest Qualification	-0.094	0.911	.957
Year in service	0.443	1.558	.036*

*Positive value of β indicate aOR > 1.0 or positive association, negative values indicate aOR < 1.0 or protective association, aOR = adjusted odds ratio, *Significant (p < .05).*

The Raven's Progressive Matrices Test was not significantly associated with most of the techniques ($p > .05$) except for gathering further evidence from parents, collecting more detailed information from the class teacher, preserving the initial information obtained, and supporting class teachers with additional teaching strategies, which showed significant associations ($p < .05$). British Picture Vocabulary The scale was significantly associated with most of the techniques ($p < .05$), except for gathering further evidence from parents, collecting more detailed information from class teachers, conducting further assessments, and supporting class teachers with additional teaching strategies. The association of Neale Analysis of Reading Ability was not significant only with gathering further evidence from parents. The Cognitive Abilities Test significantly associated with all techniques ($p < .05$) except for collecting more detailed information from the class teacher, and preserving the initial information obtained.

York Assessment of Reading for Comprehension and Comprehensive Test of Phonological Processing were significantly associated with all techniques ($p < .05$) except for collecting more detailed information from the class teacher. The Academic Progress Report was significantly associated with gathering further evidence from parents, conducting further assessments, arranging for assessment from other professionals such as Educational Psychologists, setting of targets, providing interventions as support, and providing additional staff input ($p < .05$). Behaviour Logs or Records, data indicating that a child had received exam concessions in a previous school, and information obtained through the application process showed significant association with all the SEN Children identification techniques ($p < .05$).

Discussion

The main objective of this study was to investigate the knowledge and techniques of basic school teachers in identifying and managing children with SEN. In the study, basic school teachers were found to have the knowledge and understanding of the techniques required for identifying and managing children with SEN (Table 2). The findings align with the view that teachers are usually the first to identify children with SEN, as most children are now enrolled in regular classroom settings (O'Connor et al., 2016; Osai et al., 2021). Knowledge acquisition is not only essential for qualitative teaching and learning but is critically appealing to the tenacity of handling SEN children in the absence of biological parents. The complexity of basic knowledge about this special population could be overbearing for teachers to

understand all aspects of SEN to effectively advocate for them.

Table 3 presents a significant association between participants' knowledge of, and all the tools required for SEN identification. Understanding of SEN identification tools are essential for early diagnosis and treatment. Early detection and identification of SEN children in the school environment are necessary to provide care, design effective teaching and learning strategies, and train parents, guardians, and families (Gyimah et al., 2009; Mensah & Badu-Shayar, 2016; O'Connor et al., 2016; Rose & Howley, 2006; S. Tomlinson, 2012).

Results showed that at least more than 50.0% of participants in this study mostly rely on referrals from parents, colleagues (co-teachers), academic progress reports and behaviour logs or records as tools for SEN identification. It has been emphasized that the assessment of children with SEN requires the use of variety of instruments to define "what should be measured", "procedures for data collection", and "data sources". Studies have established the purposes of assessing children with SEN as follow; "to determine progression on meaningful developmental achievements", "place or promote", "detect special needs, learning, and teaching problems", "assist with curriculum and instruction decisions", "help a child assess his or her own progress", "boost learning", "evaluate interventional programs", "monitor trends", and "high-stakes accountability" (Price, 2018; Robbins, 2011).

The present study showed that more than 50.0% of the participants employed techniques such as gathering further evidence from parents, collecting more detailed information from class teachers, conducting further assessments, supporting class teachers with additional teaching strategies, setting of targets for the identified SEN children, providing interventions as support and offering additional staff input (Table 4). Studies have shown that parents and caregivers play crucial roles in stimulating the early development of a child's potential to avert the onset of severe secondary disabling conditions, which can affect both physical and intellectual abilities (Mensah & Badu-Shayar, 2016; West & Meier, 2020).

Findings from this study indicate that most of the identification tools and techniques used by the participants significantly enhanced the identification of SEN children (Table 5). This implies that participants were able to combine appropriate tools with expected techniques to provide sustainable teaching and learning experiences. The teaching and learning environments in such situations will be encouragingly void of stigmatization of children with SEN and stimulate intellectually creative performance for children.

As seen in Table 6, participants' age, gender, marital status and qualification negatively predicted children with SEN identification while years of experience had a significantly positive prediction. The influence of these demographic factors on disability has been well reported collectively (Achenbach & Edelbrock, 1981; Coutinho et al., 2002; Coutinho & Oswald, 1998; Villodas et al., 2019) although their independent effects have not been examined.

On the other hand, the age of assessors (participants) is an unusual factor in the literature when considering SEN children identification; instead, the focus is typically on the age at which SEN children are identified. This could suggest that early identification of SEN children is significantly prioritized over the age of assessors, as seen in many studies (Acheampong et al., 2019; Mensah & Badu-Shayar, 2016; Oberklaid et al., 2013). The mean age of the participants in this study (35.04±9.05 years), which is regarded as young adulthood (Horng et al., 2001) can also play significant role in the negative influence as observed.

Given the socio-cultural insinuations about the positive roles of women in child care (Curtiss, 2018; Lewis & Kieffer, 2002), especially in West Africa (Brydges & Mkandawire, 2020; Unachukwu & Nwosu, 2020) one would expect gender to positively predict SEN identification with inclination towards women. Although the sample included more females than males (male=21, 32.3% < female= 44, 67.7%), the findings of this study indicate the opposite.

Although 66.2% of the sample population in this study were married, the negative prediction of marital status on SEN children identification negates the reflection of typical traditionally married African. Most married Africans have caring consideration and attachment to children, given parental availability and the maturity of the child (Casper & Smith, 2004). Sun et al., (2017) reported that caring parents understand the developmental risks of children based on the state of mental and physical health status through multiple social and biological pathways.

Year of experience is the only demographic factor that positively and significantly predicted SEN children identification in this study. This finding supports earlier studies showing that teachers who have experience working with children with ASD have a better understanding of the disability than those who have no previous teaching experience with ASD individuals" (Ballantyne et al., 2021).

It has been confirmed that the experience of working closely with SEN children correlates with increased self-efficacy (Mintz, 2018). This implies that consistent teacher-students (children) interaction over the years serves as impetus for

teachers to recognize maladjusted behaviour among children. Experienced teachers tend to be good listeners, observers, and most importantly, give keen and critical attention to any untoward attitude(s) of children as compared to less experienced teachers (Ballantyne et al., 2021; Li et al., 2024; Osai et al., 2021; Siboret, 2021).

Studies have shown that teachers who had experience working with SEN children had a better understanding of the disability than teachers who had no previous experience of working with individuals with SEN children (Acheampong et al., 2019; Forlina & Chambersb, 2011; Haimour & Obaidat, 2013; O'Connor et al., 2016). Recent studies affirmed that teaching experience is generally related to higher positive attitudes and knowledge towards inclusion (Abu-Hamour & Muhaidat, 2014; Avramidis et al., n.d.; Leonard & Smyth, 2020; Su et al., 2020).

Conclusion and Recommendations

Based on the findings of the study, it was concluded that the participants were young adults who had, on average, worked for more than five years in basic schools. The population comprised more female teachers most of whom were married and held BSc./BEd. certificates. A democratic leadership style was the most commonly used among the participants, who were also aware of educational and national policies for children with SEN in Ghana. They had received training and carried the responsibility of recognizing when children with Special Educational Needs were present in their classes. There was a significant association between basic school teachers' knowledge and all the tools required for SEN children identification. Basic school teachers frequently conducted further assessments, arranged evaluations from other professionals such as Educational Psychologists, arranged for assessments from Occupational Therapists, provided interventions as support and offered additional staff input as techniques of identifying children with SEN.

Comprehensive tests of phonological processing, behaviour logs or records, data indicating that a child had received exam concessions in a previous school, and information obtained through the application process had significant associations with the techniques for identifying SEN children. Most of the school teachers reported using "special attention" as the primary technique for managing SEN children, while they agreed that there are limited resources, strategies, or interventions in schools that are particularly effective in supporting children with SEN. Finally, we conclude that some basic school teachers emphasized the need to improve learning resources to reduce distractions during class, strengthen"parent-teacher agreements", ensure that "children with special needs should be attended to and given special attention", promote "parental counselling", and enhance"provision of special education teachers to assist".

Based on the outcome of this study, it is recommended that basic school teachers need to be exposed to more extensive and practical experiences to strengthen their techniques of children with SEN management. They should be adequately resourced to foster more positive attitudes towards the management of children with SEN in the regular classroom environments. There is also an urgent need for stakeholders in education to pay more attention to the early identification of children with SEN, particularly those who have difficulties with reading and learning, by integrating such content into teacher training programme. Further studies could examine the influence of age, gender, marital status and qualifications of basic school teachers on children with SEN identification and management. Additionally, exploring the type of in-service training required to better equip basic school teachers to effectively support the inclusion of children with SEN in their classes is necessary.

Table 6.

Association of Techniques for Identification of SEN Children

Identification Tools	Techniques Variables										
	A χ^2(P-value)	B χ^2 (P-value)	C χ^2 (P-value)	D χ^2 (P-value)	E χ^2 (P-value)	F χ^2 (P-value)	G χ^2 (P-value)	H χ^2 (P-value)	I χ^2 (P-value)	J χ^2 (P-value)	K χ^2 (P-value)
Referrals from parents	4.520 (.340)	19.285 (.001*)	1.634 (.803)	14.785 (.005*)	4.269 (.371)	3.201 (.525)	17.046 (.002*)	2.033 (.730)	7.404 (.116)	8.817 (.066)	3.664 (.453)
Referrals from Colleague teachers	9.341 (.053)	14.536 (.006*)	7.080 (.132)	18.640 (.001*)	12.883 (.012)	8.079 (.089)	18.180 (.001)	7.233 (.125)	15.608 (.004)	20.504 (.000)	5.282 (.260)
Referrals from Speech and Language Therapists	9.895 (.042)	4.912 (.296)	11.138 (.025)	11.022 (.026)	20.878 (.000)	31.819 (.000)	24.073 (.000)	7.837 (.098)	19.848 (.001)	28.788 (.000)	10.150 (.038)
Referrals from Medical Professionals	13.852 (.008)	6.378 (.173)	9.970 (.041)	10.502 (.033)	17.637 (.001)	29.492 (.000)	30.169 (.000)	15.569 (.004)	19.842 (.001)	32.107 (.000)	22.612 (.000)
The Ravens Progressive Matrices Test	8.392 (.078)	0.782 (.941)	13.054 (.011)	5.197 (.268)	14.738 (.005)	30.366 (.000)	21.238 (.000)	7.527 (.111)	21.788 (.000)	29.536 (.000)	16.749 (.002)
British Picture Vocabulary Scale	0.705 (.951)	0.922 (.921)	7.843 (.098)	9.675 (.046)	19.931 (.001)	10.741 (.030)	15.918 (.003)	9.418 (.051)	19.352 (.001)	30.555 (.000)	11.295 (.023)
Neale Analysis of Reading Ability	1.886 (.757)	9.411 (.052)	12.086 (.017)	12.438 (.014)	15.267 (.004)	14.344 (.006)	26.014 (.000)	19.825 (.001)	16.872 (.002)	17.391 (.002)	16.881 (.002)
Cognitive Abilities Test	18.331 (.041)	8.076 (.089)	17.471 (.002)	7.959 (.093)	16.122 (.003)	14.769 (.005)	17.197 (.002)	13.533 (.009)	13.399 (.009)	20.509 (.000)	8.903 (.064)
York Assessment of Reading for Comprehension	11.045 (.023)	7.386 (.117)	9.939 (.041)	10.343 (.035)	21.911 (.000)	13.960 (.007)	24.561 (.000)	16.722 (.002)	11.445 (.022)	18.251 (.001)	13.070 (.011)
Comprehensive Test of Phonological Processing	18.718 (.039)	9.500 (.050)	15.068 (.005)	10.569 (.032)	26.314 (.000)	17.992 (.001)	30.284 (.000)	20.023 (.000)	17.740 (.001)	26.016 (.000)	14.699 (.005)
Academic Progress Report	14.331 (.042)	2.506 (.644)	30.075 (.000)	3.606 (.462)	10.978 (.027)	9.193 (.056)	7.001 (.136)	8.783 (.068)	13.847 (.008)	9.997 (.040)	16.314 (.003)
Behaviour Logs or Records	26.489 (.000)	21.581 (.000)	18.508 (.001)	18.782 (.001)	18.103 (.001)	26.085 (.000)	13.103 (.011)	26.636 (.000)	25.528 (.000)	20.004 (.000)	20.634 (.000)
Data which indicates a child had received exam concessions in previous school	22.007 (.020*)	14.671 (.005*)	11.744 (.019*)	21.866 (.000*)	32.419 (.000*)	29.859 (.000*)	15.297 (.004*)	26.024 (.000*)	22.727 (.000*)	24.875 (.000*)	21.169 (.000*)
Information gained through the application process	12.843 (.019*)	16.633 (.002*)	12.792 (.012*)	33.257 (.000*)	16.187 (.003*)	20.955 (.000*)	19.429 (.001*)	34.045 (.000*)	29.872 (.000*)	44.816 (.000*)	31.673 (.000*)

**Significant (p<.05). Key: A-K, A = Gathering further evidence from parents, B= Collecting more detailed information from class teacher C=Conducting further assessments, D=Preserving the initial information obtained, E = Arranging for assessment from other professionals such as Educational Psychologists, F = Arranging for assessment from Speech and Language Therapists, G = Arranging for assessment from Occupational Therapists, H = Supporting class teachers with additional teaching strategies, I = Setting of targets, J = Providing interventions as support, K = Providing additional staff input*

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Adaptation of the Technology Integration Self-Efficacy Scale for Mathematics Education to Turkish

Mehmet Fatih ÖÇAL[1]
Ömer Sinan CAN[2]
İsak ÇEVİK[3]

[1] Ağrı İbrahim Çeçen University, Faculty of Education, Department of Mathematics and Science Education, Ağrı, Türkiye
[2] Ağrı İbrahim Çeçen University, Vocational School, Department of Accounting and Taxation, Ağrı, Türkiye
[3] Ağrı İbrahim Çeçen University, Vocational School, Department of Computer Programming, Ağrı, Türkiye

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Corresponding author: Ömer Sinan CAN
E-mail: oscan@agri.edu.tr

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ABSTRACT

The importance of technology integration in the context of teaching and learning mathematics is growing increasingly, making it a significant necessity to evaluate and measure the self-efficacy of pre-service mathematics teachers regarding technology integration in mathematics education. The primary aim of this study is to adapt the self-efficacy scale for technology integration in mathematics education, which was originally developed for mathematics teachers, into Turkish. During the adaptation process, first, the language validity of the scale was ensured. It was then followed by exploratory factor analysis (EFA) and confirmatory factor analysis (CFA). The reliability of the scale was assessed using the test-retest method. Adaptation findings reveal that the scale consists of six factors and shows substantial similarity to the original scale. These factors were identified as knowledge of teaching with technology, attitude, parental and community involvement, use of artificial intelligence, professional development and support, and awareness of teaching with technology. Confirmatory factor analysis results indicate that the model is valid. The findings of the study show that the scale, consisting of 27 items and six dimensions, can be used as a valid and reliable measurement tool for assessing self-efficacy in technology integration into mathematics education. In addition, this study provides a crucial contribution to the field by enabling further research and practice in mathematics teacher education.

Keywords: Technology Integration, self-efficacy, scale adaptation, mathematics.

Introduction

The integration of digital technologies into education has led to significant transformations in teaching processes (Cirneanu & Moldoveanu, 2024; Öçal, 2022; Viberg et al., 2023). Technology has emerged as a powerful tool, especially in mathematics education, to improve teachers' classroom practices and support students' understanding of mathematical concepts (Cullen et al., 2020; Li & Ma, 2010). The integration of technology into education not only increases student achievement but also allows teachers to restructure their pedagogical approaches and deliver their lessons in a more interactive and efficient way (Cullen et al., 2020; Ertmer & Ottenbreit-Leftwich, 2010). Pre-service teachers' capability is also considered to be important for their future practices (Cullen et al., 2020). However, the effective implementation of technology integration depends on teachers' competencies and self-efficacy beliefs in this field (Njiku et al., 2022). Self-efficacy refers to one's (e.g., teachers, pre-service teachers) capabilities, beliefs, and self-confidence in taking the necessary actions to accomplish a task (using and integrating technology in this context), and a high level of this self-confidence is critical for a successful integration process (Bandura, 1997).

Compared to other branches, pre-service and in-service mathematics teachers may have more difficulties in using technology effectively in the classroom, because making abstract concepts in mathematics concrete through technology depends on teachers' pedagogical and technological skills (Pierce & Ball, 2009). Digital tools such as mathematical software, graphing calculators, interactive whiteboards and simulations have the potential to provide students with a richer learning experience. However, the accurate and effective use of these tools in the classroom environment is directly related to teachers' competence levels towards technology integration (Courtney et al., 2022; Koehler & Mishra, 2009; Öçal, 2022). Understanding teachers' approaches and beliefs about technology integration is considered to be an important factor in making predictions about the extent to which they will use technology in their lessons (Li et al., 2023; Zhao & Cziko, 2001).

This study aims to adapt the Technology Integration Self-Efficacy Scale, which was developed by Li (2024) in the Chinese context with established validity and reliability, into Turkish. This scale is adapted from the original version to assess the beliefs of pre-service mathematics teachers, who will become mathematics teachers, towards

technology integration. The adaptation of such scales is of great importance to more clearly reveal the perceptions of pre-service and in-service teachers about the use of technology in different cultural contexts (Beaton et al., 2000; Li, 2024). The findings obtained from this study are believed to enhance and contribute to technology integration in mathematics education and provide guidance for the design of teacher education programs.

Self-efficacy for technology integration is a crucial component that shapes pre-service teachers' digital pedagogical competence (Njiku et al., 2022). The scale adapted in this study covers not only pre-service mathematics teachers' attitudes towards technology or teaching knowledge but also their self-efficacy for individualized learning-teaching environments, their skills in determining teaching needs with instructional methods supported by artificial intelligence, and their awareness of parental and community participation in the process of technology integration (Li, 2024). In this respect, the scale offers a more holistic and current framework. In addition, the adapted scale includes items that are particularly suitable for the pre-service teachers' age group and address the digital demands of their generation, which makes the adaptation of this scale valuable and applicable in the Turkish context.

The original version of the scale was developed in the Chinese context. However, it has some structural and cultural similarities with Türkiye's conditions. Both countries have centralized education systems and increasing responsibilities of teachers in the digital transformation process (Li, 2024; Öçal & Şimşek, 2017). Adapting the scale to the Turkish language increases the scientific contribution of the study. Therefore, this study contributes to the processes of the cross-cultural scale adaptation and enables a comprehensive evaluation of the pre-service mathematics teachers' self-efficacy for technology integration into mathematics education in Türkiye's context.

Theoretical Framework

Self-efficacy is a fundamental concept that expresses individuals' belief in their ability to successfully perform a certain task and is shaped within the framework of Bandura's (1997) Social Cognitive Theory. According to Bandura, self-efficacy is an important factor that directly affects individuals' behaviours and learning processes. In the context of education, self-efficacy shapes teachers' beliefs to act effectively in areas such as increasing student achievement in the classroom, using innovative teaching methods, and technology integration (Bandura, 1997). In mathematics education, self-efficacy plays an important role in issues such as the use of digital tools, concretisation of abstract mathematical concepts, and increasing student achievement (Holenstein et al., 2022).

Technology integration skills of in-service and pre-service mathematics teachers are especially important for the more effective instruction of complex mathematical concepts (Öçal & Şimşek, 2017; Holenstein et al., 2022). Technology has the potential to deepen students' mathematical understanding by providing opportunities such as visualisation, simulation, and interactive problem solving (Li & Ma, 2010). In this context, the Technological Pedagogical Content Knowledge (TPACK) model provides an important framework for understanding mathematics teachers' technology integration processes. Mishra and Koehler (2006) emphasise that pedagogical knowledge, content knowledge and technological knowledge should be considered together for effective technology integration. Especially in mathematics education, significant increases were observed in student achievement when digital tools (smart boards, graphing calculators, mathematics software) were effectively combined with pedagogical strategies (Koehler & Mishra, 2009).

Technology integration offers many opportunities for in-service and pre-service mathematics teachers, but it also poses various challenges. Ertmer (1999) identified lack of technical knowledge and classroom management difficulties as the primary and secondary barriers that teachers face in technology integration. These barriers are more evident for in-service and pre-service mathematics teachers because they may lack guidance on how to better teach abstract mathematical concepts with technology (Dockendorff & Zaccarelli, 2024; Pierce & Ball, 2009). However, mathematics teachers who use technology effectively have positive experiences, especially in making difficult concepts more accessible and improving students' problem-solving skills (Viberg et al., 2023). Various studies indicate that professional development programmes on the use of technology in education help mathematics teachers and pre-service teachers gain confidence in technology integration (Cirneanu & Moldoveanu, 2024; Drijvers et al., 2021; Zhao & Cziko, 2001).

Self-efficacy is an important factor that directly affects teachers' attitudes and behaviours towards technology integration (Njiku et al., 2022). In this regard, various scales have been developed to measure mathematics teachers' self-efficacy levels in technology use. The adaptation of these scales is important in terms of ensuring validity and reliability in different cultural and educational contexts. The adaptation process outlined by Beaton et al. (2000) is a critical guide for the development and use of scales that

accurately reflect mathematics teachers' beliefs about technology integration. In particular, self-efficacy scales specific to the use of technology in mathematics lessons stand out as an indispensable tool for assessing how effectively teachers and pre-service teachers use digital tools (Ertmer & Ottenbreit-Leftwich, 2010).

Method

Research Design

This study aims to adapt the Technology Integration Self-Efficacy Scale for Mathematics Education (TISSM) developed by Li (2024) to the Turkish language and culture. The study utilized the survey method as the research design (Büyüköztürk, 2020).

Participants

The participants of this study were recruited using the convenience sampling method, which is widely preferred in social sciences (Yıldırım & Şimşek, 2021). The purpose of the study was explained to the participants in detail, and participation was on a voluntary basis. The participants consisted of 398 third or fourth-year pre-service mathematics teachers studying in different cities. The reason for selecting participants from the third or fourth years is that they had completed pedagogical courses to a great extent and started to consider themselves competent as teachers.

Statistical tests such as Exploratory Factor Analysis (EFA) and Confirmatory Factor Analysis (CFA) are widely used in scale adaptation and development studies. The sample size for factor analysis should be 5 to 10 times the number of items in the scale (Tabachnick & Fidell, 2019). In this study, the original version of the scale includes 31 items. The number of participants (n=398) was approximately 13 times the number of items, which was an adequate sample size. In addition to the scale items, pre-service teachers were asked to indicate their demographic characteristics such as gender, age, year of study, and academic point average. Table 1 presents the participants' demographic information.

As shown in Table 1, 257 (64.57%) of the pre-service mathematics teachers were female, while 141 (35.43%) were male. The participants' age ranged between 19 and 29, with an average age of 21.85 (standard deviation: 1.690). Of all the participants, 214 (53,77%) were 3rd-year students, and 184 (46,23%) were 4th-year students. The cumulative grade point averages (GPAs) of all participants ranged between 1.74 and 3.98 out of 4. The mean value of GPAs was 2.83 with a standard deviation of .438.

Table 1.
Participants' demographic information

Gender	Frequency	Percentage (%)
Female	257	64.57
Male	141	35.43
Age	**Mean**	**Standard Dev.**
Ranging from 18 to 29	21.85	1.690
Year of study	**Frequency**	**Percentage (%)**
3rd year	214	53.77
4th year	184	46.23
GPA	**Mean**	**Standard Dev.**
Ranging from 1.74 to 3.98	2.83	.438

After the adaptation process was completed, the final version of the TISSM was administered to 37 pre-service mathematics teachers (22 females and 15 males) selected using the convenience sampling method to measure reliability. These participants were not involved in the earlier stages of adaptation processes (during EFA and CFA). The scale was administered using the test-retest method with a three-week interval.

Data Collection Tool

Compared to scale development studies, scale adaptation studies involve a faster process and require fewer resources in terms of costs. Besides, the applicability of a scale in different cultures enables cross-cultural comparisons by means of adaptation studies (Hambleton & Patsula, 1999). In this context, this study aimed to adapt the scale developed by Li (2024) into Turkish (see Appendix 1). The scale consisted of 31 items and aimed to evaluate the participants' self-efficacy towards technology integration in mathematics teaching. The scale includes no negative items. The items are responded on a five-point Likert scale with options including 1 (strongly disagree), 2 (disagree), 3 (neither agree nor disagree), 4 (agree), and 5 (strongly agree). The maximum possible score to be obtained from the scale is 155. Participants with high scores could be considered to have high self-efficacy in different dimensions of technology integration in mathematics teaching. There were seven dimensions in the original version of the scale. These were (1) technological pedagogical content knowledge (TPACK), (2) technology pedagogical knowledge and technological content knowledge (TPK_TCK), (3) attitude, (4) AI Utilization, (5) professional development and support (named as contextual factors in the original scale), (6) educational challenges, and (7) parental and community involvement. At the end of the process, the first two dimensions merged, and teaching with technology was named as knowledge of

teaching with technology. Li (2024) reported the dimension with the lowest Cronbach's alpha value as the parental and community involvement, with .905, and the dimension with the highest value was attitude, with .969. These values revealed that the scale had a high level of internal consistency.

Data Collection Procedure

At the beginning of the adaptation study, Li (2024), the author of the original version of the scale, was contacted via e-mail, and written permission was obtained for the adaptation of the scale. After the permission process was completed, the translation of the scale into Turkish was initiated. At this stage, attention was paid to make the translation not only linguistically accurate and comprehensible in Turkish but also culturally appropriate for the target audience (Seçer, 2015). The language, structure, and technical terminology in the field of mathematics education used in the translation process were meticulously handled. For example, the items belonging to the "educational challenges" dimension of the scale were presented in Li's (2024) study with the explanation "Please rate how strongly you agree or disagree that the following factors motivate you to integrate digital technology into mathematics teaching" and the participants were asked to rate four items (competitive nature of mathematics, attending demonstration lessons, standardised tests, and improving students' academic performance). In the adaptation study, each item was organised as an independent sentence to make the statements in this dimension appropriate to Turkish culture. For example, one item was reformulated with the statement "improving students' academic achievement motivates me to integrate digital technologies into mathematics education". Similarly, the examples of digital communication tools under the dimension of "parental and community involvement" consist of platforms such as DingTalk, WeChat and QQ, which are common in China. These platforms were replaced by WhatsApp, Instagram, and Telegram applications, which are more frequently used in the Turkish context. Such cultural adaptations were communicated to language experts at the beginning of the process. During the translation and reverse translation stages, the scale was analysed by two experts who have a PhD in English language and literature, have a good command of mathematics and technology, and are experienced in scale adaptation processes. The experts provided feedback on the linguistic and conceptual appropriateness of the scale, and necessary adjustments were made in line with this feedback. The findings obtained formed an important basis for the validity and reliability of the Turkish version of the scale.

Before the data collection process was started, necessary adjustments were made to the scale items in line with the feedback of language experts and the scale was given its final form. In this process, the scale was piloted with 15 male and female pre-service teachers from different years, face-to-face. In this phase, feedback was collected from the participants regarding the scale items, and adjustments were made in line with their suggestions. In this way, the scale was made ready for the main application.

The ethical process in the study was as follows:

- Ethics committee approval was obtained from Ağrı İbrahim Çeçen University Scientific Research Ethics Committee (Date: 29.11.2024, Number: E.118588)
- Informed consent was obtained from the participants.

Data Analysis

This study utilized SPSS and AMOS software packages to perform statistical analyses. Exploratory Factor Analysis (EFA) and Confirmatory Factor Analysis (CFA) were performed to reveal the construct validity of the TISSM. The analyses were conducted on independent groups (Büyüköztürk, 2002; 2020). Firstly, the scale data were subjected to Exploratory Factor Analysis. Kaiser-Meyer-Olkin (KMO) and Bartlett's Test of Sphericity were performed to measure the compatibility of the data for Exploratory Factor Analysis. Then, a set of criteria widely accepted in the literature was considered to determine the scale items. Items that did not meet these criteria were excluded from the scale items. The criteria considered can be summarised as follows:

- The eigenvalues of the scale items should be at least 1 (Büyüköztürk, 2020; Schriesheim & Eisenbach, 1995).
- The factor loadings of the scale items should be at least .30 (Büyüköztürk, 2020; Tabachnick & Fidell, 2019).
- Each scale item can only be evaluated in a single factor (Martin & Newel, 2004).
- There should not be a single-item factor (Büyüköztürk, 2020)
- There should be at least .10 difference between the factor loadings of two items loaded on two factors (Özgüven, 2000; Tabachnick & Fidell, 2019).

In the second stage of the adaptation study, the data obtained from Exploratory Factor Analysis were subjected to CFA in terms of the suitability of the model. In this process, many model-fit indices were used. Among these, CFI, GFI, AGFI, TLI and IFI model fit indices were analyzed (Bentler & Bonett, 1980; Büyüköztürk, 2020; Marsh et al., 2006). In addition, the RMSEA value is expected to be below .08 (Schermelleh-Engel et al., 2003). Test-retest was used

to measure the reliability of the scale. For this purpose, the final version of the scale was administered to an independent group of 37 pre-service teachers three weeks apart. Intraclass correlation and Cronbach's alpha values were analysed between the two applications.

Results

Results of Exploratory Factor Analysis (EFA)

KMO and Bartlett's Test of Sphericity were performed to determine the suitability of the final version of TISSM for EFA. Table 2 presents test results.

Table 2.
Kaiser-Meyer-Olkin (KMO) and Bartlett's Test of Sphericity Results

KMO Measure of Sampling Adequacy		.847
Bartlett's Test of Sphericity	Approximate Chi-square	1775.024
	Degree of Freedom	351
	Sig.	.000
Cronbach's Alpha		.901

KMO measure of sampling adequacy should be at least .50 for the data to be suitable for factor analysis and to ensure sample size adequacy (Field, 2000). Test results indicated that the KMO sampling adequacy measure was .847, indicating that the sample size was appropriate for EFA. In addition, Bartlett's test of sphericity results indicated that the significance value was .00 (X^2 (351) = 1775.024; p<.05). Approximate Chi-Square value was measured as 1775.024, indicating the significance of this value. The test results showed that Cronbach's alpha value was .901 for the whole scale. Given that this value should be .70 and above (Büyüköztürk, 2020), the reliability of the data was quite high. When all values are taken into account, the test results revealed that the data were sufficient and appropriate for EFA.

The Varimax rotation method and principal component method were used in the factor analysis. Before testing the factor structure with EFA, item-total correlation was analyzed for the suitability of the scale items. At this stage, four items were decided to be removed. The factor loading of M22 was less than .30. M18 and M26 were loaded on two factors and the difference between their factor loadings was less than .01. M4 worked as a single factor. This item was removed from the scale due to the concern that it could affect reliability calculations and reflect a construct outside the scale's factor structure (Büyüköztürk, 2020). After these items were removed, the Exploratory Factor Analysis was re-analysed with the remaining 27 items. Eigenvalues and variance percentages were utilised to determine the number of factors (Tabachnick & Fidell, 2019). In addition, a scree-plot was presented. Table 3 shows the eigenvalues and variance percentages.

Table 3.
Eigenvalues and Variances for EFA

Factor – Dimensions	Initial Eigenvalues		
	Total	Variance %	Cumulative %
1	7.911	29.302	29.302
2	2.751	10.189	39.490
3	1.845	6.834	46.324
4	1.684	6.237	52.561
5	1.232	4.564	57.126
6	1.184	4.384	61.509

Table 3 indicates that a total of six factors with eigenvalues greater than 1 emerged in this scale. The factor dimensions less than 1 were not considered as a new dimension (Tabachnick & Fidell, 2019). Six factors explain 61.509% total variance. The scree plot in Figure 1 shows the breaking point in the scale (dashed line indicates the eigenvalue of 1).

Figure 1.
Scree-plot for EFA

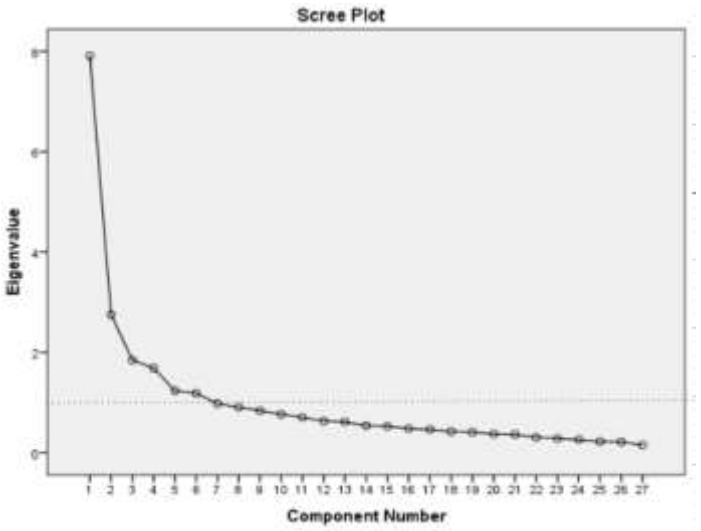


Figure 1 and Table 3 indicate that the first six dimensions are above the eigenvalue of "1". Therefore, this scale consisted of six dimensions in total. In this context, the factor structure of the scale adapted to Turkish differed from the original scale. While the original scale included seven dimensions, the scale adapted to Turkish included six dimensions. The difference emerged about the self-efficacy of pre-service mathematics teachers towards technology, content and pedagogy knowledge. In the original scale, the first four items were related to TPACK, and the next four items were related to technology pedagogical knowledge

and technology content knowledge (TPK_TCK in the original scale). In the Turkish version, these dimensions emerged as a single dimension. This dimension was named teaching with technology knowledge. Table 4 presents the factor loading values and item correlation values of the scale for these six factors.

Cronbach's alpha reliability coefficients of the items for each dimension were analysed to measure the internal consistency. In this regard, the internal consistency coefficients were .85 for the attitude dimension, .81 for knowledge of teaching with technology, .79 for parental and community involvement, .86 for the use of artificial intelligence, .78 for professional development, and .75 for the last factor (named as awareness of teaching with technology after the adaptation). For the whole questionnaire, this value was calculated as .90. Cronbach's alpha values higher than .60 indicate that the validity is at an acceptable level (Kalaycı, 2018). Therefore, the validity coefficients among the items of the factors were at a sufficient level. This indicates that the general structure and all factors of the scale are valid.

Table 4.

Factor Loading Values

	Factors – Dimensions					
Items	Attitude	Knowledge of Teaching with Technology	Parental and Community Involvement	Use of Artificial Intelligence	Professional Development and Support	Awareness of Teaching with Technology
M13	.710					
M10	.695					
M12	.665					
M11	.659					
M9	.633					
M6		.736				
M3		.684				
M1		.668				
M7		.662				
M2		.632				
M5		.629				
M8		.498				
M29			.756			
M27			.678			
M30			.668			
M28			.622			
M31			.551			
M15				.862		
M17				.759		
M14				.667		
M16				.635		
M20					.888	
M21					.737	
M19					.724	
M23						.667
M24						.567
M25						.525

In general, the results were consistent with Li's (2024) study, but M27 was related to educational challenge in the original scale, which was included in parental and community involvement in the adapted scale. In addition, while M24 and M25 were under the dimension of educational challenges in the original scale, they formed a new dimension with M23 in the adaptation study. This dimension was renamed as awareness of teaching with technology.

Results of Confirmatory Factor Analysis (CFA)

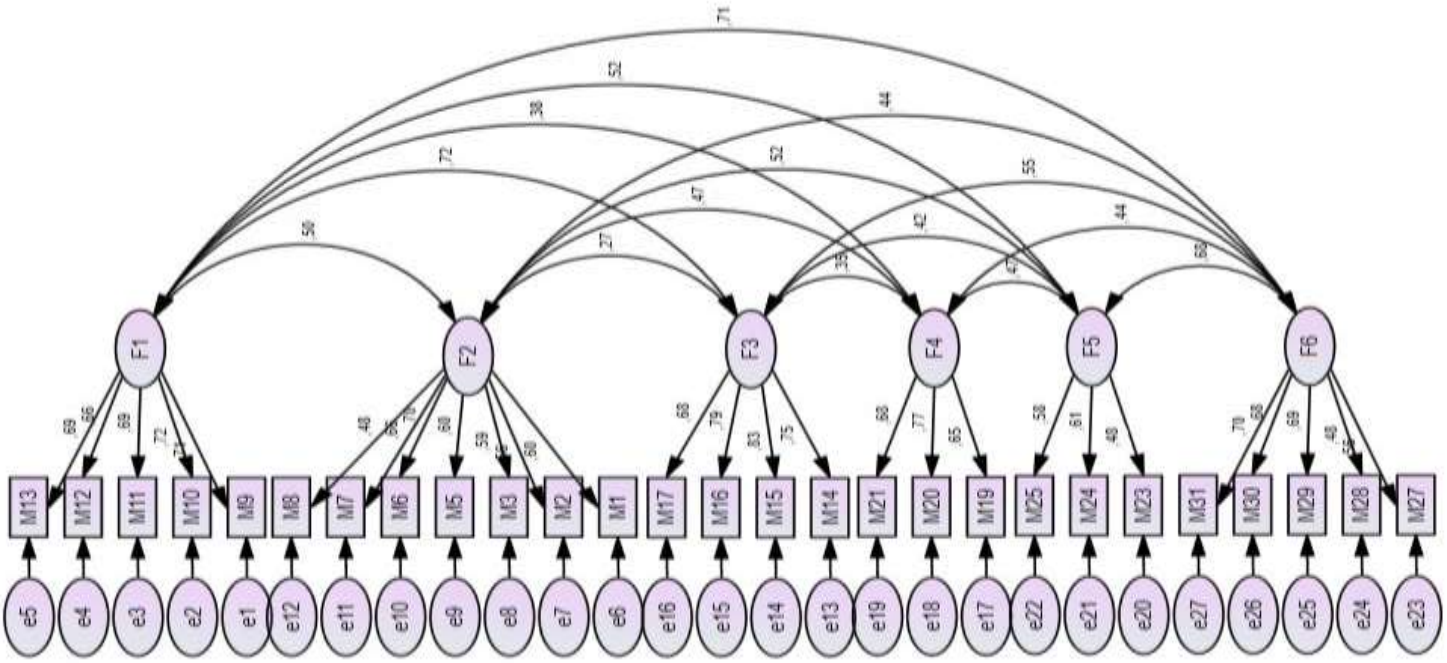
CFA for the Turkish version of the TISSM was conducted on 27 items. The data and factors were subjected to many fit criterion tests for the suitability of the model. X^2/sd, RMSEA, GFI, AGFI, CFI, TLI and IFI were among the most frequently used ones (Bentler & Bonett, 1980; Doğan et al., 2017; Marsh et al., 2006).

The CFA goodness of fit index values of this study were as follows: (X^2/sd (1.716), RMSEA= .054, CFI= .90, GFI=.87, AGFI= .84, TLI= .89, IFI= .90). Test results revealed that they were above the good/acceptable values in many respects (Bentler & Bonett, 1980; Hair et al., 2019; Marsh et al., 2006), indicating that they were appropriate to explain TISSM with a multifactor model.

The path diagram for the CFA related to the TISSM was illustrated using the AMOS package programme. Figure 2 demonstrates the path diagram for the factor loading values of the items in the scale. Figure 2 shows that the factor loading values of the items are between .48 and .83. The factor loading values of the items that were less than .30 were excluded from the analysis (Tabachnich & Fidell, 2019). In this regard, the test results showed that the factor loading values of the items have excellent, good, or average values.

When the values obtained from CFA are considered as a whole, the model-data fit of the scale is at an appropriate level. Therefore, all these findings show that the construct validity of the TISSM scale has been achieved.

Figure 2.
TISSM Scale Confirmatory Factor Analysis Path Diagram



(Note: The dimension names of the scale are as follows: F1: Attitude, F2: Teaching with Technology Knowledge, F3: Use of Artificial Intelligence, F4: Professional Development and Support, F5: Awareness of Teaching with Technology, F6: Parental and Community Involvement)

Reliability of the Study

A test-retest was performed to measure the reliability of the TISSM. Table 5 summarizes the results of these implementations.

As Table 5 shows, the internal consistency reliability was measured as .94, and the test-retest reliability consistency was measured as .89. These values show that the scale has the potential to produce stable results regardless of the duration of the application (Büyüköztürk, 2020; Ko & Li, 2016)

Table 5.
Test-Retest Results

Implementations	N	Intraclass Coefficient Correlation	Cronbach's Alpha
1	37	.89	.94
2	37		

Discussion

Integrating digital technologies into mathematics education is considered an important approach to bring a contemporary perspective to teaching practices that reflect the trends towards digitalisation of learning environments (Blannin, 2021; Öçal, 2022). In this regard, this study aimed to adapt the scale developed by Li (2024) as a valid and reliable tool to measure the competencies of pre-service mathematics teachers in Türkiye to integrate digital technologies into their courses. In this direction, exploratory and confirmatory factor analyses were performed, and the findings revealed that the dimensions in the adapted scale were parallel to those of the original scale.

While there were seven dimensions in the original scale, the items related to technology, pedagogy and content knowledge were adapted to Turkish and gathered in a single dimension called "knowledge of teaching with technology" in the adapted scale. Apart from this, the other factors were generally similar to the original scale. In addition, in line with the scores that can be obtained from the scale following the validity and reliability study, the adapted scale can assess the self-efficacy of pre-service mathematics teachers to integrate digital technology into mathematics lessons.

The language and content validity of the scale were evaluated positively in line with the opinions of two experts who had sufficient knowledge of both the English language and the concepts of mathematics education and technology integration. After the expert opinions and evaluations, the scale was administered to pre-service mathematics teachers (DeVellis, 2012). Based on the Exploratory Factor Analysis, four items in the original scale were removed, and the remaining 27 items were loaded into six dimensions. These dimensions were determined as follows: (1) attitude, (2) knowledge of teaching with technology, (3) parental and community involvement, (4) use of artificial intelligence, (5) professional development and support, and (6) awareness of teaching with technology. These dimensions explained more than 61% of the total variance, which is considered a positive result in terms of the construct validity of the adapted scale (Tabachnick & Fidell, 2019).

The fit indices obtained as a result of confirmatory factor analysis were found to be excellent or above the acceptable level (Bentler & Bonett, 1980; Marsh et al., 2006; Tabachnick & Fidell, 2019). Cronbach's alpha values were analysed to measure the consistency between the items of the scale dimensions and the scale in general, and these values showed that the reliability of the scale was at a high level. In order to evaluate the validity, a test-retest was performed on the overall scale, and these results supported that the scale was appropriate for use (Büyüköztürk, 2020; Koo & Li, 2016). These analyses showed that the scale adapted into Turkish provides a valid and reliable tool for measuring pre-service mathematics teachers' self-efficacy in integrating technology into mathematics courses.

In the context of mathematics education in Türkiye, the adapted scale meets the specific cultural and educational needs of the country. The adapted scale is consistent with the core components of the Technological Pedagogical Content Knowledge (TPACK) model (Koehler & Mishra, 2009; Mishra & Koehler, 2006) and includes support needs such as school resources, parental and community involvement. These issues are considered to have characteristics that can help to evaluate technological integration efforts in the Turkish educational environment more comprehensively.

Rapid developments and advances in digital technology integration, especially after the COVID-19 pandemic, have revealed the need for pre-service teachers to be aware of the changes in digital tools and the need to gain familiarity with them (Courtney et al., 2022; Drijvers et al., 2021). Therefore, the adaptation study was not limited to assessing their self-efficacy in using existing technologies. It also expanded its scope to assess their ability to effectively use advanced technological tools, including artificial intelligence. Therefore, this adaptation study has the potential to promote awareness of artificial intelligence applications among pre-service mathematics teachers. It is also thought that it can encourage pre-service teachers to interact with these tools to maximise their possible benefits.

The items of the scale cover a wide range of competences. Beyond assessing their self-efficacy towards individualised learning-teaching environments, attitudes towards technology integration and teaching knowledge, the scale also aims to assess pre-service teachers' ability to identify teaching needs by using instructional methods supported by artificial intelligence. In addition, prioritising parental and community involvement in the process of technology integration and awareness of teaching with technology can be counted among the important achievements of this adapted scale. In this context, the adapted scale adds a contemporary and forward-looking dimension to the efforts of technology integration in mathematics education.

Conclusion and Recommendations

When analysed from a holistic perspective, the dimensions of the scale have the potential to evaluate the self-efficacy

of the participants in a multidimensional way. Several studies examined attitudes towards technology integration in mathematics courses and self-efficacy towards related teaching knowledge (e.g., Bakar et al., 2020; Yıldız-Durak, 2021). However, the scale emphasises the importance of awareness of technology-supported teaching and professional development support received during teacher education, as well as skills related to emerging technologies such as artificial intelligence. With these aspects, the adapted scale takes into consideration the necessary competences to be a well-equipped mathematics teacher.

Recent studies have emphasized that not only basic technological skills but also pedagogical integration should come to the fore in teacher education (Bakar et al., 2020; Harris et al., 2009; Koehler & Mishra, 2009). In this context, the scale adapted in the study has the potential to assess both technological competencies and pedagogical and contextual skills of pre-service mathematics teachers. The scale offers a current and holistic approach compared to many measurement tools in the current literature, especially in terms of awareness of newly emerging technologies such as artificial intelligence and the integration of these technologies into teaching processes (Awang et al., 2025).

Another important contribution of this study is its potential to provide broader implications for teacher education. The findings from the scale suggest that pre-service teachers should not only focus on the instrumental use of technology but also consider broader teaching goals and the needs of students and teaching processes. In this context, the study suggests that mathematics teacher education programmes and the curriculum development process should be adapted to the demands of the digital age (Njiku et al., 2022).

This scale is currently only developed in Chinese and adapted into Turkish. This limits its application and evaluation in other cultural and educational contexts. In addition, the rapid development of technological advancements necessitates the need to update the scale in the future. For example, in this study, a strong dimension for the use of artificial intelligence emerged. However, this scope may need to be expanded with the new technologies that will emerge in the future. Therefore, future studies can evaluate the long-term development of pre-service mathematics teachers' technology integration skills.

This adaptation study offers both practical and theoretical contributions to the effective integration of technology into mathematics courses and mathematics education. The adapted scale is considered to be an important tool for developing individual competencies of pre-service mathematics teachers in technology integration and contributing to the shaping of educational policies (Cirneanu & Moldoveanu, 2024). The scope of this scale can be expanded and generalised with new studies.

Lastly, the adaptation of this scale fills a crucial gap in the mathematics education literature, particularly in terms of addressing technology integration skills for pre-service mathematics teachers from multiple perspectives. Different than the adapted or developed scales found in the literature, which focus on general information about technology use or attitudes towards it (e.g., Li et al., 2023; Zelkowski, 2013), the scale adapted in this study also covers current dimensions such as instructional methods supported by artificial intelligence and parental and community involvement. Therefore, the scale is a suitable tool for evaluating pre-service mathematics teachers' self-efficacy in today's digital age.

In conclusion, this study has the potential to contribute to the digitalisation process in mathematics education. In particular, it provides an important basis for pre-service teachers to create individualised teaching environments, to develop positive attitudes towards technology integration, to ensure parental and community involvement in this process, to use artificial intelligence-supported processes effectively, and to develop skills related to professional development.

Ethics Committee Approval: Ethics committee approval was obtained from Ağrı İbrahim Çeçen University Scientific Research Ethics Committee (Date: 29.11.2024, Number: E.118588)
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Appendix 1: TISSM Items

Matematik Öğretiminde Teknoloji Entegrasyonu Öz-yeterliliği Anketi

Sevgili öğrenciler,

Bu çalışmanın amacı matematik öğretiminde teknoloji entegrasyonuna yönelik sizin öz-yeterlilik algınızı belirlemektir. Anket, demografik bilgileriniz yanında toplam 31 sorudan oluşmaktadır. Sizin için en uygun seçenekleri seçerek anketi göndermeniz beklenmektedir. Samimi ve objektif cevaplarınız araştırmanın amacına ulaşması noktasında önem arz etmektedir. Ankette sizin kişisel bilgilerinizi ortaya çıkaracak herhangi bir soru bulunmamaktadır ve toplanan veriler sadece bu çalışma için kullanılacaktır.

Zamanınızı ayırdığınız için şimdiden teşekkür ederiz.

Demografik Bilgiler
Cinsiyetiniz : Kadın …. Erkek ….
Yaşınız : …….
Sınıfınız : 1. Sınıf …. 2. Sınıf …. 3. Sınıf …. 4. Sınıf ….
Not Ortalamanız : ……

Anket Maddeleri

Maddeler	Hiç katılmıyorum	Katılmıyorum	Ne katılıyorum ne de katılmıyorum	Katılıyorum	Tamamen Katılıyorum
M1 – Çevrimiçi matematik derslerine dijital teknolojileri, matematik alan bilgilerini ve öğretim yöntemlerini etkili bir şekilde entegre edebilirim.					
M2 – Yüz yüze matematik derslerine dijital teknolojileri, matematik alan bilgilerini ve öğretim yöntemlerini etkili bir şekilde entegre edebilirim.					
M3 – Öğrencilere matematik öğrenmek için dijital teknolojileri (internet kaynakları, yapay zekâ araçları, çeşitli öğrenme yazılımları vb.) kullanmaları konusunda rehberlik edebilirim.					
M4 – Matematik öğretim programına göre çevrimiçi tabanlı kendi kendine öğrenme etkinlikleri tasarlayabilirim. (Örneğin, öğrencilerin matematiği bireysel olarak incelemelerini sağlayabilecek öğretici videolar ve ödevler oluşturabilirim).					
M5 – Soyut matematiksel kavramları görselleştirmek için dijital teknolojileri kullanabilirim. Örneğin etkileşimli akıllı tahtalarda geometrik şekilleri dinamik olarak sunabilirim.					
M6 – Öğrencilerin sınıftaki öğrenme etkinliğini değerlendiren gerçek zamanlı (anlık) sınavlar tasarlamak için dijital teknolojileri kullanabilirim.					
M7 – Öğrencilerin ödevlerini derinlemesine analiz etmek ve öğretim içeriğini buna göre düzenlemek için dijital teknolojileri kullanabilirim.					
M8 – Matematik derslerimde akademik dürüstlük üzerine tartışmaları bir araya getirerek, akıllı eğitim çağında intihal konusunda rehberlik ve düzenlemelere vurgu yaparım.					
M9 – Matematik öğretimimde dijital teknolojileri kullanmak, öğretim hedeflerime etkili bir şekilde ulaşmamı sağlar.					
M10 – Geleneksel sınıflara kıyasla, dijital teknolojileri matematik öğretimime entegre etmek öğretimi daha etkili hale getirebilir.					
M11 – Dijital teknolojilere aşina olduktan sonra, bunları matematik öğretimime entegre etmeye daha istekli olurum.					
M12 – Kullanımı kolay olduğunda matematik derslerinde dijital teknolojileri kullanmaya istekliyimdir.					

M13 – Matematik dersinde, hızlı bir şekilde ustalaşabildiğim dijital teknolojileri kullanmayı tercih ederim					
M14 – Yapay zekâ destekli matematik ders sistemlerinin öğrencilerin matematikteki öğrenme yeteneklerini geliştirmelerine yardımcı olabileceğine inanıyorum.					
M15 – Yapay zekâ araçları, matematik öğretiminin ve öğreniminin kalitesini iyileştirmede önemli bir rol oynar.					
M16 – Yapay zekâ araçları, öğretimimin etkililiğini artırmamda bana yardımcı olabilir.					
M17 – Matematik derslerinde yapay zekâ araçlarını kullanmak, öğrenci motivasyonunu önemli ölçüde artırır.					
M18 – Matematik eğitiminde yapay zekâ araçlarının entegrasyonunu iyileştirmek için mesleki gelişim fırsatlarını takip ediyorum.					
M19 – Ulusal öğretmen mesleki gelişim programları (hizmet içi eğitimler ve eğitim fakültelerinin sunduğu öğretmen yetiştirme lisans programları dahil) çeşitli eğitim dijital teknolojilerinde ustalaşmama yardımcı oluyor.					
M20 – Okul ve üniversite tarafından düzenlenen öğretmen mesleki gelişim programları dijital teknolojileri entegre etme yeteneğimi geliştirebilir.					
M21 – Okul ve üniversitenin desteği dijital teknolojileri sınıfta entegre etme konusunda güvenimi artırır.					
M22 – Eğitim ortamı bana çeşitli eğitim kaynaklarına erişim sağlıyor.					
M23 – Matematik öğretmenlerinin bilgi teknolojisi yeterliliğini artırmak için uygulanan eğitim politikalarını biliyorum.					
M24 – Matematiğin rekabetçi doğası, dijital teknolojileri matematik öğretimine entegre etmem için beni motive eder.					
M25 – Örnek uygulama derslerine katılmak, dijital teknolojileri matematik öğretimine entegre etmem için beni motive eder.					
M26 – Standart testler, dijital teknolojileri matematik öğretimine entegre etmem için beni motive eder.					
M27 – Öğrencilerin akademik başarısını artırmak, dijital teknolojileri matematik öğretimine entegre etmem için beni motive eder.					
M28 – Öğrencilerim matematik görevlerinde/ödevlerinde iş birliği yapmak için dijital iletişim araçlarını (WhatsApp, Telegram ve Instagram gibi) kullanabilirler.					
M29 – Öğrencilerim matematik becerilerini ve bilgilerini geliştirmek için eğitim kaynaklarını (örneğin, matematik öğretim videoları, yapay zekâ ve matematik öğrenimi uygulamaları) kullanabilirler.					
M30 – Ebeveynlerin bilgi teknolojisi becerileri, çocuklarının matematik öğrenimine yardımcı olmada önemli bir rol oynar.					
M31 – Topluluk desteği (meslektaş, akran, ebeveyn vb.), öğretmenlerin matematik öğreniminde dijital teknolojileri kullanma tutumlarını etkiler.					

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The Mediating Role of Life Satisfaction in The Relationship Between Status Anxiety and Professional Motivation Among Teachers

Nuray AŞANTUĞRUL[1]

[1] Amasya University, Faculty of Education, Department of Educational Sciences, Amasya, Türkiye

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Corresponding author:
Nuray Aşantuğrul
E-mail: nuray.asantugrul@amasya.edu.tr

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ABSTRACT

The aim of this study is to investigate the mediating role of life satisfaction in the relationship between teachers' status concerns and professional motivation. This research is important because it can present findings to improve and increase teachers' professional motivation in line with the data obtained by examining how status anxiety, which negatively affects teachers' professional and individual development, has an effect on their professional motivation and how life satisfaction mediates this effect. The research was conducted with teachers using a quantitative method based on a correlational survey model. The study group consisted of 253 teachers (165 female and 88 male) working in public schools in the Central Black Sea Region. The teachers were selected through convenience sampling. Data collection tools in the study include the Status Anxiety Scale, the Teacher Professional Motivation Scale, the Life Satisfaction Scale and the personal information form developed by the researcher. The relationships between the variables were analyzed using Pearson's Product-Moment Correlation Analysis, revealing significant correlations. A mediation model was then established for the analysis Research findings reveal that there is a significant negative relationship between status anxiety and professional motivation, and a positive significant relationship between life satisfaction and professional motivation. As a result of the mediation analysis, it was seen that life satisfaction has a significant mediating role relationship between status anxiety and professional motivation. In order to increase teachers' professional motivation, it is recommended that teachers be supported in reducing their status-related concerns and increasing their life satisfaction.

Keywords: Status anxiety, professional motivation, life satisfaction, teachers.

Introduction

There are many factors that affect the mental health of teachers, one of the basic elements of education. One of these is economic inequality, which is a result of the economic problems the country has experienced in recent years for this study conducted in Türkiye. Melita et al. (2021) state that psychological processes should be taken into account to explain the negative consequences of economic inequality and that one of these processes may be status anxietyStatus is an important concept that reflects an individual's place, social position and success in society. Individuals may show stress reactions when faced with the possibility of losing their status or not reaching the standards of success in their social environment (Casey, 2020). These stress reactions appear in the literature as status anxiety.

Status anxiety refers to individuals' constant anxiety about their social position, success, and social acceptance (Paskov et al., 2013). Status anxiety can lead individuals to behave less socially consciously, push them to be more selfish, and this can cause individuals to behave more discriminatorily towards people with lower social status (Melita et al., 2020). It is thought that this anxiety affects the individual's life and mood as well as social life. Therefore, understanding the source of status anxiety experienced by individuals is important in understanding broader social dynamics.

Status anxiety has a different structure than the anxiety states defined in the literature. Status anxiety differs from general anxiety in that it is more specifically concerned with current social status (Balsamo et al., 2013). Research shows that status anxiety negatively affects the mental health of individuals (Blake & Brooks, 2019; Woody et al., 2018). In addition, status anxiety weakens workplace

relationships, reduces job satisfaction in employees, and reduces organizational performance (Keshabyan & Day, 2020). Based on all this information, it can be said that when individuals experience status anxiety within the organization, it can negatively affect the overall enjoyment of the work done by employees, leading to job dissatisfaction, decreased performance, and therefore decreased motivation.

Another concept related to the quality of education is motivation. Motivation is generally an internal process that directs the individual to behavior (Lussier, 2022) and is defined as the psychological need that activates the internal behavior and motivation of the individual to achieve the goal (Williams & Luthans, 1992). Individuals with high motivation have characteristics such as doing things as well as possible, doing things to achieve success, completing tasks that require effort and skill, wanting to specialize in a certain field, accomplishing difficult tasks with satisfactory results, and engaging in meaningful work (Sudarjat et al., 2015). The concept of professional motivation is a process that directs and empowers the behavior of people working in institutional areas (Leonard et al., 1999). When considered from the perspective of teachers, it can be said that professional motivation is one of the important factors affecting teachers' achievement of their goals and providing a qualified education.

It is very important for teachers to have professional motivation that will enable them to achieve the goals of their school organizations (Güneş & Köse, 2021). The motivation level of teachers is affected by many factors. These factors include personal/social factors, classroom environment, socioeconomic status, student behavior, exam stress, self-confidence/teacher's personality, and rewards/incentives (Alam & Farid, 2011). According to Kocabaş (2009), the perceptions of the teaching profession regarding their status in society are among the factors that motivate teachers. In this context, it can be thought that teachers' concerns about status may also negatively affect their professional motivation.

It is not possible for educational practices to be successful in a place where teacher motivation is low (Yarım & Ada, 2021). Research shows that high teacher motivation is beneficial for both the teacher and the student (Affuso et al., 2022; Hasibuan, 2022; Mašková et al., 2022). Gönülaçar (2016) explains the factors affecting the quality of teachers as the teacher's motivation, job satisfaction, beliefs about the job, confidence in his/her skills, participation in the decision-making process, autonomy, opportunity for promotion at work, workload, reputation of the profession, amount of wages earned, managerial attitudes, feedback on performance, relations with colleagues and working conditions. When these factors are examined, it is important to examine the status concerns and professional motivations of teachers and to suggest the necessary strategies in order to increase both the personal lives of teachers and the quality of education.

The mediating role of life satisfaction

Another concept that is thought to be related to an individual's professional motivation is life satisfaction. Life satisfaction is a cognitive component of subjective well-being and includes cognitive judgments about one's life (Diener, 1984). Life satisfaction is generally defined as the situation or outcome obtained by comparing a person's expectations with what they have (Haybron, 2004). Life satisfaction is not only related to a certain area, but is a positive evaluation of life as a whole and therefore includes the individual's work-related experiences. When considered in the light of these definitions, it is inevitable that the level of satisfaction with life will have certain effects on other areas of life.

Appleton and Song (2008) suggest that life satisfaction has six different components. These components are the person's income level, social and occupational status, opportunities and social mobility, welfare conditions, current state policy and environment, family and social relations. As can be understood from these components, life satisfaction is a concept intertwined with status and professional motivation and has a dynamic structure. In light of all this information, it is believed that life satisfaction can increase teachers' professional motivation and play a mediating role in mitigating the negative impact of status anxiety on professional motivation. Therefore, the concept of life satisfaction was included in the research as a mediating variable.

The first studies that examined the relationship between professional life and life satisfaction were based on the Overflow Approach. Overflow, as a concept, is the transition from one area to another and their interaction and assimilation. The spillover approach states that situations occurring in one living area spread to other living areas (Dolan & Gosselin, 2000). For example, if satisfaction in one area of life is low, this will affect satisfaction in other areas of life in the same direction. In the current study, this approach was used as a basis to examine the antecedents of teachers' professional motivation. Additionally, a mediation model based on the theoretical model was tested in a Turkish teacher sample.

Purpose of the Study

Recent changes in the education system have brought

about challenges to the status and prestige of the teaching profession. This has led to increased status anxiety and decreased motivation among teachers. Therefore, teachers were chosen as the target audience for this study. Status anxiety can reduce teachers' professional motivation. At this point, the present study can contribute to the understanding of the factors that cause teachers' status anxiety and help develop strategies to make teachers' professional motivation and thus education more effective. The findings of this research will be beneficial in improving the quality of education by increasing teachers' motivation and life satisfaction. Furthermore, this study is one of the first to examine the impact of status anxiety on teacher motivation through life satisfaction. In this sense, the current study is important for its contribution to the literature.

Based on the Spill-Over Approach, the current research assumes that life satisfaction may affect individuals' professional lives in the same direction. Based on this idea, the aim of the present study is to investigate the mediating role of life satisfaction in the relationship between teachers' status concerns and professional motivation. Considering these theoretical explanations and research results, the following hypotheses were created:

- H1: There is a negative relationship between status anxiety and life satisfaction.
- H2: There is a positive relationship between life satisfaction and professional motivation.
- H3: There is a negative relationship between status anxiety and professional motivation.
- H4: Life satisfaction has a mediator role between status anxiety and professional motivation.

Method

Research Model

This research was designed in the correlational research design because it examines the relationships between teachers' status concerns, professional motivation, and life satisfaction with simple mediating roles. In correlational studies, the direction and level of relationships between variables are examined (McMillan & Schumacher, 2010).

Population and Sample

The study group consisted of 253 teachers working at various levels of education in public schools in different provinces located in the Central Black Sea region during the 2024-2025 academic year. The study population consisted of teachers in public schools in the Common Black Sea Region. The teachers in the study group were reached through the convenience sampling method. The purpose of the convenience sampling method is to create a study group that is easy to participate in the research (Christensen et al., 2015).

Table 1.

Demographic Information About the Study Group

Variable		n	%
Gender	Female	165	65.2
	Male	88	34.8
Professional experience	1-5 years	22	8.7
	6-10 years	30	11.9
	11-15 years	74	29.2
	15 years above	127	50.2
Educational level	Kindergarten	27	10.7
	Primary school	80	32
	Secondary school	81	31.6
	High school	65	25.7

When the distribution of teachers by gender variable was examined, it was found that 165 (65.2%) were female, and 88 (34.8%) were male. The distribution of participants in terms of professional experience is as follows; 8.7% have 1-5 years of professional experience, 11.9% have 6-10 years of professional experience, 29.2% have 11-15 years of professional experience, and 50.2% have over 15 years of professional experience. In terms of the education level, it was determined that 10.7% of the participants were in kindergarten, 32% in primary school, 31.6% in secondary school and 25.7% in high school. In addition, participants include teachers from different branches such as preschool, mathematics, foreign language, classroom, special education, guidance, visual arts, informatics, technology design, science, religious culture and moral knowledge.

Data Collection Tools

Status Anxiety Scale

The Status Anxiety Scale, developed by Day and Fiske (2016), was adapted to Turkish by Sürücü et al. (2022). The scale has a one-dimensional structure consisting of five items. Scale items are scored between 1 = Strongly disagree and 5 = Strongly agree. As the scores obtained from the scale increase, it is evaluated that the participant's status anxiety is high. As a result of factor analysis, it was determined that the factor loadings of the items in the scale were .81 and above. The reliability coefficient of the scale was calculated as .95 by the researchers who adapted the scale. As a result of the

confirmatory factor analysis, the fit indices were found as χ^2= 24.872, df= 11, χ^2/df= 2.261, GFI= 0.984, NFI= 0.972, IFI= 0.984, TLI= 0.959, CFI= 0.984, RMSEA= 0.058. These findings confirm that the Status Anxiety Scale has construct validity. The scale includes items such as "I feel anxious about being stuck in my current position for the rest of my life." and "I sometimes worry about being in a lower social position."

Teacher Professional Motivation Scale

Teacher Professional Motivation Scale was developed by Karabağ Köse et al. (2020) to determine the professional motivation levels of teachers. The scale is answered in a 5-point Likert type, with responses ranging from "1-very negative effects to 5-very positive effects". The scale consists of 25 items and 4 sub-dimensions. These factors are; in-school factors, professional development and prestige, out-of-school factors and physical facilities. The total score to be obtained from the scale varies between 25 and 125. There are no items in the scale that need to be reverse scored. The correlation values of the scale items vary between .32 and .62. As a result of the confirmatory factor analysis conducted within the scope of validity studies, the fit values were calculated as χ^2/sd=2.17; RMSEA=.06; GFI=.86; AGFI=.82; CFI=.90; NFI=.83 for the paper-pencil test and χ^2/sd=4.95; RMSEA=.07; GFI=.88; AGFI=.85; CFI=.93; NFI=.91 for the online application. These values reveal that the four-factor structure of the scale shows acceptable fit. As a result of the reliability study of the scale, Cronbach alpha values were found to be .90 for in-school factors, .81 for out-of-school factors, .76 for professional development and prestige, and .78 for physical facilities. Finally, the scale includes statements such as "The quality of the physical environment in our school" and "The level of appreciation of the work done in our school".

Life Satisfaction Scale

The Life Satisfaction Scale, developed by Diener (1985), was adapted into Turkish by Dağlı and Baysal (2016). The scale has a one-dimensional structure consisting of five items. The reliability of the scale was determined by Cronbach's Alpha internal consistency coefficient and test-retest technique. The consistency coefficient for the entire scale was calculated as .88. In order to test the test-retest reliability of the scale, Turkish forms were applied to a group of 47 teachers at two-week intervals and the correlation coefficient between the two applications was determined as .97. As a result of the confirmatory factor analysis conducted within the scope of the validity study, the fit indices were found to be χ^2/sd=1.17; RMSEA=.03; GFI=.99; AGFI=.97; CFI=1.00, NFI=.99 and NNFI=1.00. The scale includes items such as "I have a life close to my ideals." and "I am satisfied with my life."

Procedure

The study group, which participated in the research on a voluntary basis, was informed about the importance and purpose of the research before moving on to the implementation process. In addition, participants were informed about ethical principles and confidentiality, and the data set created online was sent to married individuals to ensure their participation. Ethical permission for the research was obtained from Amasya University Social Sciences Ethics Committee.

Ethical considerations

Ethics committee approval was obtained from Amasya University Social Sciences Ethics Committee (Date: 12.05.2025, Number: 8979). The study was conducted in accordance with the Declaration of Helsinki Principles. Additionally, informed consent has been obtained from the participants.

Data Analysis

Before analyzing the data obtained in the study, the conformity of the data to univariate and multivariate normal distribution was examined with normality analyses. For this purpose, compliance with the univariate normal distribution was evaluated by examining the skewness and kurtosis values. Tabachnick and Fidell (2015) report that the skewness and kurtosis values being between [-1.5, +1.5] is a criterion for the normality of the distribution. After the multivariate normality of the data set was evaluated by examining the Mahalanobis, Tolerance and VIF values, it was decided that the data set also had multivariate normality and the analysis of the data was started. In the analysis of the data obtained in the study, Pearson product-moment correlation analysis was performed to determine the relationships between the variables. In addition, simple mediation analysis was performed using SPSS Model 4.0 (Hayes, 2018) macro to examine the mediating role of life satisfaction in the relationship between status anxiety and professional motivation. The analysis was performed using SPSS version 25 (IBM SPSS Corp., Armonk, NY, USA).

Results

Correlations between variables

Correlations between status anxiety, professional motivation, and life satisfaction are in Table 2:

Table 2.

Correlations Between Status Anxiety, Professional Motivation and Life Satisfaction (n=253)

Variable	1	2	3
1.Status anxiety	1		
2.Professional motivation	-.32**	1	
3.Life satisfaction	-.45**	.24**	1
M	14.78	90.64	15.21
SD	4.89	16.56	4.03

*p < .05, ** p < .01

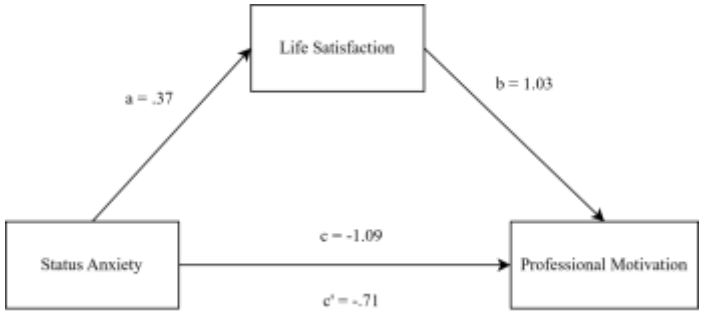
In Table 2, Pearson product moment correlation analysis indicate a significant negative relationship between status anxiety and professional motivation (r = -.32) and life satisfaction (r = -.45). There is also a positive correlation between the total score of professional motivation and life satisfaction (r = .24). The correlation analysis results show that as teachers' status anxiety increases, their professional motivation and life satisfaction decrease negatively; and as teachers' life satisfaction increases, their professional motivation also increases. Additionally, the relationship between status anxiety and the sub-dimensions of the professional motivation scale was examined, but the findings were not included in the table. As a result of the analysis, the sub-dimension of status anxiety and the total score of professional motivation scale shows a significant negative relationship between physical facilities (r = -.16), in-school factors (r = -.24), out-of-school factors (r = -.39), professional development and prestige (r = -.32).

Simple mediation analysis

The model aiming to test the mediating role of life satisfaction in the relationship between teachers' status concerns and professional motivation is presented in Figure 1.

Figure 1.

Representation of the Mediation Model



In this part of the research, the mediating role of life satisfaction in the effect of status anxiety on teacher professional motivation was analyzed with the PROCESS v3.5 plugin added to the SPSS interface and developed by Andrew F. Hayes. The regression analysis results for the mediation test are shown in Table 3:

Table 3.

Simple Mediation Analysis Results

					95% CI	
	B	SH	*t*	*p*	BLLCI	BULCI
PM (R^2 = .15)						
Model Components						
SA→ LS	-.37	.05	-7.87	.001*	-.46	-.28
LS→PM	1.03	.27	3.85	.001*	.50	1.56
Direct Effect						
SA→ PM	-.71	.22	-3.22	.001*	-1.14	-.27
Indirect Effect						
SA→LS→ PM	-.38	.11			-.62	-.17
Total Impact						
SA→ PM	-1.09	.20	-5.36	.001*	-1.49	-.69

Abbreviations: PM: Professional motivation, SA: Status anxiety, LS: Life satisfaction

***p < .001.

As seen in Table 3, as a result of the mediation analyses, it was found that the total effect of status anxiety on professional motivation was statistically significant (B = -.1.09, SH = .20, p < .001). The direct effect of status anxiety on professional motivation is also statistically significant when teachers' life satisfaction is controlled (B = -.71, SH = .22, p < .001). Finally, the indirect effect of status anxiety on occupational motivation through life satisfaction is statistically significant as the 95% confidence interval does not include zero (B = -.38, SH = .11). Life satisfaction explains approximately 35% of the total effect of status anxiety on vocational motivation. In addition, the mediation regression model created has a medium effect size, explaining approximately 15% of the variation in marital conflict scores (F (2, 250) = 22.54, ΔR^2 = .15, p < .001). As a result, the mediation analysis shows that life satisfaction has a mediating role in the relationship between status anxiety and occupational motivation. In other words, life satisfaction has a protective role in the relationship between status anxiety and occupational motivation. The negative effect of status anxiety on professional motivation among teachers is reduced by life satisfaction.

Discussion

This study aimed to determine the mediating role of life satisfaction in the relationship between teachers' status concerns and professional motivation. Analysis was

carried out in line with the first hypothesis of the research and a negative relationship was obtained between status anxiety and life satisfaction. This result means that as teachers' status anxiety increases, their life satisfaction decreases. When the literature was examined, it was seen that the result of the current research was parallel to the results of similar studies in the literature (Çetinceli & Tüzün, 2022; Delhey & Dragolov, 2014; Turaç & Donar, 2017). In the status anxiety scale development study by Sürücü et al. (2022), the relationship between them and life satisfaction was examined in order to test the criterion validity. As a result of the research, a negative correlation was found between status anxiety and life satisfaction. Blake and Brooks (2019) state that status anxiety is one of the factors that negatively affects the mental health of individuals. In this context, considering that life satisfaction, which is an individual's cognitive evaluation of himself/herself in his/her life, is closely related to positive emotions, it is an expected result that status anxiety will negatively affect satisfaction with life.

The second hypothesis of the study is that there is a positive relationship between life satisfaction and professional motivation. Analysis was conducted in line with this hypothesis, and a positive relationship was found between life satisfaction and professional motivation. In other words, as teachers' life satisfaction increases, their professional motivation increases. This result is consistent with studies in the literature showing that life satisfaction has a positive and significant relationship with motivation (Tulunay Ateş & İhtiyaroğlu, 2021; Yalçınsoy, 2017) and academic motivation (Koç, 2018). Chacko (1983) emphasizes that work life and general life are closely related to each other and that positive experiences in work life will increase the life satisfaction of individuals. Therefore, a positive relationship between professional motivation and life satisfaction is an expected result.

In line with the third hypothesis of the research, it was analyzed whether there was a relationship between status anxiety and professional motivation. The analysis results revealed that there was a negative significant relationship between teachers' status anxiety and their professional motivation, consistent with the research hypothesis. In addition, as a result of the analyses, a negative significant relationship was obtained between status anxiety and the sub-dimensions of the occupational motivation scale, physical facilities, in-school factors, out-of-school factors, occupational development and prestige. This result means that as teachers' status anxiety increases, their professional motivation decreases. Factors that increase status anxiety, such as inadequate promotions, the possibility of demotion, or insecure employment, are also considered to be factors that reduce employees' commitment to their organizations (Kalleberg, 2018). Higher status anxiety is linked to lower work motivation, which may affect individuals' occupational choices and mental health. As a result of the research conducted by As a result of the research conducted by Şahbudak and Karahan (2024), it was seen that teachers' perception of their professional status was low and this situation negatively affected their professional satisfaction and motivation. The research results by Keshabyan and Day (2020) showed that high status anxiety significantly predicts low job satisfaction. The study found that as status anxiety increases, job satisfaction and general well-being decrease. The results of the research conducted by Altaş (2024) show that as teachers' status concerns increase, their quality of work life decreases. In this context, it can be said that an increase in individuals' status anxiety will negatively affect the general enjoyment of their work, leading to job dissatisfaction and decreased performance.

In line with the last hypothesis of the study, the mediating role of life satisfaction in the relationship between status anxiety and professional motivation was analyzed. The research result revealed that life satisfaction plays a significant mediating role in the relationship between status anxiety and occupational motivation. This result means that as teachers' life satisfaction increases, the negative effect of status anxiety on professional motivation decreases. As explained above, individuals' status anxiety has a negative effect on their professional motivation. On the other hand, according to Keser (2005), it is a generally accepted idea that there is a relationship between satisfaction in work life and life satisfaction. Individuals' satisfaction with the institution they work for, the pleasure and satisfaction they get from working, and life satisfaction affect each other (Aykaç, 2019). As a result of the research conducted by Gözen (2022), it was observed that as teachers' family life satisfaction increases, their teacher motivation, professional satisfaction and personal development, motivation for the learning process and students increase. Based on this, it can be said that life satisfaction increases the professional motivation of individuals. On the other hand, a study by Çivilidağ et al. (2018) found a moderately significant negative relationship between life satisfaction scores and trait anxiety scores. In a similar study conducted by Güngör (2011), the relationship between anxiety and life satisfaction was examined, and a negative and statistically significant relationship was found between trait anxiety and life satisfaction variables. In this context, as teachers' life satisfaction increases, the decrease in the negative impact of status anxiety on their professional motivation is an expected result.

Conclusion and Recommendations

In this study, the mediating role of life satisfaction in the relationship between teachers' status concerns and professional motivation was examined. As a result of the research, negative significant relationships were found between status anxiety and both the total score of professional motivation and all sub-dimensions of the professional motivation scale. However, it was observed that there was a negative and significant correlation between status anxiety and life satisfaction. Finally, the mediating role of life satisfaction was determined to be statistically significant in the relationship between status anxiety and occupational motivation.

Based on the current research, some suggestions for future research are made. Firstly, the results obtained in this study were limited to 253 participants determined by convenience sampling. 88 of these participants were male. These are the limitations of the study. It is thought that it would be beneficial to conduct future research on this subject with a more comprehensive sample by increasing the number of male participants. Teachers were already included in this study. No analysis was made according to the institutions where teachers work. However, conditions may differ in public and private schools. Therefore, in future studies, status anxiety, professional motivation and life satisfaction of teachers can be examined according to the type of school they work in. In addition, based on current research results, it is known that status anxiety negatively affects professional motivation and life satisfaction. Therefore, by focusing on teachers' status concerns, it may be possible for educational institutions to develop supportive policies and programs in this regard, thus increasing both teachers' motivation and life satisfaction.

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Informed Consent: Written informed consent was obtained from teachers who participated in this study
Peer-review: Externally peer-reviewed.
Author Contributions: The study has a single author.
Conflict of Interest: The author has no conflict of interest to declare.

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The Effects of Museum-Based Art Education on the Cognitive and Socio-Sensory Development Levels of Preschool Children

Şebnem NOYAT [1]

[1] Dicle University, Technical Sciences Vocational School, Textile Clothing Shoes and Leather Department, Diyarbakır, Turkey

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Sorumlu Yazar/Corresponding author: Şebnem NOYAT
E-mail: sebnemnoyat@subu.edu.tr

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ABSTRACT

The purpose of this study is to examine the effects of museum-based art education in preschool on children's cognitive and socio-sensory development. Art education helps children express feelings and thoughts, develop aesthetic sensitivity, reinforce social skills, and foster healing experiences. Art activities conducted in a museum environment provide children with multisensory learning opportunities, increasing retention and supporting developmental areas holistically. The research was structured using a case study method, a qualitative design. Participants were 57–68-month-old children attending a public preschool in the İzmit district of Kocaeli province. The study group consisted of 28 children, categorized as experimental (n=14) and control (n=14). Semi-structured interviews and participant observation were used as data collection tools, and data were gathered over a 13-week implementation. Art activities were planned in three stages: before, during, and after the museum visit. According to the findings, significant improvements were observed in conceptual knowledge levels and cognitive skills such as attention, observation, sorting, and comparison of the children who received museum-based art education. Positive development was also observed in children's socio-sensory skills, such as understanding museum rules, cooperating in groups, empathizing, and expressing emotions. During the process, children integrated their museum experience with artistic production, thus concretizing their learning. In conclusion, museum-based art education stands out as an effective method that supports children's cognitive and socio-sensory development. It is recommended that structured museum visits and art-based activities be included more in preschool education programs.

Keywords: Preschool, museum education, art education, development level, Kocaeli archaeology museum.

Introduction

Art is a universal language that offers the opportunity to express the individual's feelings, thoughts and imagination. Art, which is a communication tool for people of all ages, has a separate importance, especially for children. Children explore the world around them through art, express their inner worlds and exhibit their creativity. In this context, art plays an important role in developing children's imagination, expressing their emotions and supporting their creativity, while also contributing to their emotional and mental development (Eisner, 2002). This strong expression ability of art is of great importance in the development of children.

The importance of art education in the preschool period, where academic education is not provided and learning by doing is based on living, is revealed by research. The initial research was carried out by school director G. Kerchensteiner in Munich, Germany, with additional support from Levinstein and Stern. Important findings have been obtained from the research on pictures taken by three hundred thousand children. In the 1920s, the development of behaviour according to the emotional and physical stages of the child became a common understanding in art education, and this understanding continues to exist in today's education system (San, 2010). The preschool period is the early childhood period of an individual. This period is the period when the foundations of an individual's life are laid. The foundations laid in childhood gradually turn into personal habits, which later evolve into knowledge and skills in adulthood, paving the way for the establishment of scientific foundations. Within this framework, the educational program structure adopted in Türkiye follows a 'developmental guidance'

approach, is organized in a 'spiral' format, and is characterized by an 'eclectic' model (MONE 2024).

According to Gysbers and Henderson (2012), developmental guidance program is a program that is organised and created by a particular order. This program responds to the child's achievements by focusing on the child's interests, perceptions and skills (Nazlı, 2016). According to Sönmez (2017), the spiral approach is an approach in which new learning is based on previous learning, interrelated and progressive; previous topics are repeated after the program has progressed (Direkci & Yavuz, 2018., 45). In the context of early childhood education, such structured and developmentally appropriate programs are essential for supporting children's holistic growth. However, for these programs to be truly effective, they must integrate not only cognitive and academic content but also experiences that nurture creativity, emotional expression, and social interaction. This necessitates the inclusion of pedagogical tools and practices that address the diverse developmental needs of young children beyond traditional instructional methods. Art education allows children to provide experiences by supporting their developmental steps and allows them to express themselves in social life (Karoğlu & Ünüvar, 2017, 123).

While art increases aesthetic awareness and allows one to understand and appreciate beauty, it also lays the foundations for creative and critical thinking skills. These creative processes are supported in the classroom environment and museum educational events. Educational activities in museums develop children's cognitive and social-sensory skills while contributing to the development of their imagination and creativity (Eisner, 2002). According to Ata (2002), the museum themes that students see and visit are important during museum visits.

Museums that reflect the themes of art, culture, tradition, history, science and technology play an important and active role in the child's memory. Children who receive museum-based art education achieve significant visual perception, behavioural development and academic achievement by receiving an education intertwined with art (San, 2021; Güneröz & Okuran, 2023)

Socio-Sensory Development of the Child

Sociosensory development refers to an individual's increasing sensitivity and perception of environmental stimuli. It involves the senses of smell, taste, vision, hearing, and touch, and facilitates an individual's interaction with the world. This development, which begins in infancy, continues throughout life and progresses as individuals perceive and respond to stimuli from their environment (Mather, 2018).

Sensory experiences are particularly critical in early life. For example, babies begin learning by being exposed to sensory input such as sound, smell, sight, and touch. The richness and diversity of these environmental stimuli significantly influence healthy sensory development. Providing children with opportunities to interact with a variety of sensory inputs, from colorful and textured toys to natural environments filled with the sounds and smells of nature, is crucial (Pekçetin, 2015). These experiences not only support sensory integration but also contribute to neurological development, where sensory input is organized and interpreted by the brain (Schaaf & Miller, 2005). As a result, sensory development increases a child's ability to socially interact and adapt to his or her environment throughout life (Çetin, Sultanoğlu & Aral, 2015)

Purpose

This study investigates the effects of museum-based art education on preschool children's cognitive and socio-sensory development. It investigates the potential of the art education activities carried out at the museum to support children's development levels. In addition, it investigates how the audiovisual and tactile experiences provided by museum environments affect children's learning processes.

Importance

Implementing museum trips included in the preschool education program within the framework of the education plan is important in supporting children's development areas. Museum trips have been included in the preschool education and training program of the Ministry of National Education (MONE, 2013, 2024). However, there is no specific educational flow plan for museum trips in the 'Octets' section of the program. This research also emphasises the importance of adding the museum education plan flow to the 'Octets' section of the Ministry of National Education preschool education and training program.

When the relevant literature is examined, research on museum education and art studies in the museum within the scope of art education of preschool children in Türkiye is observed; however, research focusing on the artistic function of museums in the context of art education in the preschool period is limited. During the literature review of the research, it was determined that the deficiencies in this area were identified through a TUBITAK Project. In the current literature, teachers, prospective teachers and primary and high school students have generally been identified as the target audience in studies conducted on museum education. In the master's thesis on museum education in the field of educational sciences, it was determined that there was a master's thesis titled

Investigation of the Effects of the Museum Utilization Program on 6-Year-Olds in Preschool Education completed in 2010 (Bilir, 2023). According to the National Thesis Center database, 51 theses on museum education written between 2017 and 2023 were identified (National Thesis Center, 2023).These theses generally do not focus on art studies or cover the preschool education target group. Practical realisation and dissemination of museum education in art education activities in the preschool period will significantly contribute to students' artistic development.

The research was carried out within the framework of the plans by considering the developmental characteristics of children in the preschool period of 57-68 months. The applied activities are recorded. Activities were implemented by the researcher as an art education teacher at a preschool educational institution, and direction was given to the research. The results obtained are expected to contribute to increasing the effects of art education on preschool education.

Limitations

This research is limited to a state kindergarten providing preschool education affiliated with the Directorate of National Education in the Izmit District of Kocaeli province and the Archaeological Museum in Kocaeli province. The data collection phase of the study lasted 13 weeks and was limited to students aged 57-68 months who received preschool education. The experiment (14 students) and the control group (14 students) consist of 28 students. Students participated in research and practice in two classes. In order to collect the research data, a semi-structured interview form was applied to the students. The application of art education activities in the preschool program is limited to “Museum Education”.

Method

This section includes the model of the research, the universe and the sample, the study group of the research, the collection of data, the analysis of data and the study plan.

Research Model

This research was conducted to examine the effects of museum-based art education implemented in preschool on children's cognitive and social-emotional development. The research was structured using a case study design within a qualitative research approach. This design is a qualitative research method that aims to provide a comprehensive and in-depth examination of a specific phenomenon within its natural context (Yin, 2014). The focus of the research is to reveal how children are affected by art and museum experiences.

Participants

The study group consisted of 28 preschool children, aged 57–68 months, attending a public preschool affiliated with the Ministry of National Education in the İzmit district of Kocaeli province during the fall semester of the 2023–2024 academic year. These children were enrolled in two different classrooms within the same school, and activities in both classrooms were observed during the research period. One classroom implemented museum-based art education activities, while the other classroom was observed during the natural learning process. This approach aims to assess the impact of different practices on children's development from a qualitative perspective, without distinguishing between experimental and control groups.

The participants were selected using criterion sampling, a type of purposive sampling. This method enables researchers to deliberately select individuals who meet the predetermined criteria in order to explore specific situations in depth (Büyüköztürk et al., 2016, p. 127). In this study, the selection criteria were the preschool’s proximity to the museum, the voluntary participation of preschool teachers and parents, the willingness of the museum director, archaeologist, and staff to collaborate, and the age appropriateness of the students for the planned activities.

Data Collection Tools

Data were gathered through two primary methods: Semi-structured interviews, developed in line with the Preschool Student Development Achievement Plan (MONE, 2013), and participant observation, conducted during the art activities. Semi-structured interviews were conducted with the students before and after the museum-based education to explore their experiences, thoughts, and feelings in their own words. Semi-structured interviews are a widely used qualitative data collection technique that provides a flexible framework while allowing participants to express themselves freely within a guided set of questions (Yıldırım & Şimşek, 2018). In addition, the researcher observed the natural behaviors of the students during the art activities and actively participated in the process. Participant observation allows the researcher to engage directly with participants and gain deeper insights into their behaviors and interactions. The children's reactions to art-making, their social-emotional interactions, and their creative behaviors were recorded in detail throughout this process.

Validity and Reliability

To ensure scientific rigor, expert consultation was used in the development of interview questions, and structured observation protocols were followed. A systematic

codebook was employed to maintain objectivity during data coding, and the MAXQDA 2020 software supported a transparent and reliable analysis process. These procedures were applied to strengthen the internal validity and reliability of the study (Tavşancıl, 2006; Yıldırım & Şimşek, 2018).

Research/Implementation Process

This study was designed to examine the impact of museum-based art education on children's cognitive and social-emotional development in preschool. The implementation process was planned for a total of 11 weeks and was conducted in three phases: before, during, and after. Educational activities were designed in integration with museum visits and appropriate to the children's age and developmental areas. Before the museum education, activities were conducted to develop children's artistic expression skills and raise awareness of the concept of museums. In this context, the following were implemented:"Three-Dimensional Ceramics Workshop" in the 3rd week, "Assemblage Workshop: Designing My Shuttle" in the 4th week, and "Collage Workshop: My Dream Museum" in the 5th week. During the museum education, children directly interacted with historical and artistic elements through active learning. In Week 6, the art of sculpture was introduced with the "Completing My Sculpture - Mythological Heroes" activity. In Week 7, the "Archaeology Excavation - Little Archaeologists" activity provided hands-on experience with historical finds. In Week 8, the "Find-Draw Activity - Underwater Amphora Finding" activity supported visual attention and matching skills. The activities following the museum training aimed to reinforce the knowledge learned and help the children reconstruct their experiences. To this end, the following activities were conducted: In Week 9, a second "Three-Dimensional Ceramics Workshop" was conducted. In Week 10, another "Assemblage Workshop: Designing My Shuttle Bus" was conducted. In Week 11, a "Collage Workshop: My Dream Museum" was conducted.

Throughout the process, the students' artistic productions were integrated with their museum experiences, and their developmental progress was recorded through observation and semi-structured interviews. The training process was conducted in an interdisciplinary collaboration with teachers, museum guides, and an archaeologist.

Semi-Structured Interview Questions for Preschool Children Before a Museum Educational Trip Within the Scope of Museum-Based Art Education

Questions were prepared in the direction of Cognitive and Socio-Sensory Development Acquisition (Table 1 and 2).

Table 1.

Semi-Structured Interview Questions and Codes for Preschool Children Before a Museum Educational Trip within the Scope of Museum-Based Art Education.

Questions	Category
Do you know what a museum is?	What is a Museum?
Did you like the museum space design artwork?	Museum Artifacts
Should there be rules in the museum?	Museum Rules
Are you excited about the museum field trip announcement?	Art Education in the Museum
Why do we go to the museum?	Function of the Museum

The findings were considered according to the category order. The category was taken as a title, and a semi-structured interview question and evaluation directed to preschool children before and after the museum educational trip was made.

Table 2.

Semi-Structured Interview Questions and Codes at the end of Museum Education for Preschool Children within the Scope of Museum-Based Art Education

Questions	Category
What did you learn at the museum?	What is a Museum?
Can you tell us which work in the museum impressed you the most?	Museum Artifacts
Why should we follow the rules in the museum?	Museum Rules
Which works in the museum gave you ideas for your artwork?	Art Education in the Museum
What did you do in the museum?	Function of the Museum

Data Analysis

Semi-structured interview questions were administered to the students to elicit their views on the impact of the 11-week museum-based art education program on their developmental levels. During the interviews, students were allowed to express their thoughts freely without interruption or guidance, and their responses were recorded. The questions were integrated naturally into the flow of the art education sessions and posed in a conversational manner so as not to disrupt the children's engagement. The classroom consisted of 14 children in total, divided into an experimental and a control group. The semi-structured interviews were conducted only with the experimental group, and no student was absent during the

research process. The students' responses were interpreted and visualized using mind maps.

As part of the "Museum-Based Art Education" research theme (see Figure 1), specific codes were developed to assess children's knowledge about museums before and after the educational visit. These codes included: definition of the museum, museum exhibits, museum rules, museum functions, and art education within the museum context. The qualitative data were analyzed using MAXQDA 2020, which enabled detailed examination and categorization of the dataset. A systematic codebook was developed to enhance the reliability and objectivity of the analysis. The qualitative responses were first organized in Excel and then imported into MAXQDA 2020 for coding and thematic analysis.

Research/Application Process

In this study, museum-based art education practices conducted with preschool children provided multifaceted contributions to children's cognitive and socio-sensory development. The art activities supported not only children's aesthetic production but also their connection to historical, cultural, and social contexts. Each art activity implemented throughout the process stimulated different developmental areas, increasing learning retention and deepening children's creative thinking, expression, and observation skills.

In the Three-Dimensional Ceramics Workshop, children produced three-dimensional forms of jewelry, busts, and everyday objects using clay. This process developed their perception of texture, shape, and proportion, and fostered their fine motor skills and aesthetic sensitivity. In the Assemblage Workshop, children designed their own service vehicles using recycled materials, strengthening their cognitive and psychomotor skills, such as establishing part-whole relationships, design planning, and functional thinking.

In the Collage Workshop, with the theme "My Dream Museum," students imaginatively reimagined the concept of a museum, familiar only to them from the media before the actual museum experience, and expressed it through symbolic representations. The museum experience, in turn, fostered the children's conceptual understanding of the museum and their creative thinking skills.

In the Completing My Sculpture – Mythological Heroes activity, children produced figurative drawings based on observations of Nike and Hercules figures, and strengthened their narrative and aesthetic shaping skills by establishing emotional connections with these figures. The integration of mythological elements into artistic production supported children's both cognitive and affective development.

In the Archaeology Excavation – Little Archaeologists activity, students participated in the processes of discovery and observation through a hands-on excavation experience, contextualizing their learning by re-discovering the objects they found within the museum.

The drawing and painting workshops supported not only the children's psychomotor and aesthetic skills but also their cognitive development. In these activities, children engaged in productions based on aesthetic decisions such as color selection, pattern creation, and spatial organization, while also utilizing higher-level mental processes such as selection, planning, comparison, and decision-making. It was observed that children, particularly in drawings depicting historical objects or mythological figures, recalled the details they observed and transferred them to their drawings, thus developing cognitive skills such as visual memory, attention, classification, and matching. Furthermore, children's ability to monitor their own production processes from beginning to end reinforced cognitive skills such as sequential thinking, problem-solving, and concentration. This process also allowed children to concretize their thoughts, visualize abstract concepts, and reconstruct learned information. Consequently, drawing and painting activities served not only as a means of aesthetic production but also as an important learning environment that supported children's intellectual development.

Ethical Considerations

This study was approved by the Ankara University Social Sciences Sub-Ethics Committee (Decision No: 85434274-050.04.04/1643641, Date: 15.08.2022, No: 16/225). In addition, official permission was obtained from the Kocaeli Archaeology Museum (Permit Certificate, Verification Code: E-97925780-155.03-4057639, Verification Address: https://www.turkiye.gov.tr/ktb-ebys). Written informed consent was obtained from the parents of all participating children, and the voluntary participation of the preschool teachers was ensured.

Figure 1.

Semi-Structured Interview Questions of the Research on the Effect of Museum-Based Art Education on the Developmental Areas of Preschool Children Answers Code-Category-Theme

THEME: MUSEUM-BASED ART EDUCATION Museum-Based Art Education: After and Before	
Category: What is a Museum? **CODE** Building with historical items, Place where art activities are held, Place with excavation area, Place where archaeologists work	**Category:** What is a Museum? **CODE** I don't know, It looks like a house, There are animals, It's like a market, It has a garden
Category: Museum Artifacts **CODE** Historical items, Statues, Jewelry, Excavation site, Archaeologist	**Category:** Museum Artifacts **CODE** Dinosaur bones, Stones, Chair, Table, I don't know
Category: Museum Rules **CODE** We must speak in a low voice, We can touch the chest museum objects, We must not shout, We can play in the garden, We must not run	**Category:** Museum Rules **CODE** We shouldn't run, we shouldn't touch, we shouldn't line up, we shouldn't play games, we shouldn't talk
Category: Art Education in the Museum **CODE** Painting, Drama, Excavation work, Chest museum works	**Category:** Art Education in the Museum **CODE** We make pictures, I don't know
Category: Function of the Museum **CODE** We learn historical items, we can draw, we can play games, we can do drama, we can have fun.	**Category:** Function of the Museum **CODE** We Travel, I Don't Know

Results

This section presents findings on the potential of art education activities carried out in museums to support children's developmental levels and how the visual, auditory and tactile experiences provided by museum environments affect children's learning processes.

Theme in Figure 1 was applied and presented in the MAXQDA 2020 program to determine the Code and Category.

Theme: Museum-Based Art Education - Category: Description of the Museum Before the Museum Educational Trip: Do You Know What A Museum İs?

Table 3.

Have You Been to the Museum Before the Museum Education Visit? Answers to the Question.

Theme: Description of the Museum Child's Statement	Participant Code
There are old objects and old bones in the museum.	D.A.D.
There are animals and cages.	M.Y., A.E.K.
There is a place like an open garden. There are different old stones on the ground.	E.Y.
Old forks, chairs.	H.A.
It's a big place. There are various old stones and objects on the floor.	A.T.A.
I don't know.	D.B.A., K.S.Ç., Y.E.A., A.K., E.K., M.G.
Old watches, cars, keys.	K.E.
Old toys, cups, plates, forks, chairs.	E.Y., K.E., H.A., M.G., E.K

The number of children who use the expression "I do not know" is six. It was observed that the expression "I do not know" is the most common response in the speech texts of 14 students. This situation shows that children have not had museum experience before and have limited knowledge about the museum. One of the students said (M.Y.), "There are dinosaurs. There are bones and their houses." He used the expression: "There are animals and cages." Similarly, A.E.K. used the expression that there are "Dinosaurs, animals and bones." E.Y. commented "It must be a place like an open garden, there are different old stones on the ground." It is understood from the conversations that children learn from visual communication tools such as cartoons and movies they have watched. The other five students, E.Y., K.E., H.A., M.G., and E.K., used the expression "There are old items in the museum." It was understood that the students commented based on the experiences they saw from communication and media tools such as television and the Internet. This situation shows that the museum experience can be a new experience for children and that children did not have sufficient knowledge about museums before this experience. For this reason, it is important to provide children with the correct information and preparation before museum visits.

Theme: Museum-Based Art Education - Category: Description of the Museum at the end of the Museum Educational Trip, "What Did You Learn at the Museum?"

D.B.A. has used the expression, "There were many

sculptures in the museum; it was very nice to listen to their stories". Emphasis has been placed on the narrative and educational aspects of the museum. This student revealed that sculptures were visual and that they were interested in stories. R.S. indicates that he focuses on details in the museum by saying, "The sculptures were huge and naked"; he notices visual details and carefully examines the works. M.Y. used the expression: "I learned that there are huge sculptures in the museum." It shows that the students notice the remarkable elements in the dimensions and appearance of the works in the museum experience. D.A.D. "I did not know that women used to wear jewellery in the past, but I found out." This expression indicates that the students learned that they were curious about clothing and decorating habits in their past lives. K.E. reported: "We learned about the coins used in the past; I found them through the sand" The interactive learning environment, in which the student gained knowledge about the economic system and currency of the past life and the experience of exploring the museum, increased his curiosity about the museum. Finding coins through the sand has improved his visual perception. It has strengthened the ability to recognise and distinguish different objects. In this context, it increases hand-eye coordination by developing fine motor muscles.

Y.E.A. said: "We have seen how people used to drink water and eat food in the past." This has improved the student's ability to recognise and make sense of historical objects. It enabled the student to gain practical knowledge about everyday life and emphasised the educational role of museums. The student has learned that history consists not only of events but also includes people's daily lives. E.K. stated: "We learned about the uncle, the manager who works at the museum, and the archaeologist's sister." It shows that the student knows the different tasks in the museum and the people who undertake these tasks. In addition, it has been added to the students' vocabulary in terms of concept knowledge. H.A. also expressed "We learned about the archaeologist's sister at the museum and her clothes and belongings." It shows that the student learns how archaeological studies are carried out and the tools required by these studies. M.G. said: "I found out that items were also removed from under the sea." Seeing the items recovered from the submarine improved the student's visual perception and gave him an understanding of how such finds were discovered. This has helped the student learn how historical artefacts are obtained from different sources. E.K. stated "I found out that excavation work is being done in the museum"; E.Y. said "I found out that I can paint in the museum and excavation work can be done there."; and K.S.Ç., similarly, reported "My Teacher,

Table 4.

Did you go to the museum before the museum education visit? The Answers Given to the Question.

Theme: Description of the Museum	
Child's Statement	Participant Code
My teacher, I found out that excavation work was being done for the artifacts in the museum. It was very nice to be an archaeologist.	K.S.Ç.
I found out that there are very large sculptures in the museum.	M.Y.
I learned that I can paint in the museum and that excavation work can be done.	E.Y.
I found out that excavation work was being carried out at the museum.	E.K.
I found out that items were also removed from under the sea.	M.G.
We learned about the uncle, the manager who works at the museum, and the archaeologist sister.	A.E.K.
We found out about the archaeologist sister at the museum and her clothes and belongings.	H.A.
We have seen how people drank water, ate food in the past.	Y.E.A.
We were able to touch the items in the chest. We talked.	A.T.A.
The archaeologist sister allowed us to touch some artifacts. He took it out of the chest.	A.K.
I found out that I didn't know that women used to wear jewelry.	D.A.D.
The statues were very large and naked.	R.S.
There were many statues, it was very nice to listen to their stories. I was wondering about the submarine.	D.B.A.
We found out about the coins used in the past. I found them through the sand.	K.E.

I found out that excavation work is being done for artefacts in the museum. It was very nice to be an archaeologist." Their statements are focused on the excavation work. This hands-on exploration experience allows students to realise the connection between archaeological studies and the museum. At the same time, students have discovered that museums are versatile learning spaces. A.T.A. stated "We could touch the items in the chest. We talked..." This statement indicates that the student is experiencing a more profound learning experience by directly interacting with historical objects. A.K. said "The archaeologist sister allowed us to touch some artefacts. I took them out of the chest." It shows that the student participates more actively in the learning process by physically interacting with the

objects in the museum. Based on these statements, museums help children acquire concrete and visual information about history, enabling them to understand the past better. The opportunity for the students to touch historical objects has allowed them to establish a deep connection with history and make their learning experiences concrete. The fact that the archaeologist allows students to touch the artefacts (replicas) shows that museums offer an educational and interactive environment. The artefacts (replicas) coming out of the chest allowed the experience of analysing by interacting directly with the student.

Theme: Museum-Based Art Education - Category: Museum Works Before the Museum Educational Trip "Did You Like the Museum Space Design Art Study?"

Table 5.

Did You Like the Museum Space Design Art Study Before the Museum Educational Visit? The Answers Given to The Question.

Theme: Museum Works	
Child's Response	Participant Code
There are old objects and old bones in the museum	D.A.D., E.Y., K.E.
Animals, dinosaurs and cages	E.K., R.S.
Old watches, cars, keys	M.Y.
I don't know	K.S.Ç., A.E.K., Y.E.A., A.T.A., A.K., D.B.A.
Old toys, cups, plates, forks, chairs	H.A., M.G.

Six students (K.S.Ç., A.E.K., Y.E.A., A.T.A., A.K., D.B.A.) stated "I don't know" when asked about the contents of a museum. This was the most frequently repeated response, indicating that these children had not experienced a museum visit prior to the educational trip and therefore had limited knowledge. It was observed that while preparing their museum-themed artwork, these students did not include any visuals or items specific to museums, further supporting this conclusion. Some students provided partially informed answers: D.A.D., E.Y., and K.E. mentioned "old objects and bones"; M.Y. noted "old watches, cars, and keys"; H.A. and M.G. focused on "old toys and kitchen items," while E.K. and R.S. made comments about "dinosaurs and cages." These responses suggest that children associated museums with antiquity and fossils, possibly influenced by visual media such as cartoons or TV programs. However, their knowledge remained superficial and generalized. In children's museum design drawings, many depicted parks, roads, vehicles, and human figures based on their imagination rather than real museum elements. This illustrates how children tend to construct their understanding of cultural institutions through imaginary worlds shaped by media exposure rather than firsthand experience. In conclusion, the data reveals that preschool children's knowledge about museum works was limited before the museum-based art education. The findings highlight the importance of guided educational interventions to enrich children's conceptual understanding and foster deeper connections with cultural heritage.

Theme: Museum-Based Art Education - Category: Museum Works at the end of the Museum Educational Trip, "Can You Tell Me Which Work in the Museum Impressed You More?"

Table 6.

At the End of the Museum Education Visit, Which Work in the Museum Impressed You More? The Answers Given to the Question.

Theme: Museum Works	
Child's Response	Participant Code
Ornaments worn by women in the museum	D.A.D., K.S.Ç., D.B.A.
Sculptures in the museum	A.E.K., E.K., A.T.A., R.S., M.Y., E.Y., H.A.
Old toys in the museum	A.K., M.G.
Kitchen utensils in the museum	Y.E.A.

Several students (D.A.D., K.S.Ç., D.B.A.) were most impressed by ornaments worn by women, particularly museum jewelry. These objects, often adorned with colorful stones and fine craftsmanship, drew special interest from female students. Their inclusion in painting and ceramic applications indicates improved visual perception and an appreciation of aesthetic values. A significant group (A.E.K., E.K., A.T.A., R.S., M.Y., E.Y., H.A.) mentioned sculptures as the most impressive. Notably, the Hercules statue was referenced multiple times. Its large size, detailed form, and mythological significance left a lasting impression. Students reproduced symbolic elements like the bull's head and statue poses in their artworks. Their ability to retell mythological stories in the classroom also suggests linguistic and cognitive development. R.S. emphasized head sculptures (busts), focusing on material, texture, and facial expressions, while M.Y. was captivated by the Nike sculpture, inspiring some students to create winged shoe designs in art class. Three students (A.K., M.G.) were impressed by old toys. Their reflections in artworks centered on toy shapes, materials, and colors, illustrating how historical daily life artifacts can stimulate attention and imagination. Y.E.A. highlighted kitchen utensils, such as plates and cutlery. These items helped students visualize historical home life and

contributed to their understanding of domestic history. Their inclusion in drawings enriched conceptual knowledge of material culture. Additionally, E.Y. and K.E. found coins particularly engaging. Though small, the coins' materials (copper, silver, gold) and inscriptions sparked careful observation. This indicates that even compact objects can arouse historical curiosity and promote fine-detail awareness. H.A. pointed out amphoras, noting their variety in size and shape. Their structural and decorative features deepened students' understanding of form and function in ancient pottery.

Theme: Museum-Based Art Education - Category: Museum Rules Before the Museum Educational Trip "Should There Be Rules in the Museum ?"

Table 7.

Should There Be Rules in the Museum Before a Museum Eeducation Visit? Answers to the Question.

Theme: Museum Rules	
Child's Response	Participant Code
We should be quiet	E.K., R.S., D.B.A.
We must join the queue	A.K.
We should not run	D.A.D.
We should not touch	K.S.O., A.E.K.
I don't know	D.A.D., M.Y., E.Y., K.E., H.A.
People queue up	A.T.A.
We shouldn't fight	Y.E.A

Among the students, the most frequently given answer was "I don't know," reported by five children (D.A.D., M.Y., E.Y., K.E., H.A.). This indicates that many students had limited prior knowledge or experience related to museums, suggesting a lack of familiarity with expected behavior in such cultural institutions. Three students (E.K., R.S., D.B.A.) stated "we should be quiet" in museums. However, this belief may stem from a general understanding of silence in formal spaces like libraries rather than museums specifically, indicating a common misconception. Two students (K.S.O., A.E.K.) expressed that museum objects should not be touched. These students noted that they had learned this rule during a previous school trip, suggesting that real-life experiences help reinforce appropriate museum behavior. Other student responses such as "we must join the queue" (A.K.), "we should not run" (D.A.D.), "we shouldn't fight" (Y.E.A.), and "people queue up to enter the museum" (A.T.A.) likely reflect general social behavior norms that students apply to public spaces, possibly learned through other non-museum field trips.

These findings reveal that while some children have a foundational awareness of museum etiquette, much of this knowledge is either inaccurate or generalized from other contexts. The prevalence of "I don't know" responses highlights the necessity of structured pre-visit educational activities to introduce museum rules in a developmentally appropriate and engaging way.

Theme: Museum-Based Art Education - Category: Museum Rulesa at the end of the museum educational trip, "Why Should We Follow the Rules at the Museum?"

Table 8.

Why Should We Follow the Rules at the Museum at the end of a Museum Educational Visit? The Answers to his Question.

Theme: Museum Rule		
Child's Response		Participant Code
Teacher, if we run in the museum, we can hit all the statues, they can be destroyed because they are not in the windows, they break, and those who come after us can't see them.		M.Y.
We shouldn't shout in the museum so that other people shouldn't be disturbed, but we can talk in a low voice, you told me so.		D.A.D, A.K.
If we don't follow the rules in the museum, other people may get uncomfortable, for example, if we talk shouting, other people will look at us and get uncomfortable, or museum staff can warn us, but we can talk to each other in a low voice, we can ask our teacher a question.		A.K.
If we push each other, the windows may break, and then we will hurt ourselves and damage the museum.		A.E.K.
Not inside the museum, but you allowed us to run in the garden, we definitely shouldn't run inside the museum, and we shouldn't have touched the artifacts inside the museum, but the archaeologist sister allowed us to touch the items that came out of the chest.		D.B.A.
We should not leave our teacher's side. And we should not talk by shouting at each other, we should not push each other, we should not run, so as not to disturb others.		E.Y.
Teacher, there are a lot of artifacts there, statues, objects, if we run around there, play games, we break them and it will be bad, they won't be allowed in our museum again, so we have to follow the rules.		K.E.
Teacher, there are a lot of windows there, there are items that used to be used in those windows, there are toys, and there were statues standing in the open, if we don't walk according to the rules, they may break.		H.A.
We shouldn't take the materials from the workshop because they should be able to use them for those		E.K.

who come after us.	
There were statues on things like tables, we shouldn't touch them, they might break.	R.S.
We should not touch; the archaeologist sister gave us a lot of items there, she took them out of the chest so that we could touch them, we touched them, but we should not touch the contents on them.	R.S.
The painting materials were very nice, but we shouldn't buy them, we should use them on other children.	K.S.Ç.
We should listen to what our teacher tells us.	M.G., M.Y.

Following the museum visit, students demonstrated an increased awareness of why rules are necessary in museum settings. They particularly understood the importance of not running indoors and not touching original artifacts due to the risk of damaging valuable cultural objects (M.Y., A.E.K., R.S.). Some students (D.B.A., R.S.) correctly distinguished between authentic works and educational replicas that they were permitted to touch during the workshop, reflecting an improvement in their conceptual understanding and visual perception. Additionally, students realized that talking in a low voice is acceptable in museums, as long as it does not disturb others—correcting their earlier belief that complete silence was required (D.A.D., A.K.). Awareness of shared responsibility was also observed, as students recognized the need to leave art materials and resources for the next group (E.K., K.S.Ç.). In sum, the data show that children not only grasped the content of the museum rules but also internalized the rationale behind them, contributing to the development of responsible behavior in public cultural environments.

Theme: Museum-Based Art Education - Category: Art Education at the Museum Before the Museum Educational Trip "Did the Announcement of the Museum Educational Trip Excite You?"

Table 9.

Did the Museum Educational Trip Before the Museum Educational Visit Excite You? The Answers Given to the Question.

Theme: The Function of the Museum	
Child's Response	Participant Code
Yes, I'm excited.	M.Y., K.E., E.Y., H.A.
Will my mom come?	E.K., R.S.
I don't want to come.	D.B.A., K.S.O., A.E.K.
I've never been…	Y.E.A.
I don't know that.	A.T.A.
I didn't go to the museum.	A.K., D.A.D., M.G.

Prior to the museum educational trip, students were asked whether the announcement of the visit excited them. Their responses revealed differing emotional reactions and levels of familiarity with museum experiences. A group of students (M.Y., K.E., E.Y., H.A.) expressed excitement, indicating a generally positive perception of the planned visit. In contrast, some students (E.K., R.S.) questioned whether their parents would accompany them, which may point to attachment-related concerns or uncertainty about unfamiliar environments. Others expressed reluctance or disinterest (D.B.A., K.S.O., A.E.K.), while a few students (Y.E.A., A.T.A., A.K., D.A.D., M.G.) reported having never been to a museum or not knowing about it, highlighting a general lack of exposure to such cultural spaces. These findings suggest that while some children showed readiness and enthusiasm, others demonstrated limited prior knowledge and emotional hesitation toward the museum experience. This variation underscores the importance of preparatory orientation in reducing anxiety and fostering engagement before educational field trips.

Theme: Museum-Based Art Education - Category: Art Education at the Museum at the End of the Museum Training Trip "Which Works in the Museum Gave You an Idea For Your Art Study?"

Table 10.

At the End of the Museum Education Visit, Which Works in the Museum Gave You Ideas for Your Art Work? Answers to the Question.

Theme: Art Education in the Museum	
Child's Response	Participant Code
Nike statue – I made a winged girl.	M.Y.
Hercules statue – I made it very big.	A.E.K., E.K.
Kitchen utensils	Y.E.A.
Amphora	H.A.
Toys	A.K., M.G.
Ornaments worn by women in the museum	D.B.A., K.S.Ç., D.A.D.
Coins	E.Y., K.E.
Bust sculptures / head sculptures in the museum	R.S.

An analysis of the works that shaped students' artistic production during their museum education revealed that they focused on different themes. The statue of Hercules (A.E.K., E.K.), a mythological figure, was one of the primary works that captured students' attention. The detailed structure and impressive stance of this figure developed students' observational skills and directly influenced their drawings and sculptures. Similarly, the statue of Nike (M.Y.), a winged figure, inspired students in the development of aesthetic compositions thanks to its

dynamic form and symbolic meaning. Another striking example of everyday objects is kitchen utensils (Y.E.A.). These objects fostered students' awareness of historical life practices and enriched their visual memories by establishing connections between the past and the present through form and function. Furthermore, students' sensory interest in toys (A.K., M.G.) revealed how elements such as material, form, and color can be transformed into artistic expressions. Observations on jewelry and feminine ornaments (D.B.A., K.S.Ç., D.A.D.) increased students' aesthetic sensitivity as well as their awareness of texture and shape details, which contributed to the development of fine motor skills. Ancient vessels and amphorae (H.A.) captured students' attention with their formal differences, and it was observed that the concept of "amphora" became more permanent in their mental maps through artistic production. Historical coins (E.Y., K.E.) allowed for the evaluation of both surface details and perceptions of cultural change; students constructed meanings by comparing past aesthetic understandings with present-day objects. Finally, bust sculptures (R.S.) stood out as a space where students incorporated their observations of facial expression, form, and anatomy into their artistic production processes, developing skills such as observation, interpretation, and reproduction. These findings suggest that the museum environment is not only a space for imparting knowledge but also a learning environment that holistically develops students' aesthetic perception, creativity, cultural awareness, and expressive skills.

Theme: Museum-Based Art Education - Category: Function of the Museum "Why Do We Go to the Museum" Before a Museum Educational Trip

Table 11.

(Before Visiting a Museum) Why Do We Go to a Museum? Answers to the Question.

Theme: Art Education in the Museum Child's Response	Participant Code
To learn	K.S.O. M.G.
To look	
To explore	A.N.E.K., Y.E.A., A.T.A., A.K., D.B.A., R.S.
Because our teacher took us	M.Y.
School takes us	E.K.

An examination of the students' responses to the question "Why do we go to museums?" posed before the museum visit revealed that a large portion of the students had limited knowledge of the concept of a museum and the purpose of the visit. Some students stated their reason for going to the museum as "to learn" (K.S.O., M.G.), and these responses demonstrate that individuals perceive the museum as an educational space. However, some students (M.Y., E.K.) attributed their reasons for going to the museum to external factors such as "the teacher took them" or "the school takes them," suggesting that these visits were perceived as guided activities rather than self-motivated. Similarly, the "I don't know" responses of E.Y., K.E., and H.A. indicate that the students lacked sufficient cognitive awareness of the concept of a museum and that the purpose of their museum visits was not clearly communicated to them. While D.A.D.'s response of "to look" suggests that they perceive the museum solely as a place for observation, the response of A.N.E.K., Y.E.A., A.T.A., A.K., D.B.A., and R.S., "to wander," suggests that they view museum visits more within the framework of entertainment and social activities. These findings suggest that museum visits are limited to visual observation, that students' engagement with the museum is low, and that they often define the museum as "a place to wander" due to the lack of participatory/practical educational activities. Therefore, prior to museum education, it is essential to provide students with guiding and preparatory information about the museum's function, purpose, and contribution to learning.

Theme: Museum-Based Art Education - Category: Function of the Museum at the End of the Museum Educational Trip, "What Did You Do at the Museum?"

Table 12.

What Did You Do at the Museum at the End of the Museum Education Visit? Answers to the Question.

Theme: Function of the Museum Child's Statement	Participant Code
Digging in the museum garden, being an archaeologist, was so much fun.	M.G., D.B.A.
I was so curious about what the excavation would bring. My teacher and I unearthed a coin.	M.Y., A.K.
I saw the same artifact I unearthed in the museum.	E.Y., K.S.Ç.
The archaeologist gave us some old artifacts and had us talk into a microphone.	A.T.A., D.A.D.
We dressed up in archaeologist costumes; it was like a theater.	A.E.K.
The chest the archaeologist brought contained many artifacts.	D.A.D.
We had fun in the workshop and painted.	H.A., E.K.
I saw how big the statue of Hercules was.	M.Y., R.S.

The work of underwater archaeologists was very interesting.	K.E., Y.E.A.

It is anticipated that such preparation prior to the educational process will contribute to students gaining greater academic and artistic benefits from their museum experiences. At the end of the museum visit, students' responses to the question, "What did you do at the museum?" reveal the degree to which students engaged with the activities and the multifaceted nature of the learning experience. Students like M.G. and D.B.A., in particular, described their experiences of "being an archaeologist" and excavating as "very fun," demonstrating the positive impact of structured, hands-on activities on students. A.K.'s statement, "I was very curious to see what would come out," stimulated curiosity, while E.Y. and K.S.Ç.'s statement, "re-visiting the object they found during the excavation in the museum," demonstrated a contextualization of learning. This demonstrates that students, through active participation, were able to attribute meaning to historical objects and enhance visual retention. The interest of students like A.T.A. and D.A.D. in the archaeologist figure was reinforced through interactive activities such as speaking into a microphone; A.E.K.'s comment, "It was like theater," highlighted the educational impact of dramatic play. These experiences are believed to support children's affective domain gains such as self-confidence, expressive skills, and social participation. The workshops (H.A., E.K.) also provided another learning environment where children enjoyed creating and developed their artistic expression skills. M.Y. and R.S.'s comments on the Hercules statue, a mythological figure, indicate that the students developed their visual perception, spatial positioning, and aesthetic awareness skills. The statue's size, details, and the teacher's theatrical narrative captured the children's attention while also contributing to their mental construction of the mythological content. Furthermore, K.E. and Y.E.A.'s interest in underwater archaeology demonstrated that the students were open to exploring different scientific disciplines and that the museum environment provided a suitable context for such explorations. The structured museum education process engaged children not only as observers but also as active participants. This process stimulated their curiosity, simultaneously enhancing their exploration, meaning-making, production, and interpretation skills, contributing to their cognitive, affective, and psychomotor development in multiple ways.

Discussion

Is there a difference in the cognitive development levels of preschool children who have used a museum-based art education application before and after museum education?

This study revealed a significant difference in the cognitive development of preschool children before and after museum-based art education practices. In interviews conducted before the museum visit, it was observed that the children's knowledge of the museum was quite limited, and they generally described it as a vague, abstract space. The children's description of the museum as "a place with old objects and bones" and their frequent response of "I don't know" clearly demonstrates these conceptual deficiencies. Furthermore, their knowledge of museum rules was superficial and often inaccurate.

In interviews conducted after the museum visit, it was observed that the children were knowledgeable about the archaeological excavation processes carried out in the museum, could define the duties and responsibilities of archaeologists, and could establish concrete and meaningful connections with the historical objects on display. It was determined that they began to perceive the aesthetic and cultural values of historical objects, particularly through striking elements such as the statue of Hercules. Furthermore, it was observed that they interpreted museum rules more consciously, reasoning about their necessity and explaining them. All these gains demonstrate that children's conceptual learning processes deepened and that higher-order cognitive skills such as analytical thinking, reasoning, and problem-solving developed.

These findings are consistent with those of Karaca, Şenol, Akyol, and Can Yaşar (2018), who indicated that museum visits contribute to children's learning in multiple ways. Aktın's (2017) findings also reveal that museum visits effectively develop preschool children's historical thinking skills. Hein (1998) argues that museums, with their constructivist approach to learning, enable children to construct meaning through individual experience. Falk and Dierking (2000) emphasize the contextual and social nature of learning, stating that museum environments offer multiple avenues for interaction. Hooper-Greenhill (2007) emphasizes that meaning construction and critical thinking, rather than the transmission of information, are encouraged in museums, while Bitgood (2011) focuses on the museum visitor's attention, interest, and the interactive nature of the learning context. DeWitt and Storksdieck (2008) demonstrate that the processes children experience in informal learning environments foster curiosity, discovery, and knowledge transfer.

Conclusion

Consequently, it can be argued that museum-based art

education contributes to the cognitive development of preschool children in multiple ways. Children are able to connect abstract concepts to concrete experiences, develop an awareness of aesthetic and historical values, and make their learning processes meaningful and lasting. Moreover, art-based activities offered within the enriched learning context of the museum environment play a significant role in helping children acquire higher-level cognitive skills.

Is there a difference in the socio-sensory development levels of preschool children who have participated in museum-based art education before and after museum education?

Based on the analysis of interviews conducted before and after the museum education trip conducted as part of this research, it was determined that preschool children made significant progress in their socio-sensory development. Socio-sensory development is a multifaceted process encompassing skills such as children's ability to recognize and express their emotions, communicate effectively with others, adapt to social rules, and develop empathy and cooperation. The research findings revealed that, prior to museum education, children experienced uncertainty, anxiety, and a lack of social interaction regarding the museum environment; they lacked a sufficient understanding of the rules and were uncertain about how to behave in a new environment. Generalized statements such as "I don't know" and "We shouldn't touch things" indicate a limited level of recognition and application of social norms.

Interviews conducted after the museum education trip revealed that children had a better understanding of social norms, developed a sense of social responsibility, and began to express their emotions more openly and positively. Statements like, "We shouldn't shout, others will be disturbed," "If we don't follow the rules, we'll lose our teacher," and "Excavating was so much fun" indicate that children experience significant improvements in their empathy, trust, cooperation, positive emotional expression, and group functioning skills. Furthermore, during the museum experience, children were observed to experience emotions such as excitement, curiosity, and awe more consciously and to be able to express these emotions in their own words.

The research results are consistent with Dağal and Bayındır's (2016) findings that museum visits increase children's positive emotions. Usbaş (2010) and Su (2022) state that planned and effectively structured museum visits make a significant difference in students' both cognitive and socio-emotional development, and that these experiences are reflected in their daily lives.

Anderson and Piscitelli (2000), Paris (2002), and Vygotsky (1978) emphasize that museums are not only places for children to acquire knowledge but also dynamic learning environments where emotional and social skills develop through social interaction and shared experiences. Silverman (2010) states that museums strengthen a sense of belonging and social bonds, helping children connect with the community. Rennie and Johnston (2004) demonstrated that children's in-group interactions in museums positively impact the development of self-confidence and their perception of social responsibility.

In conclusion, it can be said that museum-based art education practices support the socio-sensory development of preschool children in a multifaceted way, increasing their emotional awareness, strengthening their ability to adapt to social norms, and developing their tendency to form social bonds. Museum environments should be used more effectively in educational settings as multifaceted learning spaces where children are enriched not only by aesthetic and historical knowledge but also by emotional experiences.

Recommendations

Based on the results of this study, research conducted with an interdisciplinary approach can guide future studies and researchers. In addition, the experimental phase of this research has shown that activities and educational plans based on museum artefacts enhance the development of visual perception in preschool students. In this context, based on the findings of the study and its interdisciplinary nature, suggestions that may shed light on future studies and researchers can be listed as follows: Given that the development of visual perception through activities based on museum works is compelling, art educators should be encouraged to include such activities in their educational programs. Workshops, seminars, online manuals, digital platforms and training programs should be organised for professional development programs for art education teachers. Educators should design activities appropriate for preschool students' development areas by collaborating with museum employees. This collaboration will provide students with more hands-on experience in museums. Art education teachers and preschool teachers should participate in professional development programs about museum-based activities and increase their awareness of museum-based art education.

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The Compatibility between the Reading Questions and Reading Objectives at High School Level in Türkiye

Eslem GÜLÜMSEYEN[1]

Gülay KIRAY[2]

[1] National Defense University, School of Foreign Languages, İstanbul, Türkiye

[2]İstanbul University-Cerrahpaşa, Hasan Ali Yücel Faculty of Education, English Language Teaching Department, İstanbul, Türkiye

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Corresponding author: Gülay Kıray
E-mail: gkiray@iuc.edu.tr

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ABSTRACT

As communicative language use is of growing importance, countries worldwide focus on English language teaching through communicative and authentic approach. As a part of communication in language education and assessment, the reading skill plays a crucial role in the curriculum as well as the teaching and assessment practices in Türkiye. In 2023, the Ministry of Education introduced a shift in the assessment practices by publishing sample questions for testing reading skills, aligning them with the objectives derived from the existing curriculum. As this initiative is relatively recent, no studies in the literature have directly examined the alignment between these sample questions and the objectives. The present research aims to explore the cognitive levels of learning objectives embedded in the questions, examine how these levels progress from grades 9 to12 and analyze the alignment between the objectives and sample questions provided by the Ministry of Education, employing Bloom's revised taxonomy as the analytical framework. The results show that there are different distributions of levels through the grades, and the number of compatible questions outnumber the number of incompatible ones a lot; however, some questions still fail to adequately assess higher-order cognitive skills.

Keywords: language teaching, reading skill, reading objectives, assessment of reading, Bloom's revised taxonomy.

Introduction

In today's globalized world, English has become the dominant language of international communication, enabling individuals from diverse regions to interact effectively. Learning English, therefore, has been a priority for many nations and individuals across the globe for various social, economic, and educational reasons. In Türkiye, the teaching of English at the high school level is largely shaped by the national English curriculum, which is designed by the Ministry of National Education.

A Brief Background of English Curriculums in Türkiye

Türkiye is among the countries that acknowledge the critical role of English in education and continue to adopt their English language teaching (ELT) practices accordingly. In an attempt to change Türkiye's ELT practice, the Turkish Ministry of National Education and the Turkish Higher Education Council decided to make significant modifications to the country's English language policy in 1997. In this regard, a plan known as "The Ministry of Education Development Project"—a significant curriculum innovation project in ELT—was started to encourage teaching of English in Turkish educational institutions (Kırkgöz, 2007).

According to Sönmez and Köksal (2022), three major curriculum reforms were implemented in Türkiye between the late 20th and early 21st centuries to improve English teaching. The first ELT curriculum reform occurred in 1997; further reforms to the program were implemented in 2005 as part of the government's initiative to align instruction with EU standards. The primary ELT curriculum was updated in 2005 by a team of national curriculum experts, incorporating other Western-derived educational methodologies and global trends. These changes significantly transformed classroom pedagogy by integrating a constructivist approach and strengthening the communicative dimension of language acquisition It was an effort to align Türkiye's ELT curriculum with the EU's language education criteria.

Kırkgöz (2007) emphasizes that along with the new curriculum in 2005, the length of education in all secondary schools was also increased from three to four years, and English language instruction was broadened throughout

the curriculum, in order to guarantee consistency in ELT across all kinds of schools.

Koç et al. (2007) state that a shared set of principles consisting of four components—social, individual, economic, and historical and cultural elements—guides the design of the curriculum for each course. Additionally, it is suggested that the Ministry of National Education values the individuality of each pupil in addition to their cultural and social origins. The goal of the curriculum reform is to enhance both the social and personality development of the children.

Another major shift in terms of the English curriculum in Türkiye occurred in 2013. Aksoy (2020) reported in his study that The Ministry of National Education created and implemented a new foreign language curriculum for the 2013–2014 school year. Formerly, most students viewed English as an academic pre-requisite and couldn't use it as a tool of communication. Therefore, the curriculum's focus was on creating a connection between the materials and students' everyday experiences.

Yaman (2018) stated that the introduction of the revised curriculum in 2013 resulted in the commencement of English instruction from the second grade onwards. Within the principles of the Common European Framework of Reference for Languages, a communicative and action-oriented approach was preferred. In 2018, a new framework was developed in the line with the philosophy and principle of the previous one, maintaining the primary goal of English language education as using the language for communication. This revision, however, a values education component was incorporated into the curriculum, and was informed by the input of diverse stakeholders, including English teachers, universities, and civil society organizations.

Gel and Kuyumcu Vardar (2021) mentioned in their research that the curricula implemented between 2014 and 2017 primarily emphasized communicative themes. Four language abilities, fundamental functions to be learned, grammar, and all required materials are included in each unit of the curriculum. Furthermore, it is mentioned that the CEFR descriptors are used as a guide.

Testing and Assessment of Language and Reading Skill

A test is a tool used for evaluating an individual's performance, knowledge, or ability within a specific domain. As a systematic method of assessment, it must accurately measure the targeted construct, whether related to ability, knowledge or performance. In the case of a proficiency test, that domain assessed is the individual's general competence across all language skills. In contrast, assessment is a continuous process that encompasses a much broader scope of factors. During the teaching process, the teacher continuously evaluates each student's performance whenever a student answers a question, makes a comment, or attempts to use a new word or structure. As a broader concept, assessment encompasses various forms of evaluation, of which tests constitute only one component (Brown, 2003).

Bachman and Palmer (2010) claim that what is being assessed depends on the program's content, the objectives given in a syllabus, the content given in the coursebooks, materials and the activities used for teaching and learning. All of these elements provide us with what is going to be used for the language assessment in the course. In addition to this idea, how the content taught will be assessed should also be associated with how we're teaching it. The way in which something is taught provides a foundation for designing the assessment component.

In their book "Language assessment: Principles and Classroom Practices", Brown and Abeywickrama (2018) list practicality, reliability, validity, authenticity and washback as principles of language assessment. The logistical, practical, and administrative challenges associated with creating, administering, and grading an assessment tool are referred to as practicality. Authenticity is the extent to which a given language test task's characteristics match those of a target language task. Washback refers to the testing's effect on the educational process. Reliability refers to the consistency and dependability of a test, indicating the extent to which it yields similar results when administered to the same student or to comparable students on two different occasions. Reliability concerns might come from the test itself, the rater, the student, or the test's administration. Validity is perhaps the most crucial factor and the most complicated requirement for an effective test. It refers to the extent to which a test measures what it is intended to measure. For example, in the case of reading skills, a valid reading test should assess actual reading ability rather than unrelated factors such as perfect eyesight or prior knowledge of the material. There are different types of validity we can use to explore the validity of a test in detail. These types of validity examines validity from different perspectives such as content validity, criterion-related validity, construct validity, consequential validity and face validity.

The principles do not inherently account for each other. According to Razı (2012), a reading test may demonstrate reliability; yet, if it predominantly assesses grammatical knowledge via fill-in-the blanks items, it fails to achieve validity in measuring reading comprehension.

Gilakjani and Sabouri (2016) emphasized that reading is one of the most essential skills students should acquire. Students engage in reading for various purposes, including both entertainment and the pursuit of information. It supports EFL students to become more linguistically proficient and acquainted with the topics in their educational programs.

Green (2021) points out the fundamental challenge in assessing comprehension: it can't be observed directly. Simply watching someone read a report or listen to a news broadcast provides no conclusive evidence about their level of understanding. To determine the extent to which a language learner has understood, assessment designers must elicit evidence of receptive language processing by requiring the learner to perform an additional task beyond merely reading or listening. The additional task mentioned could be acting, sketching, speaking, or writing. Green (2021) also claims that we frequently combine various forms of reading to accomplish our aims. The types of reading such as fast reading, scanning, search reading and skimming, differ in certain aspects, which in turn influence how they are assessed. When scanning, the reader looks for particular words or phrases. In search reading, the reader has something more in mind than simply one or two key words or phrases since they are searching for concepts related to a particular subject. In search reading, information finding is typically a preparatory phase, but in scanning, discovering the important information typically signals the end of the reading process. There is a local focus when it comes to scanning and search reading which is on specific textual elements, such as words, phrases, or sentences. In contrast, the reader's goal is to grasp the gist—a concise yet comprehensive summary of a long book in skimming. In order to provide a broad overview, this may entail selecting a few crucial components (such as chapter titles, introduction and conclusion paragraphs, images, first phrases of paragraphs.). By skimming, the reader can read more quickly. It is recommended assessors to be precise regarding the goal of measurement in a particular setting and choose or design tests that meet the goal. In terms of the standpoints of cognition and development, it is crucial to take into traits of test-takers, as the causes of individual variances evolve with time. For example, inferencing is typically more significant for older and more proficient readers, whereas decoding is essential for younger and less experienced readers.

To classify reading objectives in terms of cognitive processes required to achieve them, Bloom's Revised Taxonomy can serve as an appropriate framework. Originally created for general educational reasons, Bloom's taxonomy is a classification system for learning objectives (Larsen et al., 2022). In the original taxonomy, there were six categories: Knowledge, Comprehension, Application, Analysis, Synthesis, and Evaluation. The categories were arranged from concrete to abstract and from simple to complex. In the revised taxonomy, the Knowledge category is called Remember, the Comprehension category is named Understand, the Synthesis category is renamed as Create and moved to the top category, and the remaining categories are Apply, Analyze, and Evaluate (Krathwohl, 2002).

In a research about reading comprehension carried out by Dagostino et al. (2014) in Malaysia, Bloom's Revised Taxonomy was used as a classification system, and thus, the researchers were able to determine more precisely which particular cognitive abilities were being evaluated for each test item. They found the use of revised taxonomy significant because, unlike most current reading comprehension tests, it provided a structured set of objectives for categorizing the learning, teaching, and assessment within the cognitive domain- an element that is fundamental to instruction across most subject areas.

A variety of research related to coursebooks were conducted in the literature. Focusing on reading comprehension, Ulum (2021) analyzed an EFL coursebook and presented how reading questions ranked in terms of cognitive levels in Bloom's revised taxonomy. Kasimi (2022) used descriptive content analysis with Bloom's revised taxonomy to analyze reading comprehension questions in a coursebook and recommended that future research can focus on to what extent higher cognitive skills are included into the curriculum regarding reading questions.

In a Chinese context, Wu and Pei (2018) analyzed reading comprehension questions in three coursebooks used for the intensive reading course of English majors using a coding scheme based on Bloom's taxonomy and suggested that coursebooks should promote critical thinking and be compatible with the curriculum.

Another analysis of a coursebook has been done by Dallasheh (2024) in the Middle Eastern context and the results were similar to the previously mentioned studies as the results show that for the analyzed wh- questions, they are more linked with lower order skills than higher order ones.

Rebla and Büyükahıska (2023), on the other hand, conducted a research using Bloom's revised taxonomy to evaluate reading questions in a 7th grade English coursebook published by Turkish Ministry of National Education. Results of the research showed that lower-level cognitive skills were more dominant than the higher ones. They concluded that the coursebook failed to achieve

critical thinking because questions that assessed higher level skills were limited and not enough for the development of critical thinking.

Another study which was aimed to determine the extent to which reading parts of EFL textbooks written for Turkish high school students incorporated the revised version of Bloom's taxonomy was carried out by Köksal et al. (2023). The research's findings indicated that the assessed materials lacked the higher order cognitive skills listed in the revised version of Bloom's taxonomy.

Assessment of EFL in Türkiye

Assessment and learning are strongly interrelated in terms of theory and practice. According to Tuzcu Eken (2021), the assessment process is viewed as a crucial component of education in Türkiye because an inconsistent evaluation could undermine all of the goals that have been set and accomplished. Since the CEFR serves as the foundation for the new language education curriculum, process-oriented and alternative assessment methods are generally advised. One idea for foreign language evaluation in Türkiye is that similar to international examinations like the TOEFL and IELTS, which demand that students concentrate on learning English, students may be held responsible for every English skill in the national exams.

Large-scale exams play a crucial role in the Turkish education system. However, when we review the English curriculum and its focus on the teaching of the four skills, we can see that the large-scale exams do not match this focus. There are many alternative assessment methods such as portfolios, blogs, vlogs, podcasts, roleplays, case-studies for the testing of speaking, listening, reading and writing but large-scale exams as well as in-school exams may still be carried out using test-based exams. According to Altan (2017), test-based language assessment is doomed to failure, dissatisfaction, and ultimately, fruitlessness. There are numerous tools available in language classrooms for evaluating pupils, including both formal and informal evaluations. Language teachers should be capable of coming up with efficient methods for figuring out what and how much their pupils are learning. It should be possible for teachers to evaluate what sorts of assessments best serve their educational goals and language should be assessed the way it is taught.

Kırkgöz (2007) emphasizes the importance of developing students' communicative competence in English, identifying it as a key factor driving significant changes in testing and evaluation practices. Conventional "pen and paper" exams, which were widely used in Turkish state elementary schools, are no longer regarded as suitable instruments for assessment. Rather, the use of portfolios for performance-based assessment is suggested, as it is thought to be more in line with the principles of communicative language instruction.

Further findings in a research carried out by Gürel and Demirhan İşcan (2020) show that due to the lower student-teacher ratio in private schools, teachers were able to employ both individualized assessment methods and the curriculum's assessment tools, such as e-portfolios. Teachers working in public schools, however, claimed they only utilized paper and pencil exams with the rare practical assessment instead of apps like video blogs and e-portfolios.

Whereas their primary focus is not on the assessment of language skills, numerous studies in the literature examine reading skills and Bloom's revised taxonomy. Widiana et al. (2023) conducted an experimental research to focus on the links between Bloom's revised taxonomy-oriented learning activities with reading interest and creative thinking skills and found that such activities increased both the interest and critical thinking skills. Another study by Neldis et al. (2024) looked at how English teachers created questions based on Bloom's revised taxonomy and underlined that using higher order cognitive skills from the taxonomy could mean that students will be motivated to study English. Following the theme of assessment, Baghei et al. (2020) stated that content analysis of questions related to their cognitive complexity has attracted increasing attention.

Additionally, the literature includes some studies directly addressing the topic of reading assessment. For example, in an Indonesian context, Laila and Fitriyah (2022) analyzed reading questions in a textbook using Bloom's revised taxonomy. In the Turkish context, Çimen (2022) explored the assessment of EFL reading, while other research has examined assessment and reading comprehension in Philippines and New Zealand contexts, respectively (Abejuela et al., 2023; Fjørtoft, 2024). However, there is still a lack of research related to the analysis of reading assessment questions published by the Turkish Ministry of Education. Starting from 2023-2024 academic year, the high school assessment practices moved towards a curriculum related approach. As teachers are recently obligated to construct exam items in accordance with the objectives specified in the curriculum, each item is linked with objectives articulated through verbs that assess distinct cognitive skill. Therefore, the present study analyzing the reading example questions provided by the Ministry of Education in Türkiye using Bloom's Revised Taxonomy as the framework is expected to contribute to the literature by giving further insight to the current

reading assessment practices in the Turkish context. Moreover, the current study, by interpreting the compatibility of testing questions with the curriculum's behavioral objectives and introducing the distribution of cognitive challenge of activities through grades, aims to serve for cognitive processes students go through during their high- school life.

Purpose of the Study

The purpose of the study is to explore the compatibility between the learning objectives and reading questions provided by the Ministry of National Education through the use of Bloom's Revised Taxonomy as a framework to conduct a thematic analysis. The following will be analyzed in order to achieve this purpose:

- To which level of the taxonomy does each learning objective correspond?
- How do the objectives and cognitive levels progress through different levels (9th-12th grade)?
- How compatible are the objectives and questions?

Method

Research Model

Qualitative research is highly valuable in the field of ELT and Applied Linguistics as it provides in-depth insights into the teaching and learning of language (Pandey, 2025). The present research is based on a qualitative model as it includes document analysis, which is a method based on gathering empirical data in a manner that is unobstructive and nonreactive as well as low-cost (Bowen, 2009). Descriptive content analysis was used for the analysis of the collected data. Content analysis collects texts, and analyses, breaks down and examines them into a summary form using both emerging themes and pre-existing categories (Cohen et al., 2007). Before the analysis of the data, levels of cognitive skills from Bloom's taxonomy were chosen as categories for the classification of objectives. In terms of compatibility between questions and objectives, there were the categories of Compatible, Partially Compatible and Not Compatible before the analysis of the data. After the analysis, the code of Doesn't Assess Reading emerged as a new category. In content analysis, the importance of specific concepts or meanings in a document is determined by how frequently a given item is used and how many contexts it appears in (Jupp, 2006). The present study analyzes and interprets the data based on frequency of each cognitive level in objectives, questions categorized according to their compatibility with objectives, and their distributions for different grades of high school level.

Data Sources of the Research

The data sources for this research comprised the first and second English exam scenarios and example questions of the first semester for all high school grade levels, as published by the Ministry of National Education of Türkiye.

Data Collection Tool

The documents analyzed in the research were found online and they were open access. They were taken from Ministry of Education's website. All of the documents analyzed included the example reading questions along with the learning objectives, which the questions are meant to assess.

All of the data was analyzed and discussed by both of the researchers in order to reach an accurate conclusion.

The ethical process in the study was as follows:

- Ethics committee waiver was obtained from Istanbul University-Cerrahpaşa Social and Human Sciences Research Ethics Committee (Date: 05.06.2024, Number: E-74555795-050.04-1007142)
- No participant is included in the research.

Data Analysis

The analysis of the data for this qualitative research follows steps from Creswell (2009).

Step one includes the preparation of data for analysis. For this step, all the documents to be analyzed were downloaded and saved in a file. Then only the reading example questions from 9th to 12th grade were extracted from the documents and they were transferred to different documents. After organizing the questions, the objectives stated above were extracted and compiled into a separate file to identify the levels at which each objective was addressed.

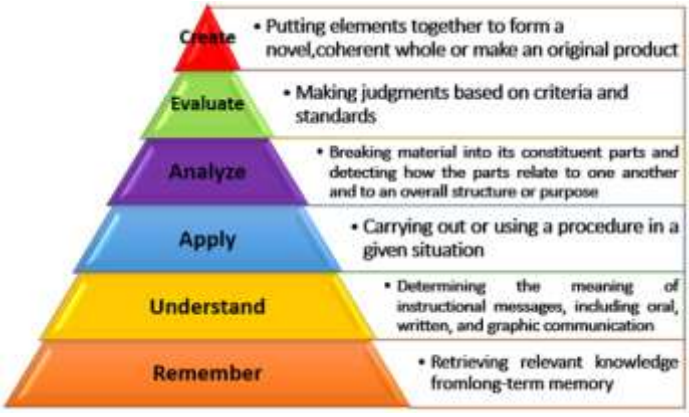
For the second step all the data must be read to get a general idea of the content. Thus, all the data were read to get an overall understanding of how objectives and reading questions were given in the examples.

Third step marks the beginning of the coding process. In this process, the behavioral objectives were read and action verbs in the objectives were highlighted and put in a table to see how the action verbs progressed through different levels, how many times and at which level each verb occurred. Then, cognitive processes and their descriptions were obtained from an article by Krathwohl (2002) which further explores the revised version of Bloom's taxonomy (See Figure 1). The cognitive processes and their descriptions were used as a framework to categorize the objectives into their categories of cognitive

functions. Although the levels included example verbs for cognitive processing, like recognizing and recalling under "remember" or inferring and comparing under "*understand*", they were not taken into consideration as each example verb may not directly fall under the same category for reading comprehension. For example, in the taxonomy, the verb "*summarizing*" is given under the level of "*understand*". But if students are analyzing a short story to summarize it, this means that students will go through higher levels of processing than just determining the meaning of written messages as they will compare parts of a story and make decisions on what and what not to include in their summary. Therefore, only cognitive processes and their descriptions of what each process means were used. A similar coding process was applied for the sample questions of reading. They were coded by looking at the objective that was given for the question, its level at the taxonomy and then analyzing the question to see if it is at the level of the given objective to determine the level of compatibility.

Figure 1.

Cognitive Process Levels and Their Descriptions



For step four, the researcher needs to determine the themes that emerge from the analysis of the data. The coding process was used to determine the compatibility between the objectives' levels at the taxonomy and the example reading questions given. There were four themes emerging from the analysis of the documents: "Reading Questions That Are Compatible with the Objectives", "Reading Questions That Are Partially Compatible with the Objectives", "Reading Questions That Aren't Compatible with the Objectives" and "Questions that Don't Assess Reading". Different files were created for each theme, and the example questions were separated accordingly.

For step five, the process of describing the themes in the narrative is supposed to be carried out. It was determined that each theme emerging from the research findings would be explained for each grade level, accompanied by descriptions of example questions and an analysis of their alignment with the objectives in terms of their compatibility. Tables were also used in order to summarize and give an overall picture of the data.

For step six, interpretation of the data is conducted. The data was interpreted in terms of how these findings can help us understand the different cognitive processing levels represented in the documents and how they were distributed across grades 9 to 12 and the extent to which the reading questions assessed what the objectives were intended to measure.

Results

In the documents, 9th grade has twelve, 10th grade has ten, 11th grade has nine and 12th grade has thirteen example reading questions. In total, 44 questions were analyzed. The layout given in the documents is consistent across all grades, with each objective followed by an example question designed to assess it. However, in some cases, the same objectives are associated with different questions. For example, in the 9th Grade, the objective "E9.1.R1. Students will be able to recognize familiar names, words and very basic phrases in simple texts such as postcards, greeting cards and emails." is given for three different questions. This is the reason why there aren't 44 unique objectives. The number of unique objectives at each level are seven for 9th grade, six for 10th grade, seven for 11th grade and eight for 12th grade making it a total of 28 unique objectives.

Learning Objectives and their Cognitive Level

The main verbs given in the objectives include: recognize, find, read, scan, identify, diagrammatize, skim, answer, paraphrase, order, analyze, infer, read (aloud), match and reorder. Based on the verbs alone, recognize, find, read, identify and match are categorized at the level of "*remember*" and scan, skim, paraphrase, and infer are at the level of "*understand*". For "*apply*", we can list the verbs: order, reorder and diagrammatize. Moving onto the three high levels of cognitive processing, the verb "*analyze*" belongs to the category of "*analyze*" and there are no verbs that can be categorized at the levels of "*evaluate*" and "*create*" at the first phase of coding process. However, after analyzing the objectives in detail, it was seen that in some of the objectives, although the main verb indicates one level in the taxonomy, the following words in the objective change their level in the taxonomy.

At the 9th grade level, the verb "*find*" was used in two different objectives. While one of the objectives focused on finding specific information, the other one focused on

finding the main idea. This meant that finding specific information stayed at the original cognitive category of the verb "*find*", which was "*remember*", while finding the main idea was moved to the "*understand*" level. In terms of the verb "*scan*", it is normally placed at the "*understand*" level. However, in the task, students are expected to go through additional cognitive processes of evaluation and decision making where they would evaluate given film reviews. Therefore, the objective itself actually was accepted as the "*evaluate*" level. For the 10th Grade level objectives, the verb "*scan*" was followed by the task of filling in the timelines. To accomplish this, students are required to transfer the information provided into a different form, thereby placing the objective at the "*apply*" level. Another change at this level is the verb "*identify*" given in two different forms: identify specific information and identify the differences. For the former one, students are at the "*remember*" level, searching for specific words to answer the questions while for the latter, there is a need for analyzing which elements are related and which are not, in order to identify the differences, thereby elevating the task to the *"analyze"* level. Lastly, for skimming to draw a conclusion, students need to read to get the gist but drawing a conclusion means that they are also required to make judgements and check what the text actually leads up which takes an objective with the main verb "*skim*" to the "*evaluate*" level. For the 11th Grade, the verb "*find*" means that students are expected to find information but as the objective requires them to find the main idea, they need to understand the whole text which takes it one level higher to "*understand*". The verb "*identify*" is similar at the "*remember*" level, but identifying thesis statements and topic sentences means that students need to read the text, see how parts relate to each other to figure out these elements which makes it belong to the *"analyze"* category in the cognitive process. Another verb included in the objectives is "*analyze*" which would typically correspond to the *"analyze"* level. However, as the objective requires students to analyze a short story in order to summarize it, the task moves one level higher; summarizing entails deciding which parts of a story to include, thereby placing it at the "*evaluate*" level. Lastly at the 12th grade, the verb "*find*" which was initially at the "*remember*" level is changed completely because while one objective requires students to find the supporting ideas which means that it is on the "*understand*" level and finding irrelevant content being the other one means analyzing how parts relate or not which takes the objective to the *"analyze"* level. For the last one, identifying main conclusions in argumentative texts was categorized as "*evaluate*" since there will be argumentative texts and students need to make judgments based on the arguments in order to reach a conclusion.

The verb "*answer*" is not categorized in the sense that answering may mean different level of cognitive processing for different questions asked. Lastly, the verb "*read*" was not categorized because only the topic of what the students will read was given and there were no additional verbs along with reading in the objectives.

The following table shows the cognitive processes and how many objectives are given for each level.

Table 1.
The Number of Objectives and Their Cognitive Levels

	Total
Remember	8
Understand	6
Apply	4
Analyze	4
Evaluate	4
Create	0
Not Categorized	2

Progression of Objectives and Cognitive Levels Through the Grades

For the 9th grade level, four of the seven objectives are at the first level, "*remember*". There are two objectives at the "*understand*" level and there is one objective at the Evaluate level. If we look at it from the higher and lower perspectives of the taxonomy, six out of seven objectives are at the lower two levels of "*remember*" and "*understand*".

At 10th grade, there is one objective at "*remember*", two objectives at the "*apply*", one objective at *"analyze",* one objective at the "*evaluate*" level and one objective that was not categorized. From the lower categories in the taxonomy, there are three objectives and from the higher categories, there are two objectives.

At 11th grade, there is one objective at "*remember*", one objective at "*apply*", one objective at *"analyze",* one objective at "*evaluate*" and two objectives at the "*understand*" level. There are three objectives at the lower three levels of "*remember*", "*understand*" and "*apply"* and two objectives at higher levels of *"analyze"* and "*evaluate*".

Lastly at 12th grade, there are two objectives at "*remember*", two objectives at "*understand*", two objectives at *"analyze*", one objective at "*apply"* and another one at "*evaluate*" level. There are five objectives from the lower half of "*remember*", "*understand*" and "*apply*" levels while three objectives from "*analyze*" and "*evaluate*" levels.

Overall, there are eighteen objectives in total from the lower levels of "*remember*", "*understand*" and "*apply*" and eight from the higher levels of "*analyze*" and "*evaluate*".

There are no objectives that are categorized in the *"create"* level. If we look at the progression beginning from 9th grade to 12th grade, we can see the different levels given through the grades (See Table 2). The objective count is higher at the level of "*remember*" and "*understand*" for 9th Grade and moving on to 10th grade, there is a move towards "*apply*", "*analyze*" and "*evaluate*" levels. At 11th grade, there's almost an even distribution of the levels and we can see at least one objective from each level. Lastly in 12th grade, the distribution is similar to that of the 11th grade in that it is almost even. However, the number of objectives at the lower levels increases compared to 11th grade, with four objectives falling under "*remember*" and "*understand*" levels for 12th grade.

Table 2.

Progression of Objectives Through Grades

	9th Grade	10th Grade	11th Grade	12th Grade
Remember	4	1	1	2
Understand	2		2	2
Apply		2	1	1
Analyze		1	1	2
Evaluate	1	1	1	1
Create				
Not Categorized		1	1	

The Compatibility Between Objectives and Questions

There is one question at the 9th grade level which doesn't assess the reading skill. In the objective given for the question, it says that students will be able to read a simple text for simple information. In this question, the instructions require students to fill in the blanks with names of public buildings and a set of sentences provided beneath the instructions. An example sentence is *"People go to the ..... to buy medicine."* For reading tasks, students read sentences, paragraphs, texts, essays in order to do another action based on what they've read. Although the objective says that they will read a text for specific information, the question does not include a text. If we look at the question, it requires students to fill in the blanks with vocabulary they will recall from memory, therefore this is not a reading task. As this question is not included, there are 43 reading questions that belong to one of the categories of: compatible, not compatible or partially compatible (See Table 3).

At the 9th grade level, nine out of eleven reading questions analyzed are compatible with their given objectives. These include questions given for objectives with recognizing, finding specific information, reading and scanning to find out. As an example, for a compatible question, we can give a question where the objective asks students to read a text for specific information about jobs, nationalities and countries. There is a postcard including a text written from Asia to John about Türkiye. In the text, she describes the city of Ankara, the popular places in Ankara, the food and the people. Following the text, the questions ask specific information related to it such as *"Where did Asia visit in the city?" and "What kind of food did Asia try?".* This is a compatible question as finding specific information was categorized at the "*remember*" level and at this level and this question, students will retrieve information in order to answer questions.

At the 10th grade level, seven out of ten reading questions are compatible. One of the compatible questions is a question that is given with an objective including "*to answer*" as a main verb. The question asks students to answer questions according to the text given about how life was in the past. The questions given for the text ask for specific information such as *"Where did Leo use to play when he was a child?" and "What did Leo use to do in the library?".* Although the verb "*answer*" was not categorized at a cognitive level, the question given for the objective requires students to answer questions about short texts, we can say that the questions asked directly to assess how well they can recall information from the text, it is on the "*remember*" level and the objective and question are compatible.

At the 11th grade level, seven out of nine reading questions are compatible. A question containing the verb answer in its objective is also included among the compatible questions. Similar to the answer example from the 10th grade, it is classified at the "*remember*" level as it features a text about people's past habits and experiences followed by questions requiring specific information explicitly stated in the text. An example for a compatible question is that there are events from Aziz Sancar's life and students are asked to put them in order.

At the 12th grade level, eight out of thirteen reading questions are compatible. Two of the eight questions are identical, appearing in different exam scenarios; therefore, we can count them as one, resulting in seven unique compatible questions. An example of a compatible item is a question associated with the objective *find irrelevant content*. The question presents the learners four sentences that describe Sarah. While three of the sentences describe

her physical appearance, one of them describes her personality. Students are asked to find the irrelevant sentence which means analyzing how the sentences relate to one another and determining which one doesn't. This makes the objective at the "*analyze*" level and the question compatible.

For the questions that are incompatible with the stated objectives, it was seen that at the 9th grade level, one question does not align with its corresponding objective. In the question, the students are asked to firstly scan film reviews and then decide which movie to watch. This objective was categorized at the "*evaluate*" level in the taxonomy because decision making requires judgement of information. In the example question, the reviews are given and all of the options ask students to remember specific information such as who talks about a certain subject or how many people have negative comments, making the question and the objective incompatible. There are no decision-making processes in the question but only retrieving specific information about the reviews from memory.

At the 10th grade level, three questions are incompatible with the objectives. These questions are given with the same objective which requires students to skim a text in order to draw a conclusion. All of the questions follow a similar pattern: a text presents a person's future plans, and the accompanying questions ask about specific details of those plans. Remembering details is at the "*remember*" level in the taxonomy but drawing a conclusion is at the "*evaluate*" level as discussed before. There is no need for students to deduce information for conclusion; therefore these questions are incompatible with the objective.

At the 11th grade level, there is one question that is incompatible with the objective. The objective includes the process of analyzing to summarize which is at the "*evaluate*" level. The question includes a short story and learners are instructed to complete a table with plot, setting, characters and climax. Analyzing to summarize is a process which requires students to make decisions about which elements to include in a summary. By contrast, this question involves writing down elements from the story, where students simply read the story and complete the table rather than summarizing.

Table 3.

The Compatibility Between Objectives and Questions Through Grades

	C	PC	IC	DAR
9th Grade	9	1	1	1
10th Grade	7		3	
11th Grade	7	1	1	
12th Grade	8		5	

Abbreviations: C, Compatible, PC, Partially Compatible, IC, Incompatible, DAR, Doesn't Assess Reading

At the 12th grade level, there are five incompatible questions. Three of these questions have the same objective which includes analyzing surveys/interviews to answer questions. These questions are very similar as they have a graphic table with a percentage or number of students who listen to different types of music, and the options include questions about the survey. An examination of the questions reveals that they ask about the most or equally popular song among students. These items do not require students to analyze the graphic tables; rather, they only involve reading the numbers to provide an answer, which reduces the cognitive demand to a level below "*analyze*". The other two incompatible questions are linked to the objective of identifying main conclusions in argumentative texts. In both of the questions, there are three people having the same opinions but in one of the questions, there is one more person having an opinion about friendship. The set of questions includes one that asks students to identify the general topic of a conversation and another that requires them to locate specific information regarding who holds a particular opinion. The objective, however, is defined as identifying conclusions in argumentative texts, entails evaluating statements from multiple perspectives in order to reach a conclusion. In contrast, this question operates at the lower cognitive levels of "*remember*" and "*understand*" rather than at the objective's intended *"evaluate"* level.

Lastly, there are partially compatible questions, one of which appears at 9th grade. The objective given for the question says that students require to find the main idea which is an objective at the "*understand*" level. In the question, there's a dialogue between two people following three questions. The first one, *"What are Brian and Rose talking about?"* corresponds to the "*understand*" level, as it requires identifying the main idea. In contrast, the other two questions, asking about the genre of movie Rose prefers and the time they're going to the cinema, require recalling specific details, thereby placing them at the "*remember*" level.

Another partially compatible question is at the 11th grade level. The objective requires students to identify the main idea of a text which was categorized at the "*understand*" level in the revised taxonomy. In the question, there is a text, and learners are instructed to read the text and answer the questions. The text is on Steve Jobs's life. There are three questions given under the text. The first one is compatible with the objective "*What is the text about?"*. However, there are two more questions which require specific information by asking when he was born and what his profession was. Therefore, we can say that while the first question is at the "*understand*" level, the other two are at the "*remember*" level and the example question is partially compatible with the objective given.

Since the number of compatible questions are higher at every grade level, Table 4 provides a detailed overview of how these questions are distributed across grades in terms of their cognitive levels, as aligned with the corresponding objectives.

Table 4.

Cognitive level of compatibility through grades

	9th Grade	10th Grade	11th Grade	12th Grade
Remember	8	4	4	2
Understand	1		1	2
Apply		2	1	1
Analyze		1	1	3
Evaluate				
Create				

Discussion

In the literature, the studies on the skill of reading are centered around the topics of textbook activities and reading questions, objectives of reading courses for various levels, assessment of reading skill and the relationship of reading skill with the development of some other skills such as critical thinking and problem solving (Gerez Taşgın & Taşgın, 2023; Şara Hürsoy & Karadedeli, 2022) as well as the attitudes of learners in other fields of learning (Arslan, 2023).

As in the present study, Bloom's taxonomy is a widely applied framework in research on reading skill (Baghaei et al., 2020; Güven & Yaşartürk, 2025; Sönmez, 2019). The results of the study show that the learning objectives, when classified according to cognitive levels in Bloom's Revised Taxonomy, don't follow a developmental progression from 9th grade to 12th grade. Lower-level objectives exist more on the 9th grade level; however, they are more evenly distributed across the other grades. While 10th grade shows a progression towards higher levels of "*apply*", "*analyze*" and "*evaluate*", this progression does not continue on the higher levels for the 11th grade. Instead, there is an even distribution of levels. For the 12th grade, there is no progression to higher levels from the 11th grade but a similar distribution with even more objectives at "*remember*" and *"understand"* levels. While students' both cognitive capacity to process information and their language proficiency increase with age, this increase is not adequately reflected in the assessment of reading. This result partly collides with the study by Güven and Yaşartürk (2025) who reported that teachers tend to ask slightly higher-order questions as students advance through grade levels.

The compatible questions outnumber the incompatible ones in relation to the objectives, which indicates that the aim of assessing reading skills can largely be accomplished through these questions. However, the questions that are not aligned with the objectives may raise validity concerns, as they fail to measure what they are intended to assess. As Fjørtorft et al. (2024) highlighted in their qualitative content analysis study, such mismatches may prevent reading assessments from effectively improving learners' reading skills even though both policymakers and teachers express a willingness to support improvement in reading comprehension and literacy skills. The objective specifies what a question is intended to assess, and the question itself should reflect this aim. However, when incompatibility arises between the objective and the question, students may still answer the question without actually reaching the intended cognitive level. For example, one objective required students "to scan to decide", which implies making use of the input, forming judgements about it and stating a personal decision. Yet, the corresponding task only provided the input and asked students to recall specific details, thereby reducing the cognitive demand to the "*remember*" level in the revised taxonomy. An examination of the incompatible questions with their objectives-found across all grades' levels-shows that they were classified as such because they failed to assess higher-order cognitive skills required by the objectives. All of the questions were at a lower level, some moving down one level and some moving multiple levels at the revised taxonomy. This means that although we see higher cognitive levels in the objectives, the questions given for

them couldn't maintain them, which means that there's a gap in the assessment of higher-level cognitive skills. A similar finding reported by Lestari and Pratola (2024) found that the final examination questions in private junior Indonesian high- schools tests predominantly tested students' lower-level skills, in contrast to Indonesian education policies and objectives that emphasized higher-order cognitive processing. Moreover, such inconsistencies have been shown to undermine the reliability of exams (Özen & Mert, 2024).

The results of the present study are similar to other studies (Dallasheh, 2024; Kasimi, 2022; Köksal et al., 2023; Laila & Fitriyah, 2022; Maryamah et al., 2024; Ulum, 2022; Ulum, 2024; Wu & Pei, 2018) in terms of lower cognitive levels outnumbering the higher ones (See Table 1). In their studies, the textbooks included more reading comprehension questions that assessed the lower-level thinking skills than questions that assessed the high-level thinking skills of the taxonomy. It is also mentioned in the aforecited studies that an equal distribution of the high and low levels would be better, which is an idea that can also apply to this study, as an equal distribution of the levels would have a positive effect on the assessment process overall by not just focusing on recalling but also helping students' critical thinking skills. On the other hand, Qasrawi and Andelrahman (2020) compared the objectives of two editions of a coursebook and found that there is an increase in cognitive level of objectives including synthesis in the second edition, and the coursebooks aim to enhance both lower and higher order cognitive processing skills in contrast to the results of Adli and Mahmoudi (2017) who have found that advance level coursebooks included less demanding reading questions neglecting higher-order questions. Two other studies also show diverse results from our study with the result that coursebooks include both cognitive levels of lower and higher orders (Kamil et al., 2024; Sucipto & Cahyo, 2019).

Echoing other studies (Rebla & Büyükahıska, 2023; Mayor, 2024; Widiana et al., 2023; Wu & Pei, 2018), higher level cognitive skills can be linked with critical thinking. Therefore, a lack of higher-level cognitive skills in practiced materials in the language learning context may mean that learners will not have opportunities to develop their critical thinking skills.

There were no objectives given which were on the level of "*create*". "*Create*" is the highest level in the taxonomy and even at the highest level of secondary education, there are no objectives or example questions that require students to create something original after reading. This is significant, as the curriculum over the years has shifted toward a communicative use of language, enabling students to interact with people in real-life contexts. For example, students may read the news and report it to someone or read a book and write a review- both of which involve creation. Since creation plays a central role in the everyday use of language, there is a clear need for creation-based objectives and tasks in reading assessment. A similar suggestion for more equitable distribution of reading competency was made in the context of Philippines at the conclusion of a qualitative study conducted by Abejuela et al. (2023).

Another issue is that the questions given are example questions to guide practicing teachers in Türkiye on how they can assess reading. As the teachers have to take a certain number of objectives and create questions for each exam, they may use these questions as samples to create their own questions. The incompatible questions with the objectives may mislead the teachers for reading assessment. In the research conducted by Çimen (2022), it is stated that there is a mismatch between the curriculum and teachers' practices in terms of assessment. It is found that teachers assess language knowledge rather than focusing on the suggestions of the curriculum, one of which is using production focused activities for assessment. Bearing this in mind, teachers who will create reading questions should also focus more on questions where students will produce meaningful content rather than solely use the correct forms or vocabulary. Thus, students can use higher cognitive skills more than the lower ones.

Another issue highlighted by Neldis et al. (2024) is that lack of questions assessing higher level cognitive skills may reduce students' motivation to study English. Within the scope of the present study, the fact that the example questions can serve as a guide for teachers in designing reading assessment tasks raises a concern: teachers may adopt a similarly lower cognitive focus. This, in turn, could negatively affect students' motivation to learn English as they progress through grade levels.

Conclusion and Recommendations

While assessing the reading skill at the high school level, the example questions taken from the documents published by the Ministry of Education had more questions that were compatible with their objectives than incompatible ones. The cognitive processes from 9th to 12th grade showed an upward trend, with objectives demanding higher-level skills from 9th to 10th grade; however, the distribution of cognitive levels became more balanced at 11th and 12th grades. Yet, the incompatible questions demonstrated that the assessment of higher-level skills was unsuccessful as the items with the objectives predominantly required lower-level cognitive

skills. This result aligns with studies that analyzed the reading sections of textbooks and similarly reported a lack of higher-order cognitive skills (Dallasheh, 2024; Kasimi, 2022; Köksal et al., 2023; Rebla & Büyükahıska, 2023; Ulum, 2021; Wu & Pei, 2018).

This research focused exclusively on the objectives in terms of their placement within the revised taxonomy and examined whether the questions are compatible with these cognitive levels. The assessment of reading is a complex process, and the questions can be analyzed further using different processes or elements of the process for a better understanding of the validity. The analysis of inference questions, for instance, even could provide fruitful results on the assessment of reading comprehension. Rice et al. (2023) conducted a systemic review and specifically studied inference as a cognitive skill in reading comprehension and assessment of reading. Therefore, the compatibility of the questions with the objectives may change based on other criteria or framework used to analyze the same questions. There are also various elements that were not included in the research such as types of texts given in the questions and/or the objectives, themes surrounding the questions, length of the texts, types of reading the questions require and more, all of which can be the starting point of further research on the sample documents analyzed. On the other hand, compatibility studies of curricula could become stronger if they are conducted in real contexts of learning and teaching not only with assessment documents but also with learning and teaching practices as Green (2021) points out that comprehension is a complicated process to be observed and assessed.

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Artificial Intelligence in Applied Linguistics Research: A Bibliometric Study Tracing Between the Years of 2017 and 2024

Zafer SUSOY[1]

Elham ZARFSAZ[1]

[1]Tokat Gaziosmanpasa University, Faculty of Education, English Language Teaching Department, Tokat, Türkiye

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Corresponding author:
Zafer Susoy
E-mail: zafersusoy@gmail.com

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ABSTRACT

Drawn upon data from 117 full-length research articles from 19 Social Science Citation Index (SSCI)-indexed journals of applied linguistics, the current study presents a bibliometric analysis of the use of artificial intelligence (AI) in the field from 2017 to 2024. It examines various aspects, including the most frequently discussed topics, the most highly cited publications, the countries and institutions' contributions, and the shifts in citation trends locally and globally. The study employed bibliometric techniques to analyze publication trends, citation patterns, and thematic focuses across SSCI-indexed applied linguistics journals, covering the period between 2017 and 2024. The results show that there has been a substantial increase in the number of applied linguistics studies discussing AI and their citations since 2021. As for the country-based analysis, China is the leading country in single-country publications; however, in the multi-country publications, the USA is taking the lead, followed by the UK. Frequently discussed topics such as ChatGPT, language learning, student performance, and automated assessment and feedback indicate intense research on applying AI to enhance language learning and assessment. Furthermore, keywords such as "machine learning," "chatbots," "NLP," and "large language model" form another cluster, showcasing the various AI technologies employed in applied linguistics. Overall, these trends underscore a robust and evolving intersection of technology and education, suggesting that future research may further illuminate the transformative potential of AI in language acquisition and pedagogy.

Keywords: Applied linguistics, artificial intelligence, language learning, bibliometrics

Introduction

Artificial intelligence (AI) has a significant impact on language instruction in applied linguistics, especially when it comes to second language (L2) acquisition. Language education is changing as a result of developments in machine learning (ML) and natural language processing (NLP), which are replacing earlier approaches with more individualized learning opportunities (Pokrivcakova, 2019). This change is primarily due to AI-driven chatbots offering comprehensive language practice (Dokukina & Gumanova, 2020; Huang et al., 2023). Studies by de la Vall and Araya (2023) and Alm and Nkomo (2020) demonstrate that these chatbots significantly improve language proficiency through simulated discussions. The learning process is further enhanced by the tailored input and feedback provided by these interactions (Tsivitanidou & Ioannou, 2021).

The rising demand for the possibilities of AI in language training is reflected in the increasing quantity of review papers on the subject (Zhu et al., 2023). Comprehensive studies by Xu et al. (2019) and Oliva et al. (2021) show the significant impact of technology on language learning. Research employing bibliometrics by Liang et al. (2023) and Huang et al. (2022) reveals trends in the application of AI to language acquisition. However, Yang and Kyun (2022) and Ali (2020) point out the need for more thorough syntheses to fully understand the field's evolution and future directions.

Originally named "bibliométrie" by Otlet (1934) and renamed "bibliometrics" by Rousseau (2014), bibliometrics is the quantitative analysis of readership and publication statistics. This definition was further clarified by Pritchard (1969), who defined it as studying publications and other kinds of communication by applying statistical and mathematical techniques. Bibliometric analysis is broadly

synonymous with scientometrics and involves multiple approaches. For example, Author Co-citation Analysis (ACA) examines the relationships between co-cited authors to map knowledge domains (Wang et al., 2018), while Document Co-citation Analysis (DCA) identifies important documents based on citation patterns. Citation Analysis is another popular bibliometric technique that evaluates the impact of writers, publications, organizations, and documents using a variety of citation measures.

Researchers usually use one of three databases for bibliometric investigations: Google Scholar, Scopus (Elsevier), or Web of Science (WoS). Every database has benefits and drawbacks. For instance, using Google's search engine, Google Scholar provides open access to many academic publications (Aguillo, 2012). However, this openness may also be a disadvantage since it might make it harder to identify reliable sources, leading to the creation of a "noisy database" (Aguillo, 2012). Moreover, Google Scholar's absence of co-citation data and inability to distinguish between academic and non-academic citations make it challenging for bibliometric research (Zhang, 2020). We chose Web of Science (WoS) for our study since it is relevant and thorough. Zhang (2020) and Roemer and Borchardt (2015) noted that WoS has a user base of over 7,000 subscribers. The WoS Core Collection currently includes over 21,100 peer-reviewed academic publications from various fields, including the social sciences, humanities, and arts, as well as conference proceedings and book data, according to Clarivate's official website. Bibliometric researchers often use abstracts, titles, and keywords to extract information about academic disciplines. On the other hand, co-citation analysis is a recent trend that looks at references. The method's perceptive results have made it popular in many different fields. Bibliometric analysis and co-citation techniques are increasingly popular for identifying scholarly trends and links.

Purpose of the Study

Bibliometric methods are becoming more popular for monitoring and analyzing the spread of knowledge in many forms. Lei and Liu (2019) conducted two important investigations in this area. The first examined contributions to the "System" journal during 40 years (1973–2017), emphasizing recurring themes, highly cited works, and significant authors and references. The second study used bibliometric analysis to identify changing patterns in research trends in applied linguistics (AL) from 2005 to 2016.

A bibliometric analysis of second language acquisition (SLA) from 1997 to 2018 was carried out by Zhang (2020). Zhang discovered key trends, significant papers, authors, institutions, and geographic areas influencing SLA by methodically examining the subject and utilizing the Web of Science (WoS) for data retrieval. This analysis brought to light important developments and new trends in the industry. Several bibliometric studies published in 2021 demonstrated how popular this research methodology is becoming. Bibliometric analysis was used by Hyland and Jiang (2021) to investigate the evolution of the field of English for Specific Purposes (ESP). By examining 3,500 articles released since 1990, they could pinpoint important subjects, significant writers, and noteworthy works. Their research revealed a growing interest in academic and professional discourses and a persistent emphasis on classroom activities.

In addition, Liu and Hu (2021) examined ESP through a co-citation study of papers published between 1980 and 2018. The field was tracked through four developmental stages: methodological development, maturing (1990s–2000s), conceptualizing (1970s–1990s), and flourishing (2000s–present). This approach found 52 seminal studies and 11 key research clusters; recent spikes in citations indicate ongoing research interests. These bibliometric studies offer a thorough summary of their subjects, enhancing typical narrative evaluations with insightful information.

Our work seeks to close the gap by thoroughly bibliometrically examining AI in language teaching. By concentrating on important research themes, patterns, writers, records, and sources, we hope to shed insight into the advantages and difficulties associated with teaching second languages (L2) to contribute to creating more potent language teaching techniques.

The following research questions form the basis of our investigation:

1. What are the artificial intelligence (AI) publication trends and citation metrics in applied linguistics?
2. What bibliometric trends may be found in published papers on artificial intelligence in applied linguistics journals?
3. Which institutions and countries contribute to artificial intelligence publication?
4. Which documents are the most cited within artificial intelligence studies?
5. How do the most cited sources in intelligence studies appear on a network map and density view?

Method

Research Model

We chose WoS as the central database for the current study sample of AI documents. WoS has a user base of over 7,000 subscribers. The WoS Core Collection currently includes

over 21,100 peer-reviewed academic publications from various fields, including the social sciences, humanities, and arts, as well as conference proceedings and book data (Roemer & Borchardt, 2015; Zhang, 2020).

Data Sources of the Research

For our study sample, we chose 19 highly respected journals (the complete list is in Table 1). The selection criteria were among those for journals covering a wide range of second language (L2) study topics and publishing articles with various methodological perspectives. These journals are also included in the Social Sciences Citation Index (SSCI).

After choosing the journals, we looked for AI studies published in them. Utilizing the Web of Science (WoS) search parameters (Artificial Intelligence*) OR (AI*), we analyzed complete texts, abstracts, titles, and keywords from 2017 to 2024. Following a comprehensive analysis, we pinpointed papers that declared themselves AI research and included pertinent AI literature. In the end, we found 117 studies exclusively about AI in the 19 L2 journals, the first one published in 2017. This figure is consistent with earlier surveys of AI research published in prestigious applied linguistics publications, indicating a relative dearth of conclusive AI research in the area. We only considered full-length articles in our analysis; book reviews and other shorter forms of writing were not included.

We gathered pertinent data from WoS and stored it as a text file. This data included titles, authors, affiliations, abstracts, and references. As some research used multiple names for identical authors, we also cleaned the information to address author name inconsistencies.

Data Collection Tool

Leading journals such as System, CALL, and Language Teaching Research publish many AI-related studies. This indicates their role as key platforms for disseminating AI research in applied linguistics.

The table lists journals (SO: Source Titles) ranked by the frequency (Freq) of AI-related publications in applied linguistics and education technology. The cumulative frequency (cumFreq) indicates the cumulative publications count as you move down the list. Education and Information Technologies leads with 18 publications, suggesting a strong focus on integrating AI with educational information technologies.

Table 1.

The Table Lists of Journals

SO	Rank	Freq	cumFreq
EDUCATION AND INFORMATION TECHNOLOGIES	1	18	18
INTERACTIVE LEARNING ENVIRONMENTS	2	9	27
INTERNATIONAL JOURNAL OF EDUCATIONAL TECHNOLOGY IN HIGHER EDUCATION	3	9	36
AUSTRALASIAN JOURNAL OF EDUCATIONAL TECHNOLOGY	4	8	44
LANGUAGE LEARNING & TECHNOLOGY	5	7	52
EDUCATIONAL TECHNOLOGY & SOCIETY	6	6	59
INTERNATIONAL JOURNAL OF MANAGEMENT EDUCATION	7	7	66
BRITISH JOURNAL OF EDUCATIONAL TECHNOLOGY	8	4	70
INNOVATIONS IN EDUCATION AND TEACHING INTERNATIONAL	9	3	73
ASSESSMENT & EVALUATION IN HIGHER EDUCATION	10	4	77
JOURNAL OF COMPUTER-ASSISTED LEARNING	11	3	80
STUDIES IN HIGHER EDUCATION	12	4	84
SYSTEM	13	3	87
ASSESSING WRITING	14	2	89
ETR&D-EDUCATIONAL TECHNOLOGY RESEARCH AND DEVELOPMENT	15	2	91
JOURNAL OF HOSPITALITY LEISURE SPORT & TOURISM EDUCATION	16	2	93
MEDICAL EDUCATION ONLINE	17	2	95
TESOL QUARTERLY	18	2	97
THINKING SKILLS AND CREATIVITY	19	2	97

Interactive Learning Environments ranks second with nine publications, highlighting its role in exploring AI applications in dynamic and interactive learning settings. The International Journal of Educational Technology in Higher Education has nine publications indicating significant interest in AI's impact on higher education technology.

The cumulative frequency provides a sense of the distribution of AI-related research across journals. The top five journals have 52 publications, showing a research concentration in a few key journals. Journals like Language Learning & Technology (8 publications) and Educational Technology & Society (7 publications) are mid-tier in terms of publication frequency. These journals bridge the gap between the highest and lowest frequencies, reflecting diverse research interests and methodologies in AI applications. Journals like Medical Education Online, TESOL Quarterly, and Thinking Skills and Creativity have two

publications. These journals, while having fewer AI-related articles, still contribute to the overall body of research and indicate niche application areas.

The spread of publications across various journals demonstrates the interdisciplinary nature of AI research in applied linguistics. It spans various aspects of education, from interactive learning environments to higher education and specific language learning technologies. The inclusion of journals like Medical Education Online and TESOL Quarterly suggests emerging trends in applying AI to specialized fields such as medical education and teaching English as a second language. This points to the broadening scope of AI applications beyond traditional educational technology contexts. The concentration of publications in a few key journals highlights the importance of these venues in advancing the field. Researchers may target these journals for higher visibility and impact, contributing to the critical discourse on AI in education.

We divided our bibliometric analysis into co-citation analysis and citation analysis of impact. In the first stage, we used Bibliometrix Rstudio by Aria and Cuccurullo (2017) to run the citation analysis and map the publishing trends of AI publications. In the second stage, van Eck and Waltman's VOS viewer was used for co-citation analysis (2017).

Data on the annual publication of AI research and their total global citation counts (TGCS) and total local citation counts (TLCS) were provided by Bibliometrix Rstudio for yearly publication trends and citation counts. The TGCS indicates how frequently papers on AI have been cited by other articles that are indexed in WoS on an annual basis. Every year, TLCS counts the citations made by other pure AI articles in the same index to publications only about AI. The frequency of AI studies across 19 journals and their TGCS, TGCS/t (annual total global citations), TLCS, and TLCS/t (annual total local citations) were determined by analyzing journal frequency and citation metrics. We also assessed institutional contributions by looking at the quantity of AI research institutions generated, the number of citations they received, and their global partnerships.

The ethical process in the study was as follows:

• Ethics Committee Approval: The author stated that ethical permission was not required for the study because humans and animals were not used. However, ethical guidelines were followed throughout the study.

• Informed Consent: No living beings requiring informed consent were involved in this study.

Results

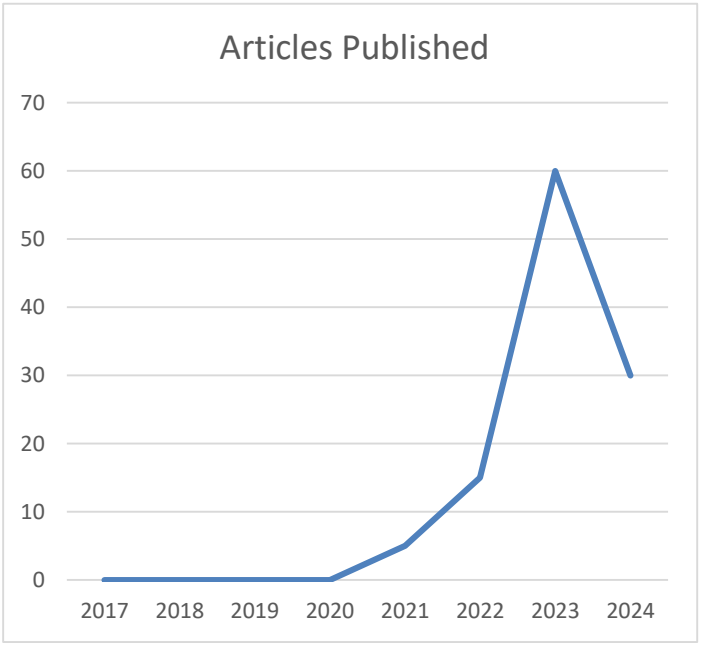
Yearly Publication Trends

The graph shows the number of articles published yearly from 2017 to 2023. The number of articles has increased noticeably, with a significant spike in 2023.

The graph in Figure 1 shows the number of articles published yearly from 2017 to 2023. There is a noticeable increase in articles over this period, with a significant spike in 2023. From 2017 to 2020, the number of articles remains relatively low and stable. 2021, there will be a slight increase, followed by a sharp rise in 2022 and a peak in 2023. A slight decline is observed in 2024, though the number of articles remains significantly higher compared to the earlier years.

Figure 1.

Graph Showing Published Article Amounts



The initial years show minimal publication activity, which could be attributed to the nascent stage of integrating AI in applied linguistics. During this period, researchers may have been exploring the feasibility of AI technologies and their initial applications in this field. The slight increase in 2021 suggests growing interest and preliminary research findings being published. This period likely saw early adopters and pioneering studies that paved the way for more extensive research. The dramatic increase in 2022 and peak in 2023 indicate a breakthrough period for AI research in applied linguistics. Several factors could contribute to this spike:

Significant improvements in AI technologies, such as natural language processing (NLP), machine learning, and

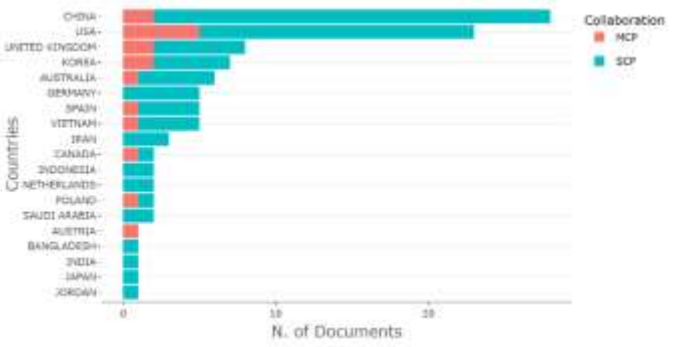
conversational agents like ChatGPT, could have driven more research and publications. More funding and grants from academic institutions, governments, and private sectors could have supported extensive research projects, leading to a higher output of publications. Greater collaboration between linguists, educators, and AI researchers might have led to more interdisciplinary studies and innovative findings. The COVID-19 pandemic might have accelerated the adoption of AI technologies in education as remote learning solutions and automated assessment tools became critical. The slight decline in 2024 could be due to several reasons. Natural fluctuations in publication cycles, where some years have more publications due to the culmination of multi-year research projects. Initial rapid growth might slow as the market saturates and the research community consolidates its findings. Researchers might focus on addressing emerging challenges or refining existing technologies rather than producing new publications.

Citation Trends

The graph in Figure 2 shows the number of citations per year from 2017 to 2023. There is a peak in citations around 2018, followed by a sharp decline and a gradual increase from 2021 onwards.

Figure 2.

Number of Documents Graph



The initial rise and peak in 2018 suggest that early publications on AI in applied linguistics gained significant attention and were widely cited. This could be due to pioneering studies or influential reviews that laid the groundwork for subsequent research in this field. The high citation count indicates that these early works were considered foundational, contributing valuable insights and methodologies that other researchers built upon.

The sharp decline in citations in 2019 could be attributed to several factors. Citations often take time to accumulate, and there may have been a lag following the initial burst of influential publications. The initial novelty might have worn off, leading to fewer new publications and, thus, fewer citations. Researchers might have shifted their focus to different aspects of AI, leading to a temporary drop in citations for earlier studies. The gradual increase in citations from 2021 onwards suggests a resurgence of interest in AI applications in applied linguistics. This period likely reflects the field's maturation, with newer studies building on the foundations laid by earlier research and addressing more complex or nuanced questions. The rise in citations could also be driven by advancements in AI technology and increasing integration into educational practices, prompting more citations of relevant work.

International Collaboration in AI and Applied Linguistics

China has the highest number of documents, predominantly single-country publications (SCP). The USA also has many documents, a significant portion of which are multi-country publications (MCP). The United Kingdom shows a balanced contribution with both SCP and MCP. Other notable contributors include Korea, Australia, Germany, and Spain, each with a mix of SCP and MCP.

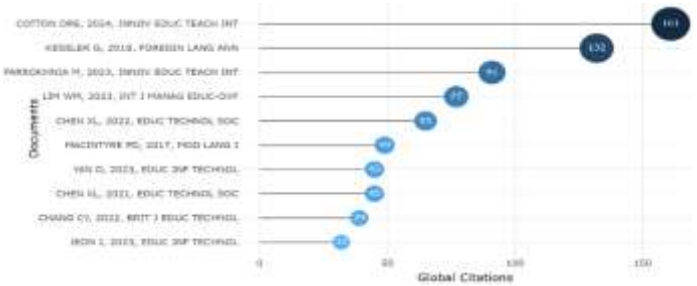
MCP indicates collaborative research efforts between authors from different countries. The USA, UK, Korea, and Germany show significant MCP activity. SCP represents research efforts within a single country. China, Iran, and Vietnam have high SCP counts, indicating strong domestic research activities.

Most Cited Documents in AI and Applied Linguistics

Cotton (2024) in Innovative Education and Teaching International leads with 161 global citations, indicating strong influence. Kessler (2018) in Foreign Language Annals follows with 132 global citations, highlighting its foundational role in foreign language learning and AI integration. Farrokhnia (2023) in Innovative Education and Teaching International stands third with 91 global citations, showing the rapid recognition of recent works addressing pressing issues or introducing groundbreaking methodologies.

Figure 3.

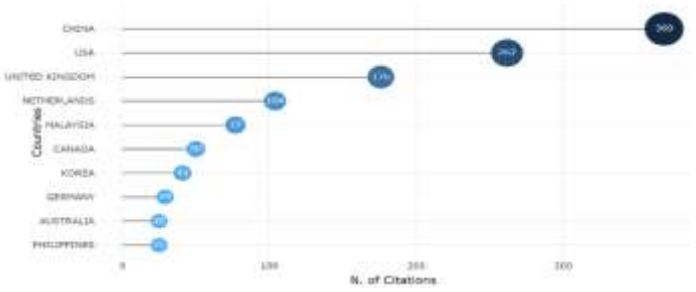
Global Citations Graph



Cotton (2024) is influential, with its high citation count reflecting significant impact and wide recognition within the academic community. The document's focus on innovative educational practices and teaching international contexts resonates strongly with current research trends and practical applications. Kessler (2018), as the second-most cited document, underscores the importance of foreign language learning and the integration of AI in this domain. Its sustained citation count since 2018 demonstrates its ongoing relevance. Farrokhnia (2023) quickly gained recognition due to its contribution to the field within a short time frame. Lim (2023) is another recent work with substantial citations, indicating its importance in management education and the application of AI in administrative and educational leadership contexts.

Figure 4

Citation Count Graph



The diversity of journals and topics among the most cited documents indicates a wide range of research interests within AI and applied linguistics. This includes educational technology, language learning, management education, and innovative teaching practices. The presence of multiple citations from journals like Educational Technology & Society and Innovative Education and Teaching International suggests that these publications are key platforms for disseminating influential research.

Citation Distribution by Country

China leads with 369 citations, indicating a strong impact of its AI and applied linguistics research. The USA follows with 262 citations, reflecting its significant contributions and influence, while the United Kingdom stands third with 176 citations, showcasing its role in advancing the field. The citation distribution highlights the leading roles of China, the USA, and the UK in AI and applied linguistics research. These countries' high citation counts reflect their capacity to produce influential studies that shape the research landscape. Their academic institutions, research funding, and collaborative networks enable them to lead global research efforts.

Countries like the Netherlands and Malaysia also show significant citation counts, indicating their rising influence. This suggests successful efforts to develop AI research capabilities and contribute to international discourse. These emerging countries bring diverse perspectives and innovative approaches, enriching the global research community. The presence of countries from various regions, including Asia, Europe, and North America, highlights the international nature of AI research in applied linguistics, fostering cross-cultural collaborations and knowledge exchange.

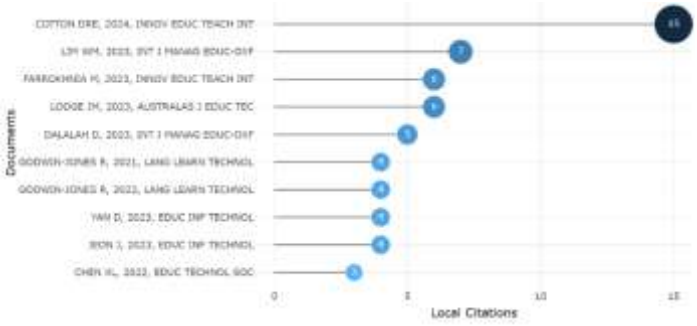
The impact of leading countries' research can be linked to national strategies and policies promoting AI and educational research. For instance, China's high citation count reflects its strategic focus on AI development and integration into education. Similarly, the USA and UK's research policies and funding mechanisms support their leading roles.

Local Citations in AI and Applied Linguistics

Figure 5 displays the total global citation counts (TGCS) and total local citation counts (TLCS) over the years.

Figure 5

Local Citation Analysis Graph



The top locally cited documents reveal significant insights into the research landscape. Cotton (2024) leads with 15 local citations, indicating strong relevance within the field. Lim (2023) follows with seven local citations, significantly impacting management education. Farrokhnia (2023) and Lodge (2023) each have six local citations, highlighting their influence. Other notable documents include Dalalah (2023), with five local citations; Godwin-Jones (2021), both with four local citations each; Yan (2023), with four local citations; Jeon (2023), with four local citations; and Chen (2022), with three local citations.

Cotton (2024), with the highest number of local citations, is highly regarded and frequently referenced, suggesting significant contributions to ongoing research. Lim (2023), with the second-highest local citations, reflects its impact on management education, providing valuable insights and

methodologies. Farrokhnia (2023) and Lodge (2023) have quickly become influential due to their high local citation counts within a short time frame, addressing pressing issues or introducing innovative approaches. With consistent local citations, Godwin-Jones (2021) reflects ongoing relevance and contributions to language learning and technology.

The local citation count provides insights into the most influential documents within the AI and applied linguistics research community. High local citations suggest that a document's findings, methodologies, or theoretical contributions are frequently referenced, indicating its importance in shaping ongoing research. Recent publications with high local citations, such as those by Cotton and Farrokhnia, demonstrate the field's responsiveness to new research addressing current challenges or leveraging recent AI advancements. The diversity of topics covered by the most locally cited documents, from educational technology to management education and language learning, highlights the interdisciplinary nature of AI applications in education. This diversity suggests that AI research in applied linguistics addresses various educational contexts and challenges. The presence of multiple highly cited documents from journals like Innovative Education and Teaching International and International Journal of Management Education indicates these journals are key venues for impactful research, enhancing a document's visibility and influence within the research community.

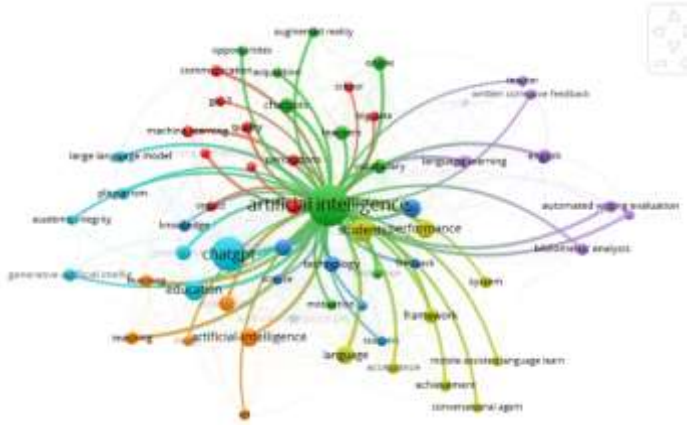
Network Visualization

The network visualization graph provides a comprehensive view of the relationships and connections between various keywords in AI and applied linguistics. Each node represents a keyword, and the edges (lines) between them indicate the co-occurrence of these keywords in the literature. The size of the nodes and the thickness of the edges reflect the frequency of the keywords and their co-occurrence, respectively.

Artificial Intelligence is the most prominent node, indicating its central role in the research. It is highly interconnected with many other keywords, reflecting its widespread application and relevance across various topics in applied linguistics. ChatGPT is another significant node that shows the relevance of AI-driven conversational agents in the research landscape. Its connections to other keywords like "education" and "language learning" highlight its importance in these contexts. Education and technology are also central nodes, showing strong connections with AI and indicating the integration of AI technologies in educational settings.

Figure 6.

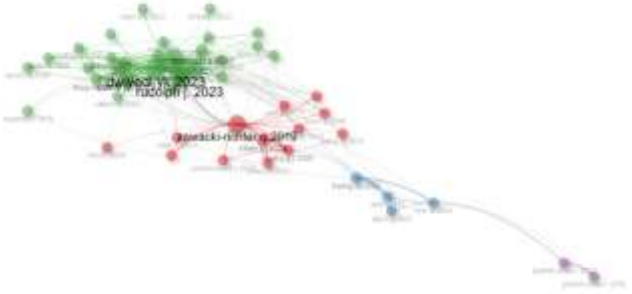
AI Brain Map



Keywords like "language learning," "student performance," "automated writing evaluation," and "feedback" form a cluster, indicating a strong research focus on applying AI to enhance language learning and assessment. Keywords such as "machine learning," "chatbots," "NLP," and "large language model" form another cluster, showcasing the various AI technologies employed in applied linguistics. Keywords like "student performance," "perceptions," and "teacher" indicate research exploring the impact of AI on educational outcomes and stakeholder perceptions.

Figure 7.

AI Research Heat Map



Keywords like "generative artificial intelligence" and "GPT-3" highlight emerging technologies, reflecting recent advancements and their applications in education and linguistics. The presence of keywords like "plagiarism" and "academic integrity" suggests ongoing discussions about the ethical implications of AI in education, particularly concerning the use of generative AI tools.

Co-citation Network Visualization

Dwivedi (2023) and Rudolph (2023) are central nodes, highly connected and frequently co-cited with other significant documents, indicating their influential status in the field. Similarly, Zawacki-Richter (2019) remains a central node, showcasing its continued relevance and impact over the years.

The green cluster is dominated by recent publications from 2023, indicating active and emerging research areas, with key figures like Dwivedi and Rudolph. The red cluster features Zawacki-Richter (2019) as a central node, suggesting its foundational role in the literature, along with notable nodes such as Chen (2020) and Atlas (2023). The blue cluster includes recent works such as Huang et al. (2022) and Fryer (2020), highlighting their relevance in specific subfields. The purple cluster contains documents by Godwin-Jones from 2016 and 2023, focusing on a specialized area of research within the broader field.

Figure 8.

AI Research Citation Heatmap

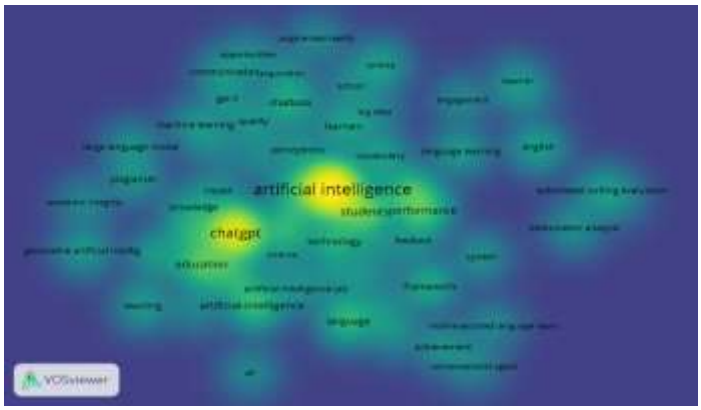
Documents by Godwin-Jones (2016) in the purple cluster are more peripheral, suggesting a focused but less central area of research. Historical references like Vygotsky (1978) in the green cluster indicate that foundational theories are still referenced in contemporary research.

Density Visualization Graph

The Central High-Density Cluster comprises pivotal documents such as Dwivedi (2023), Rudolph (2023), and Zawacki-Richter (2019), marking them as highly influential in the field. Surrounding these are high-density nodes like Lo (2023), Strzelecki (2023), and Chan (2023), indicating significant influence within the central cluster. In moderate-density areas, works by Huang et al. (2022), Chen (2020), and Hwang (2020) show considerable influence, albeit not as central. Low-density areas feature specialized documents like Godwin-Jones (2021) and historical references such as Vygotsky (1978) and Floridi (2020), reflecting foundational influence.

Figure 9.

AI Research Keywords Heat Map



Dwivedi (2023) and Rudolph (2023) occupy central, high-density positions, highlighting their crucial role in ongoing research. These works are frequently cited and serve as key sources of knowledge and methodology. Similarly, Zawacki-Richter (2019) maintains a central position, providing essential frameworks and insights. Emerging influential works, including Lo (2023) and Strzelecki (2023), address contemporary issues or introduce new methodologies, demonstrating strong resonance within the research community. Historical and theoretical contributions like Vygotsky (1978) continue to underpin current research, while specialized works such as those by Godwin-Jones (2023) offer niche insights into AI and applied linguistics.

Density Visualization Discussion

The density visualization map reveals essential topics and their interconnections in AI and applied linguistics research. Central terms like "artificial intelligence," "chatgpt," "machine learning," and "education" indicate their pivotal roles and frequent co-occurrence in scholarly work. The centrality of "artificial intelligence" and "chatgpt" highlights their significance in the current research landscape. The prominence of "machine learning" and "education" underscores the application of AI technologies in educational settings.

Emerging trends such as "augmented reality," "big data," and "automated writing evaluation" signify innovative applications in the field. These technologies pave new paths for enhancing language learning and assessment. Connections among terms like "students' performance," "language learning," "technology," and "feedback" illustrate the integrated approach researchers use to improve educational outcomes through AI.

Discussion

The density visualization offers a thorough overview of key themes and trends in AI research within applied linguistics.

The central role of AI and technologies like ChatGPT highlights their foundational impact on current research. Focusing on educational applications and language learning underscores the practical benefits of AI technologies. The examination of advanced technologies and ethical considerations reflects the dynamic and evolving nature of the field. By understanding these themes and trends, researchers and policymakers can better guide future efforts to maximize AI's potential in education, ensuring it is used effectively, ethically, and equitably to enhance learning outcomes and support language acquisition.

There has been a significant rise in AI-related publications in applied linguistics, particularly since 2021, indicating growing interest and advancements in this interdisciplinary field. The sharp increase in publication and citation counts highlights the rapid development and widespread recognition of AI applications in education. Central figures such as Dwivedi (2023), Rudolph (2023), and Zawacki-Richter (2019) are pivotal in shaping research discourse. These frequently co-cited, and highly referenced studies provide foundational insights and innovative methodologies guiding ongoing research. Journals like Innovative Education and Teaching International, Educational Technology & Society, and Language Learning & Technology are critical platforms for disseminating high-impact research.

Leading institutions from China, the USA, and the UK dominate research output, reflecting their robust academic infrastructure and significant investments in AI research. The density and co-citation visualizations highlight key themes such as the integration of AI in educational technology, language learning, and automated assessment. Prominent keywords like "artificial intelligence," "ChatGPT," "education," and "language learning" indicate primary focus areas within the research community. The interdisciplinary nature of AI research in applied linguistics is evident from integrating historical and foundational theories, such as those by Vygotsky (1978), alongside contemporary advancements. Ethical considerations, including academic integrity and the responsible use of AI, are also prominent, emphasizing the need for a balanced and thoughtful application of technology in education.

The analysis of international collaboration patterns shows significant contributions from countries across Asia, Europe, and North America, with notable leaders being China, the USA, and the UK. Emerging contributors like the Netherlands and Malaysia are also making substantial impacts, demonstrating AI research's global and collaborative nature. The bibliometric analysis of AI in applied linguistics offers a detailed overview of the field's growth, influential research, key contributors, and thematic trends. It reveals a significant and steady increase in AI-related research within applied linguistics, especially from the early 2000s onwards. This upward trend highlights the growing recognition of AI's potential to revolutionize language education through innovative tools and methodologies.

Citation analysis underscores the impact of AI research, marked by notable peaks in total global citation counts (TGCS) and total local citation counts (TLCS). These peaks align with the publication of influential studies that have significantly shaped the field. High citation counts reflect the widespread acknowledgment of AI's relevance and interdisciplinary influence, reaching beyond applied linguistics into education, cognitive science, and computational linguistics. The co-citation analysis provides insights into the intellectual structure of AI research in applied linguistics. The distinct clusters of frequently co-cited references highlight major themes such as NLP, machine learning applications, and AI-driven language assessment. These clusters point to foundational texts and emerging trends, guiding researchers toward essential literature and new research directions.

Leading journals like 'System,' 'CALL,' and 'Language Teaching Research' are pivotal platforms for disseminating AI research. The concentration of AI-related publications in these journals emphasizes their role in advancing technological integration in language education. Researchers aiming for high visibility and impact should consider these journals for their submissions. Key institutions such as Lancaster University, Macquarie University, and Iowa State University are major contributors to AI in applied linguistics. These institutions are likely centers of innovation and collaboration, offering valuable resources and expertise. Their prominence reflects robust academic programs and research capabilities, setting benchmarks for quality and innovation. Geographically, the USA, UK, and China lead contributions, reflecting their strong research infrastructure and investment in AI technologies. This global distribution underscores the universal relevance of AI in enhancing language education and fostering international collaborations and knowledge exchange.

Conclusion and Recommendations

The analysis of the most cited articles reveals pivotal studies that have introduced new concepts, methodologies, or technologies. These highly cited works

are key references, guiding subsequent research and indicating successful strategies and emerging trends. The author's co-citation network further illustrates the collaborative nature of the field, identifying influential researchers and their collaborative relationships. The heatmap of references provides a visual representation of the most influential works, serving as cornerstones for developing new research. These references offer comprehensive reviews, methodological innovations, or significant findings that drive the field forward. The word cloud visualization also captures the key topics and concepts, offering a snapshot of the main areas of interest and potential directions for future research.

Overall, the bibliometric analysis highlights AI research's dynamic and interdisciplinary nature in applied linguistics. The field is characterized by rapid growth, significant contributions from leading institutions, and influential studies that shape ongoing research. Understanding these patterns provides valuable insights for researchers, educators, and policymakers aiming to leverage AI technologies to enhance language learning and teaching. Integrating AI in applied linguistics holds promise for developing innovative educational tools, personalized learning experiences, and more efficient language assessment methods, ultimately advancing the field and improving educational outcomes.

The bibliometric analysis and visualizations of AI research in applied linguistics offer a comprehensive view of the current research landscape, highlighting key trends, influential studies, and emerging themes. This discussion will delve into the implications of these findings, exploring the transformative potential of AI in education, the challenges and opportunities ahead, and the strategic directions for future research The transformative potential of AI in education is underscored by a significant increase in related publications and citations in applied linguistics. Natural language processing (NLP), machine learning, and ChatGPT are revolutionizing language education through personalized learning, automated assessments, and real-time feedback, enhancing student engagement and performance.

AI tools create adaptive environments tailored to individual needs, improving language acquisition and retention. Automated writing evaluation reduces educators' workload and provides consistent, objective feedback, enhancing learning. AI is widely applied in education, from intelligent tutoring systems to virtual classrooms, supporting teaching and learning. Ethical concerns include academic integrity, data privacy, and algorithmic biases. Addressing these requires robust guidelines and policies. Implementation challenges involve funding, infrastructure, and training, particularly in under-resourced areas. Continuous research is needed to refine AI tools and adapt them to various educational contexts. Interdisciplinary collaboration and international partnerships are vital for advancing AI research. Emerging technologies like augmented reality and big data offer new possibilities for immersive learning. Sustainable and ethical AI use in education requires ongoing stakeholder dialogue to create and enforce best practices.

The findings from this bibliometric analysis highlight the dynamic and evolving nature of AI research in applied linguistics. The increasing trends in publications and citations, alongside identifying key influential studies and central themes, underscore the transformative potential of AI technologies in education. The interdisciplinary approach and focus on ethical considerations are crucial for ensuring that AI applications remain innovative and responsible. Future research should build on these foundational works, explore emerging technologies, and address new challenges. Interdisciplinary collaboration and international partnerships will be essential in advancing the field, fostering innovation, and developing effective and ethical AI applications that enhance language education and learning outcomes globally. By understanding these patterns and leveraging insights from influential studies and emerging trends, researchers, educators, and policymakers can guide the development of AI in applied linguistics, ensuring its positive impact on education and society.

Ethics Committee Approval: Not needed since there was no intervention or any experiment in the study
Informed Consent: There was no human participant in the study.
Peer-review: Externally peer-reviewed.
Author Contributions: Concept-EZ; Design-EZ/ZS; Supervision-ZS; Resources-EZ; Data Collection and/or Processing-EZ/ZS; Analysis and/or Interpretation-EZ; Literature Search-ZS; Writing Manuscript-ZS; Critical Review-ZS;
Conflict of Interest: The authors have no conflicts of interest to declare.
Financial Disclosure: The authors declared that this study has no financial support.

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Descriptive Content Analysis of Research on Cognitive Structures in Science Education in Turkey

Nesrin KIZMAZ[1]
Hasene Esra YILDIRIR[2]
[1] Mecidiye Şehitler Secondary School, Balıkesir, Turkey.

[2] Balıkesir University, Faculty of Necatibey Education, Department of Mathematics and Science Education, Balıkesir, Turkey.

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Corresponding Author: Hasene Esra YILDIRIR
E-mail: epoyraz@balikesir.edu.tr

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ABSTRACT

In this study, the trends of cognitive structure researches published in the field of science education in Turkey were identified. A descriptive analysis of 156 studies (113 articles, 34 postgraduate theses and 9 proceeding papers) published between 2003 and 2023 was carried out using document analysis method. These studies were accessed from the National Thesis Centre of the Council of Higher Education, articles published by Turkish researchers searched in national and international databases, and proceedings of national congresses/conferences/symposiums held in Turkey. In order to evaluate the studies, the publication classification form prepared for the subject area by making use of the literature was used. With this form, the distribution of the studies according to year, language of publication, place of publication, type of publication, subject of the study, research model, sample, research method, data analysis, results and recommendations were determined. Descriptive statistics and descriptive content analysis were used to present the analysis's findings. In this study, it was seen that many studies were conducted on cognitive structures in science education and these studies were concentrated between 2017-2020. It was determined that the studies mostly aimed to determine the cognitive structures of individuals with a subject, mostly qualitative research method was used and mostly Word Association Test (WAT) was used as a data collection tool. The most common conclusions drawn from the investigations were that the sample's cognitive structures were lacking and that they had misconceptions regarding the topic.

Keywords: Cognitive structure, content analysis, science education, word association test.

Introduction

Cognitive structures are the frameworks that allow information to be organized meaningfully, to form connections with one another, and to be accessed when needed (Ceylan, 2015). As Ausubel (1963) points out, the most critical factor in making new information meaningful and connecting it with previous knowledge is current cognitive framework of an individual (Ausubel, 1963; as cited in Khurshid & Iqbal, 2009). According to Gilbert and Watts (1983), cognitive structure is an assumption-based framework that represents the connections between the ideas we commit to long-term memory (as cited in Kurt & Ekici, 2013).

There are some ways for identifying cognitive structures. Flow maps (Selvi & Yakışan, 2005), concept maps (Ekinci & Şen, 2020), structured grid, V-diagram, concept cartoon (Bahar, 2003; Tsai & Huang, 2002), and word association test (WAT) (Baptista & Martins, 2023; Ercan et al., 2010; Yıldırır et al., 2020) are the most commonly used methods. By identifying cognitive structures, teachers can better understand students' learning difficulties and improve their instruction (Snow, 1989; as cited in Temel & Özcan, 2016). For this reason, researchers have undertaken studies aimed at determining cognitive structures and misconceptions, while investigating the effects of different teaching methods on them.

A review of the research regarding cognitive structures indicates that many national and international studies have been carried out. "Science Education" has been the subject of most of these studies (Bahar et al., 1999; Önel et al., 2023; Özatlı, 2006; Yıldırır & Demirkol, 2018). Furthermore, research has been conducted in the following areas: "Social Studies Education" (Aksoy, 2022; Saleh, 2022; Yeni, 2023); "Mathematics Education" (Tanışlı & Köse, 2013); "Turkish Education" (Yıldız & Yaman, 2017); "English Education" (Aslan, 2019; Ersanlı, 2016); "Basic Education" (Gündoğan & Gültekin, 2018; Yurtbay, 2022); and "Music Education" (Gerekten, 2018; Özaydın, 2022). These studies focused on determining the cognitive structure of a given subject (Aksoy, 2022; Bahar et al., 1999; Demirkaya et al., 2020; Ersanlı, 2016; Gündoğan & Gültekin, 2018; Önel et al.,

2023; Özatlı, 2006; Saleh, 2022; Tanışlı & Köse, 2013; Yeni, 2023; Yıldırır & Demirkol, 2018; Yıldız & Yaman, 2017; Yurtbay, 2022), identifying misconceptions (Ercan et al., 2010), examining the influence of teaching methods on cognitive structures (Doruk, 2015), and investigating the process of conceptual change (Ercan et al., 2010). In light of the studies conducted in line with these objectives; researchers found that alternative teaching methods caused positive changes in students' cognitive structures (Ercan et al., 2010), students' cognitive structures were not valid and they had alternative concepts (Ersanlı, 2016; Önel et al, 2023; Özaydın, 2022; Saleh, 2022; Yıldız & Yaman, 2017), that they lack knowledge about the subject (Ersanlı, 2016; Gündoğan & Gültekin, 2018; Özaydın, 2022; Yıldırır & Demirkol, 2018) and that they have sufficient level of knowledge about the subject but not many misconceptions (Aksoy, 2022; Gerekten, 2018; Tsai & Huang, 2002; Yeni, 2023; Yurtbay, 2022). Based on the research findings, studies on cognitive structures can be carried out across various subjects and with different participant groups (Aksoy, 2022; Ekinci, 2015; Ersanlı, 2016; Gündoğan & Gültekin, 2018; Yeni, 2023), new methods and techniques can be used in research (Özatlı, 2006; Özaydın, 2022; Tanışlı & Köse, 2013; Tsai & Huang, 2002; Yurtbay, 2022), qualified education can be given to prospective teachers (Gerekten, 2018; Yıldız & Yaman, 2017), lesson planning can be made by determining misconceptions (Yıldırır & Demirkol, 2018), interdisciplinary studies can be included (Kaya & Taşdere, 2016), and scientific knowledge should be included more in the curriculum (Önel et al., 2023; Saleh, 2022) has been proposed.

When the descriptive analysis studies related to the field of science education are examined, technology supported science education (Arduç, 2024; Fındık et. al., 2023; Ültay & Comardoğlu, 2021; Ünlü et al., 2024), adaptive learning environments in science education (Palta-Benek & Çirkinoğlu-Şekercioğlu, 2024), cooperative learning model in science education (Saygın, 2024), flipped learning model in Turkey (Karamete, 2024) and flipped learning model in science education (Ültay et al., 2023), learning cycle model (Oğuzman, 2023), student success in science education (Kara, 2023), brain-based learning in science education (Tosun & İlkörücü, 2023), computer-assisted instruction in science education (Şahin, 2021), science experiments conducted with pre-service teachers (Özkurt et al., 2023), scientific process skills in science education (Çevik & Kaya, 2021), affective variables for science course (Ültay & Sungur, 2019), associating science education with daily life (Ormancı & Çepni, 2018), qualitative studies in science education (Güven, 2014; Ültay & Aydın, 2017), trends in science education in Turkey (Kula-Wassink & Sadi, 2016), interdisciplinary studies in science education (Ültay et al., 2019) and science education for visually impaired students (Sözbilir et al., 2015) have been studied. There are studies in which theses and articles are examined together (Arduç, 2024; Oğuzman, 2023; Ormancı & Çepni, 2018; Saygın, 2024; Tosun & İlkörücü, 2023) as well as studies in which only theses (Bayraklı, 2019; Çevik & Kaya, 2021; Kaplan et al., 2022; Kara, 2023; Şahin, 2021) and only articles (Güven, 2014; Kula-Wassink & Sadi, 2016; Sözbilir et al., 2015) are examined. As a result of these examinations, no study was found for the descriptive analysis of cognitive structure studies for the subjects in science education neither nationally nor internationally. This study is expected to serve as a valuable resource for researchers investigating cognitive structures.

This study employed descriptive content analysis to demonstrate the classification of research on cognitive structures in the field of science education in Turkey from 2003 to 2023 by year, within the framework of many dimensions. In the field of science education, there are many studies investigating students' cognitive structures at international level (Tsai, 1999). However, it is seen that these studies started to be conducted in our country at the beginning of 2000s (Kaptan & Korkmaz, 2001). For this reason, in this study, screening was started to be carried out from the year 2000. As a result of the scanning, since it was seen that there were cognitive structure studies on science subjects since 2003, the date range in this study was determined as 2003-2023. In the research, answers to the following questions were sought. For studies on cognitive structures in science education in Turkey;

1. How is the distribution according to the type of scientific publication?
2. How is the distribution by years?
3. How is the distribution according to the university, journal and congress in which it was published?
4. How is their distribution according to their objectives?
5. How is the distribution according to the research model?
6. How is the distribution of the sample and sample size?
7. How is the distribution according to the research topic?
8. How is the distribution according to the data collection method?
9. How is the distribution according to data analysis methods?
10. How is the distribution according to the most important results?
11. How is the distribution according to the suggestions?

Method

Research Model

This study is based on the document analysis method, which includes the analysis of written and printed materials (Yıldırım & Şimşek, 2016). Documents include documents and pictures that are recorded without the contribution of the researcher. The types of documents that can be used in research are books, journals, diaries, maps, newspapers, artworks, invitations, survey data, public records, etc., and provide information to researchers (Labuschagne, 2003; cited in Kıral, 2020).

Data Collection

Between 2003 and 2023, master's and doctoral theses related to cognitive structure in science education, proceedings of national-international congresses/conferences/symposiums held in Turkey, and studies identified through different search engines were collected as a result of literature research conducted within a period of approximately one year. Research data were obtained through the YOK National Thesis Center, the ERIC database, the Google Academic search engine, and TUBITAK ULAKBIM DergiPark.

The studies used in the research were required to be thesis, article or paper. The keywords "cognitive structure, cognition, cognitive perception, and cognitive structure" were searched in the databases. As a result of the search with key words, a total of 259 studies were reached. Of these studies, 14 were excluded from the scope of the review because they were conducted in the fields of mathematics education, 48 in history and geography education, six in Turkish education, two in English education, 12 in educational sciences, nine in tourism and finance, four in information technologies, and six in music education. The remaining 158 studies were included in the study since they were conducted in the field of science education. However, since the full text of two of these studies could not be accessed, the research was limited to 156 studies. Studies that were inaccessible or whose full texts were not available were excluded.

The ethical process in the study was as follows:

- Ethics Committee Approval: Since this study was a review study and did not involve any application on humans or animals, it did not require ethics committee approval. However, ethical guidelines were followed throughout the study.
- Informed Consent: Informed consent was not obtained as this was a review study.

Data Analysis

Data was created using a classification form. The study classification form created by Sözbilir et al. (2012) was utilized in the production of this form, which was organized based on the issue under investigation. The forms were used to categorize the studies on cognitive structures based on variables such as year, research model, sample type, sample size, data collection tool, data analysis method, result, and recommendation. In the descriptive content analysis, especially in the analysis of the purpose, reasons, results, and recommendations of the studied studies, creating a code pool in accordance with the qualitative analysis approaches and using the appropriate thematizing/categorization method will ensure that the descriptive content analysis studies are enriched in terms of quality (Ültay et al., 2021). During the analyses, more than one marking was made for some variables. For example, it was seen that some of the studies investigated more than one purpose, and more than one marking was made in the frequency table related to the purpose. For this reason, the total frequency value is higher than the total number of studies, and the frequency values in the tables do not express the number of studies.

Validity and Reliability

Sources were randomly selected as 20% from each data group. Accordingly, 32 studies (23 articles, seven postgraduate theses, and two papers) were evaluated and classified by two researchers who have research in this field. Cohen's Kappa (Cohen's Kappa Coefficient) value was calculated to ensure the reliability between the two assessors. The calculated Cohen's Kappa (κ) was found to be .94. This value indicates a high level of agreement (Landis & Koch, 1977).

Results

In the study, 156 studies were analysed to answer the sub-problems. The analysed data were coded following the themes, and their percentages, frequencies, total percentages, and total frequencies according to years are given in the tables below.

Results Concerning the First Sub-Problem

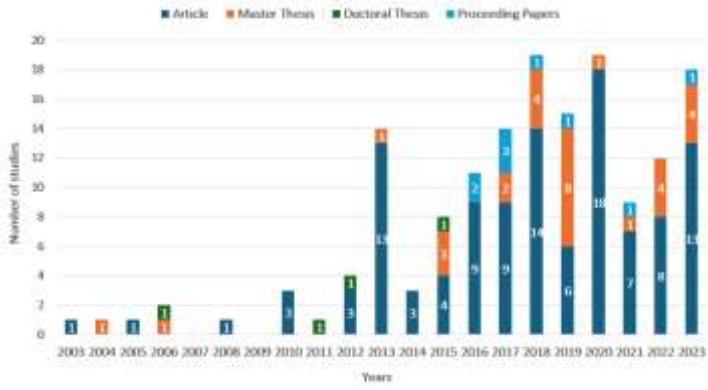
In light of the analyses related to the research's first sub-problem, 113 (72.4%) studies in article format, 30 (19.2%) in master's degree format, 4 (2.6%) in doctoral thesis format and nine (5.8%) in proceedings format were published in Turkey between 2003 and 2023. 48 articles were published in national journals and 65 articles were published in international journals.

Results Related to the Second Sub-Problem

The findings related to the second sub-problem of the research are displayed in Figure 1. When Figure 1 is examined, it is seen that the most studies on cognitive

structures were conducted in 2020, while no studies were conducted in 2007 and 2009. Looking at the type of studies, it is understood that articles were conducted in 2020, master's theses in 2019, and papers in 2017 with the highest rate.

Figure 1.
Classification of Studies by Year



Results Concerning the Third Sub-Problem

The findings related to the third sub-problem of the research are presented below.

When Table 1 and Table 2 are analysed, it is seen that 65 articles were published in international journals and 48 articles were published in Turkish journals. The journal with the highest number of articles published in Turkey was "Necatibey Faculty of Education Electronic Journal of Science and Mathematics Education" with six articles. The journal with the highest number of articles published internationally was 'Educational Research and Reviews' with five articles.

It is seen that the theses examined within the scope of the study were carried out in various universities in Turkey. When the distribution of these according to universities is analysed, it is determined that Necmettin Erbakan University is the institution that contributes the most, with nine theses. This is followed by Balıkesir University (five theses), Niğde Ömer Halis Demir University (four theses), and Hacettepe University (three theses). While Uludağ University is represented with two theses, Gazi University, Abant İzzet Baysal University, Uşak University, 19 Mayıs University, Kırıkkale University, Mersin University, Aydın Adnan Menderes University, Erzincan Binali Yıldırım University, Alaaddin Keykubat University, Süleyman Demirel University, and Sakarya University have one thesis each.

Table 1.
Classification of Journals in Which Articles Were Published in Turkey

Journals	(*f*)
Necatibey Faculty of Education Electronic Journal of Science and Mathematics Education	6
Journal of Inonu University Faculty of Education	3
Turkish Journal of Science Education	2
Journal of Dicle University Ziya Gökalp Faculty of Education	2
Turkish Studies (Electronic)	2
Kastamonu Education Journal	2
Yüzüncü Yıl University Journal of Faculty of Education	2
Abant Izzet Baysal University Journal	1
Journal of Ahi Evran University Kırşehir Faculty of Education	1
Hacettepe University Journal of Faculty of Education	1
Gazi University Journal of Faculty of Education	1
Journal of Science Teaching	1
Turkish Journal of Social Research	1
Journal of Amasya University Faculty of Education	1
Ekev Academy Journal	1
E-International Journal of Educational Research	1
Mustafa Kemal University Journal of Institute of Social Sciences	1
Electronic Journal of Social Sciences	1
Estüdam Education Journal	1
Journal of Education and Training Research	1
Anemon Mus Alparslan University Journal of Social Sciences	1
Baskent University Journal of Education	1
Pamukkale University Journal of Faculty of Education	1
Journal of Ağrı Chechen University Graduate School of Social Sciences	1
Third Sector Journal of Social Economy	1
Manas Journal of Social Research	1
Journal of Scientific Research in Turkey	1
Osmangazi Journal of Education Research	1
Gumushane University Institute of Social Sciences Electronic Journal	1
Çukurova University Journal of Faculty of Education	1
Adıyaman University Journal of Educational Sciences	1
Western Anatolian Journal of Educational Sciences	1
Uşak University Journal of Educational Research	1
Erzincan University Journal of Faculty of Education	1
Mevzu Journal of Social Sciences	1
Trakya Education Journal	1
Total	48

Table 2.
Classification of Journals in Which Articles were Published Abroad

Journal	(f)
Educational Research and Reviews	5
Chemistry Education Research and Practice	4
International Education Studies	3
Journal of Turkish Science Education	3
European Journal of Physics Education	2
Universal Journal of Educational Research	2
The Eurasia Proceedings of Educational and Social Sciences	2
Journal of Education and Training Studies	2
Journal of Qualitative Research in Education	2
Journal of Science Learning	2
International Council of Association for Science E.	2
Journal of Baltic Science Education	2
Educational Sciences: Theory and Practice	1
Eurasian Journal of Physics and Chemistry Edu.	1
American-Eurasian Journal of Agricultural & Environmental Sciences	1
Global Journal of Education Research	1
Creative Education	1
International Online Journal of Educational Sci.	1
International Journal of Research in Teacher Edu.	1
International Electronic Journal of Environmental	1
Journals of Education Sciences Research	1
Elementary Education Online	1
Journal of Education and Practice	1
International Journal of Human Sciences	1
European Journal of Education Studies	1
Journal of Education and Future	1
International Journal of Education Science and Technology	1
Higher Education Studies	1
World Journal of Education	1
Asian Journal of Education and Training	1
International Journal of Society Researches	1
The Journal of International Social Research	1
International Journal of Research in Education and Science	1
Online Journal of Mathematics, Science and Technology Education	1
Jurnal Penelitian Dan Pembelajaran Ipa	1
International Journal of Curriculum and Instruction	1
International Journal of Progressive Education	1
Acta Didactica Napocensia	1
Ibad Journal of Social Sciences	1
Shanlax International Journal of Education	1
Journal of Biological Sciences and Health	1
International Journal of Science Education	1
Jurnal Ilmıah Peuradeun	1
Science Education International	1
International Journal of Social, Humanities and Administrative Sciences	1
Journal of Individual Differences in Education	1
Total	65

Within the scope of this study, it was seen that the proceedings analyzed related to cognitive structures were presented in six different congresses. When the distribution of the proceedings according to the congresses is studied, it is seen that the highest participation rate is IV. International Eurasian Educational Research Congress (34%). This was followed by the III. International Eurasian Educational Research Congress (22%) and the 12th National Science and Mathematics Education Congress (11%). XVI. International Congress of Educational Research, AIP Conference Proceedings, and International Congresses on Education are equally represented (11%). This distribution shows that research on cognitive structures is particularly concentrated in Eurasian Congresses on Educational Research.

Results Concerning the Fourth Sub-Problem

Table 3 presents the findings pertaining to the fourth sub-problem of the study.

A review of Table 3 reveals that the researches was carried out for seven reasons: "to determine cognitive structure about a subject, to examine the impact of teaching strategies on cognitive structure, to determine misconceptions, to identify the cognitive structure and examine its permanence, to compare cognitive structure at different grade levels, to observe concept change, to investigate the structural and descriptive properties of cognitive structures, and to compare cognitive structures according to gender.". It was determined that 91 of the articles, 23 of the theses, and seven of the papers conducted research to "determine the cognitive structures of the participants about a subject.". This purpose was the most common purpose in the studies. In the second place in the articles, cognitive structure studies were carried out for the aim of "determining misconceptions" (f=13) and "examining the impact of instructional methods on cognitive structure" (f=13). Secondly, the researchers' goal in the theses was to examine how teaching methods affect cognitive structure. The aim of "investigating the structural and descriptive properties of cognitive structures" in articles, the aim of "comparing cognitive structures at different grade levels" in theses, and the aim of "determining misconceptions in papers" in dissertations emerged at the lowest rate.

Table 3.
Classification of Studies According to Their Purposes

Objective	Article (*f*)	Thesis (*f*)	Proceedings (*f*)	Total (*f*)
To determine cognitive structure about a subject.	91	23	7	121
To examine the impact of teaching strategies on cognitive structure.	13	6	-	19
To identify misconceptions.	13	5	2	20
To identify the cognitive structure and examine its permanence.	4	-	-	4
To compare cognitive structure at different grade levels.	3	1	-	4
To observe concept change.	-	2	-	2
To investigate the structural and descriptive properties of cognitive structures.	1	-	-	1
To compare cognitive structures according to gender.	-	1	-	1
Total	125	38	9	172

Results Concerning the Fifth Sub-Problem

Table 4 presents the findings pertaining to the fifth sub-problem of the study.

Table 4.
Classification of Studies According to Research Method

Method-Pattern		Article (*f*)	Thesis (*f*)	Proceedings (*f*)	Total (*f*)
Quantitative	Survey	10	4	-	14
	Experimental	8	6	-	14
	Descriptive	3	5	-	8
	Correlational	1	-	-	1
	Total	**22**	**15**	**-**	**37**
Qualitative	Unspecified	29	4	-	33
	Case study	23	4	2	29
	Survey	11	-	-	11
	Phenomenology	10	1	1	12
	Action Research	1	-	-	1
	Descriptive Research	-	3	6	9
	Total	**74**	**12**	**9**	**95**
Mixed	Unspecified	15	6	-	21
	Explanatory	2	1	-	3
	Total	**17**	**7**	**-**	**24**
General Total		**113**	**34**	**9**	**156**

Analysis of Table 4 reveals that the qualitative research approach is most frequently used in articles and proceedings (*f*=74 and *f*=9, respectively), whereas the quantitative approach is most frequently used in theses (*f*=15). It was revealed that the number of quantitative (f=22) and mixed (f=17) research articles was close to each other, while the number of qualitative research (f=12) was higher than mixed research (f=7) in theses. Among the studies carried out with the quantitative research method, most of the studies in article-type publications were conducted in survey design (*f*=10) and most of the studies in thesis-type publications were conducted in experimental design (*f*=6). It was observed that the research design was not mentioned in 29 of the article-type publications with the highest rate among the studies conducted with the qualitative research methods. It was revealed that four of the thesis-type publications in which qualitative research was conducted were case studies, and four other studies did not specify the research design. In proceedings, it was determined that six studies were carried out with a descriptive design, two studies were carried out with a case study, and one study was carried out with a phenomenological design. When all studies are evaluated, it is seen that most studies were conducted with qualitative research methods (*f*=95). When all studies are evaluated, it is seen that most studies were conducted with qualitative research methods (*f*=95).

Results Concerning the Sixth Sub-Problem

The sixth sub-problem of the study is 'How are studies conducted on cognitive structures in science education in Turkey distributed according to sample group and sample size?'

When the sample groups of the studies are examined, it is seen that 64 of the publications in the article type studied with undergraduate students, 13 of the publications in the thesis type, and 4 of the publications in the paper type studied with secondary school students as the sample group. In thesis-type publications, high school students (f=9) ranked second. While high school (f=2) and undergraduate students (f=2) were the second most studied group in proceedings, secondary school students were the second most studied group in articles with 26 studies. There are also studies in which several sample groups are used together. In four articles, three theses, and one proceeding, different sample groups were used together.

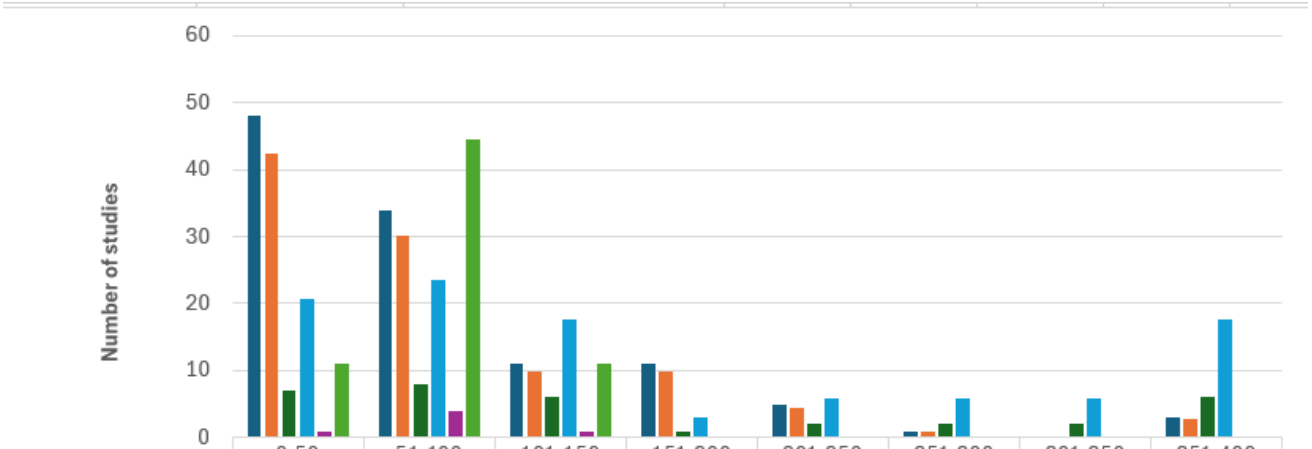
When the studies were analysed, while all of the articles and theses gave information about the sample size, three out of nine proceedings did not give information about the sample size. The data of the studies giving information about sample size are given in Figure 2. It is evident from Figure 2, which lists sample sizes, that the majority of the research are conducted using sample sizes ranging from 0 to 50 to 51 to 100.

Results Concerning the Seventh Sub-Problem

Table 5 presents the findings pertaining to the seventh sub-problem of the study. When Table 5 is analysed, it is seen that cognitive structure studies in articles (*f*=63), theses (*f*=19) and proceedings (*f*=4) are mostly related to biology subject area. In articles, chemistry (*f*=19), physics (*f*=14), other subject areas (*f*=9) and science education and training (*f*=8) followed. In theses, chemistry (*f*=8), physics (*f*=5) and science education and training (*f*=2) are the subject areas respectively. In the proceedings, while two studies were related to physics and other subject areas, only one study was found to be related to chemistry subject area.

Figure 2.

Classification of the Size of the Samples in the Studies



	0-50	51-100	101-150	151-200	201-250	251-300	301-350	351-400
Article (f)	48	34	11	11	5	1	0	3
Article (%)	42.48	30.09	9.73	9.73	4.42	0.88	0.00	2.65
Thesis (f)	7	8	6	1	2	2	2	6
Thesis (%)	20.59	23.53	17.65	3	5.88	5.88	5.88	17.65
Proceedings (f)	1	4	1					
Proceedings (%)	11.11	44.44	11.11					

Table 5.
Classification of Studies According to Their Subjects

	Subject area	Article (f)	Thesis (f)	Proceedings (f)	Total (f)
Physics	Physical phenomena	8	-	-	8
	Energy	4	2	1	7
	Astronomy	2	-	1	4
	Light and sound	-	2	-	2
	Friction force	-	1	-	1
	Total	**14**	**5**	**2**	**22**
Biology	Life science	12	-	-	12
	Cycles of matter	4	-	-	4
	Blood	4	-	-	4
	Systems	4	4	-	8
	Plants	4	-	1	5
	Cell	16	1	-	17
	Genetics	6	3	1	10
	Ecology	13	10	2	16
	Our food	-	1	-	1
	Total	**63**	**19**	**4**	**86**
Chemistry	Matter and change	15	6	-	21
	Stereochemistry	1	-	-	1
	Kinetic-equilibrium	1	-	-	1
	Periodic table	1	-	-	1
	Quantum numbers	1	-	-	1
	Acid-Base	-	1	-	1
	Gases	-	1	-	1
	Heat and temperature	-	-	1	1
	Total	**19**	**8**	**1**	**28**
Science education and teaching	Science self-efficacy/ attitude	-	1	-	1
	Basic physics, chemistry, biology concepts	1	-	-	1
	STEM	4	1	-	5
	Argumentation	1	-	-	1
	Micro teaching	1	-	-	1
	Classroom management	1	-	-	1
	Total	**8**	**2**	**-**	**10**
Other	Technology	2	-	-	2
	The nature of science	1	-	-	1
	Self-regulation	1	-	-	1
	Science	1	-	-	1
	Innovation	1	-	-	1
	Life skills	1	-	-	1
	Educational game	1	-	-	1
	School	1	-	-	1
	Physics teacher concept	-	-	1	1
	Science centre concept	-	-	1	1
	Total	**9**	**-**	**2**	**11**
	General Total	**113**	**34**	**9**	**156**

Among the most studied topics by biology subject area, 'cell' (f=16) is the focus in articles, while 'ecology' is prominent in theses (f=10) and proceedings (f=2). In the subject area of chemistry, "matter and change" was mostly studied in articles (f=15) and theses (f=6), and "heat and temperature" was studied in only one proceeding. In the subject area of physics, "physical events" (f=8) in articles, "energy" (f=2) and "light and sound" (f=2) in theses, "energy" (f=1) and "astronomy" (f=1) in proceedings were studied. It was observed that articles and theses were conducted on "science education and training" and cognitive structure research was mostly conducted on the subject of STEM. When the subjects collected under the title of "other" were analysed, it was determined that

"technology" subject was studied more and the frequency of other subjects was the same.

Results Concerning the Eighth Sub-Problem

Table 6 presents the findings pertaining to the eighth sub-problem of the study.

Table 6.

Classification of Studies According to Data Collection Tool

Data Collection Tool	Article (f)	Thesis (f)	Proceedings (f)
WAT	100	26	9
DWT	31	6	3
Concept map	6	5	-
Written expression	6	-	-
Interview	5	4	-
Metaphor	4	4	-
Survey	3	1	-
Knowledge/ Achievement test	3	8	-
Flow map	2	1	-
Thinking aloud	1	1	-
V diagram	1	1	-
Structured grid	1	1	-
Concept cartoon	1	3	-
Concept inventory	1	-	-
Attitude scale	1	4	-
Mind maps	1	-	-
Open-ended question	-	6	-
Free writing	-	2	-
Concept test	-	1	-
Reflective diaries	-	1	-
Model	-	1	-
Total	167	76	12

Table 6 shows that WAT was the most frequently used data collection tool across all study categories, followed by DWT (f=31, f=6, f=3), concept map (f=6, f=5) and written expression (f=6).

Results Concerning the Ninth Sub-Problem

Table 7 presents the findings pertaining to the ninth sub-problem of the study.

When Table 7, which is the distribution table of the data analysis methods used in the studies, it is seen that descriptive analysis (f=83), descriptive statistics (f=19) and content analysis (f=8) are mostly used in articles, theses and proceedings, respectively. This is followed by content analysis in articles and theses (f=58; f=13) and descriptive analysis in proceedings (f=1), respectively.

Table 7.

Classification of Studies According to Data Analysis Method

Data Analysis Method		Article (f)	Thesis (f)	Proceedings (f)
Quantitative	Descriptive statistics	4	19	-
	Predictive statistics	-	1	-
Qualitative	Descriptive analysis	83	5	1
	Content analysis	58	13	8
Quantitative + Qualitative		4	3	-
Total		149	41	9

Results Concerning the Tenth Sub-Problem

Table 8 presents the findings pertaining to the tenth sub-problem of the study. When Table 8 is examined, 12 result statements were determined in the studies related to cognitive structure. In all of the studies, the result that the participants' cognitive structures related to the subject studied were weak was the highest. This result was reached in 71 article-type studies, 24 thesis type studies and seven proceedings. Secondly, in 21 articles, and 12 thesis-type studies, it was concluded that alternative teaching methods for the subject positively affected the cognitive structures of the students. Apart from this, it was observed that there were three different results in proceedings-type studies.

These results are that teaching methods affect the cognitive structures of students; WAT is the most effective tool in determining cognitive structures, and the cognitive levels of high school students in the studies about the concept of physics teacher are sufficient.

Results Concerning the Eleventh Sub-Problem

The eleventh sub-problem of the research was expressed as "How is the distribution of the studies on cognitive structures in the field of science education in Turkey according to their suggestions?

Table 8.
Classification of Studies According to the Most Important Results

Results	Article (f)	Thesis (f)	Proceedings (f)	Total (f)
Participants' cognitive structures related to the subject are weak.	71	24	7	102
Alternative teaching methods for the subject positively affect students' cognitive structures.	21	12	1	34
The participants' prior knowledge caused differences in their cognitive structures.	10	8	-	18
Participants' cognitive structures towards technology are at low level.	4	-	-	4
Compared to other data collection tools, WAT is an effective method in determining cognitive structure.	3	3	1	7
Lessons in the laboratory positively affected the development of cognitive structure.	2	1	-	3
Students have more developed cognitive structures about the word "BİLSEM" and parents have more developed cognitive structures about the word "school".	1	-	-	1
Students at various levels—secondary, high school, and undergraduate—had comparable cognitive processes.	1	1	-	2
It was determined that the participants could not establish a relationship between science and engineering.	-	1	-	1
Participants' cognitive structures related to the subject are at a sufficient level.	-	12	1	13
Total	113	62	10	185

When the suggestions from the studies were analysed to address the sub-problem, it was found that these suggestions are categorised under four headings (Suggestions for future research, suggestions for teacher education, suggestions for classroom teaching and suggestions for measurement and evaluation). In article (f=52) and thesis-type studies (f=58), most of the suggestions were made for future researches, while in proceedings-type publications, most of the suggestions were made for classroom teaching (f=5). Researchers suggested that cognitive structure studies can be repeated using different methods and different sample groups for future research. Moreover, it was suggested that conceptual teaching of pre-service teachers should be given importance and courses on cognitive structure should be added to education programs. It was mentioned in the recommendations for in-class instruction that by selecting various subject-related teaching strategies, the alteration in cognitive structures may be examined. Lastly, the need to employ various measuring instruments to improve the dependability of the research was emphasized in the recommendations for measurement and evaluation.

Discussion

This study conducted a descriptive analysis of theses, proceedings, and articles on cognitive structures in science education in Turkey from 2003 to 2023. Research on cognitive structure in science education was conducted mostly between 2016 and 2023, with the greatest number of studies (f=19) occurring in 2018 and 2020 and the fewest (one each) in 2003, 2004, 2005, 2008, and 2011. The study's findings showed that no research was conducted in 2007 or 2009. Therefore, the rise in research over the past seven years can be interpreted as a sign that the topic of cognitive structure is becoming increasingly significant. Simultaneously, it is anticipated that research in the area of scientific education will become more significant over time and that there will be more studies in the upcoming years.

When the types of studies were analysed, it was seen that there were more studies in article type. In thesis type studies, it was determined that doctoral theses were less. Özkul (2023) reached the same result in his study with mental model applications. There are fewer studies on thesis and paper kinds, which could be because graduate school involvement in science education is low nationwide (Tosuntaş et al., 2019). Moreover, the reason for this situation may be that, as Dağ and Horzum (2022) state, although the number of universities offering master's

programmes in Turkey is quite high, the number of universities offering doctoral education is more limited.

Analysis of the papers' distribution by the periodicals in which they were published revealed, it was seen that more studies were sent to journals publishing abroad (f=65) than to journals publishing in our country (f=48). For this reason, in the examination of the publication language of the studies, it was determined that the most studies were in English (41.67%). Among these journals, "Educational Research of Reviews" has the highest number of publications with five studies. The journal with the highest number of publications in Turkey was Necatibey Faculty of Education Electronic Journal of Science and Mathematics Education with six studies. This shows that researchers in Turkey prefer international journals. In terms of the distribution of thesis studies by the universities where they were published, Balıkesir University came in second with five studies and Necmettin Erbakan University first with six. In the type of paper, the congress where the most studies were presented was Pamukkale University IV. International Eurasian Education Studies Congress with three studies.

Most of the studies (55.13%) were in the biological discipline, according to an analysis of the research subjects. The other topics were "Physics", "Chemistry", "Biology", "Science education and teaching" and "Other". According to subject areas, 'Physical Events' (36.36%) in Physics, 'Cell' (22.08%) in Biology, 'Matter and Change' (75%) in Chemistry, 'STEM' (50%) in Science Education, and 'Technology' (18.18%) in the 'Other' category are the prominent topics.

It was found that the majority of research on cognitive structures in science education focused on identifying misconceptions (11.63%), assessing the impact of teaching methods on cognitive structure (11.05%), or determining cognitive structure about a subject (70.35%). It is crucial to try to ascertain the learner's cognitive structure in educational research, particularly in scientific education (Tsai, 1999), and to create instructional strategies that take this into consideration (Tsai & Huang, 2002). Learners' misconceptions and learning challenges can be identified by analysing their cognitive structures (Jonassen, 1987; Varoğlu et al, 2020). Educators will then be able to plan what has to be done to enhance students' learning experiences.

It was observed that case studies, one of the qualitative research methodologies, were primarily favoured in the publications on cognitive structure in science education. In theses, quantitative and qualitative methods were used together, but experimental design from quantitative methods was given more weight. The reason why experimental studies are more preferred is that researchers have the opportunity to conduct comprehensive and long-term research in thesis type studies. Such studies are widely preferred because they focus on determining the effect of a particular teaching approach on the change in students' cognitive structures, especially by using experimental methods in one or two semesters. All of the proceedings were carried out according to qualitative method. While there are more quantitative studies in other educational researches (Göktaş et al., 2012; Selçuk et al., 2014), qualitative method is at the forefront in cognitive structure studies. In qualitative studies, detailed information is obtained by using many data collection tools. In cognitive structure studies, data collection tools such as WAT, concept map, flow map, paired interviews and DWT are used to reveal students' cognitive structures. With these tools, mis associated concepts in students' minds and the misconceptions they have accordingly are revealed. The data obtained from these tools can be evaluated together in accordance with the nature of qualitative research. The detection of misconceptions requires a detailed and in-depth analysis process. Data collection tools used in qualitative research methods provide rich and detailed data to understand students' misconceptions (Jamaludin & Maat, 2020). Therefore, it can be thought that the more frequent preference of qualitative research methods in articles and papers is related to this situation. It is recommended in the literature that more qualitative research be done in studies that use descriptive analysis (Kula-Wassink & Sadi, 2016). It is stated that different research methods should be used in educational research due to the nature of teaching systems (Driscoll, 1995; Göktaş et al., 2012).

When sampling types were analysed in the studies, it was determined that convenience sampling was mostly preferred. Similarly, it is seen that the most preferred sampling types in the literature are purposive and convenience sampling (Şimşek et al., 2008). The reason for this situation may be that the analysed studies were mostly conducted with qualitative research method and case study. Convenience sampling favours smaller sample sizes.

Secondary school students are the most favoured sample group in theses and dissertations, but undergraduate students (64 pre-service teachers) are the most favoured sample group in articles. The preference for pre-service teachers as the primary sample group in the articles may stem from the researchers' goal to explore the cognitive structures of future teachers and to design instruction to

address any misconceptions. The reason why secondary school students were mostly selected in theses and proceedings can be considered as the fact that the science curriculum includes the teaching of concepts that form the basis for the following levels. Groups of fewer than fifty people were the most frequently explored in the examined papers when it came to sample size, however groups of up to 300 persons were more preferred in theses. Comparing the papers by sample size revealed that groups of fewer than 100 people were studied. This is believed to be because the articles and papers under review have fewer than 50 and 100 samples, the WAT and DWT are primarily employed as data collection instruments, and the research is primarily conducted using the qualitative research approach.

It was found that practically all of the research on cognitive structure in scientific education used WAT as a data gathering technique. We can conclude that WAT is an effective data collection tool in determining cognitive structure (Önal, 2017). The DWT was seen to be the most popular instrument in the investigations, following the WAT. With this technique, participants can express what they cannot express with words by drawing (Nergiz, 2022). It was noted that the research lacked details regarding the reliability and validity of the instruments used to collect the data. Akdemir and Kılıç (2021), who analysed 187 articles prepared with a qualitative approach, similarly determined that there were no findings on validity and reliability in some of the articles they examined. The ability of researchers to prove the validity and dependability of their findings is one factor that determines the worth of a scientific study (Arslan, 2022, p. 396). Because of this, researchers will improve the quality of their work if they describe how they guarantee validity and reliability in their studies, whether they are quantitative or qualitative. In addition, incomplete information in the method section of the studies poses a threat to validity and reliability. In order to avoid inadequate methods and lack of information, it is extremely important for graduate students to carry out data collection, data analysis and research report writing processes by researching a certain problem in the "scientific research methods and ethics" course. In order to increase the quality of research, faculty members should manage the process well by guiding graduate students.

Examining the data analysis techniques revealed that while most research used multiple analysis techniques, descriptive analysis was the most often employed. This may be due to the fact that qualitative research methods are mostly used in the studies on cognitive structures. It was found that the majority of quantitative research was analysed using descriptive and predictive analysis, whilst qualitative studies were analysed using descriptive and content analysis.

In general, it was determined that the results of articles, theses and proceedings were similar to each other. The participants' cognitive structures were found to be weak once the study's results were analysed. In addition, it was found that alternative teaching methods positively affected the cognitive structures of the participants. In the light of these results, it is recommended that researchers conduct further research to develop teaching strategies that enable students to have a stronger cognitive structure.

Conclusion and Recommendations

This study identified the trends of cognitive structure research published in the science education field in Turkey. A descriptive analysis of 156 studies published between 2003 and 2023 was carried out using document analysis method. This study determined that the number of studies on cognitive structure in science education increased between 2016 and 2023 in Turkey and that most studies were conducted in 2018 and 2020. The majority of these studies are in the article type and the number of doctoral theses was found to be less. It was determined that researchers in Turkey prefer international journals more; the most published international journal was Educational Research of Reviews, and in Turkey, Necatibey Faculty of Education Electronic Journal of Science and Mathematics Education. Within the scope of the analysed studies, it was determined that cognitive structure research was mostly conducted in the field of biology. It was observed that most of the studies focused on determining the cognitive structures of the participants about a subject. It was determined that the most commonly used method in the analysed studies was case study and WAT was used as a data collection tool. In the light of the findings obtained, it was revealed that secondary school students were mostly selected as the sample in the theses and undergraduate students (teacher candidates) were selected as the sample in the articles. In addition, it was determined that descriptive analysis method was used in most studies on cognitive structure. According to the results of the analysed studies, it was determined that the cognitive structure of the participants was weak and alternative teaching methods positively affected the cognitive structure. In the cognitive structure studies, it was seen that most of the suggestions for future research were made in the form of "cognitive structure studies can be repeated using different methods and different sample groups".

Educators can have information about students' prior knowledge and metacognition when they investigate their cognitive structures (Tsai & Huang, 2002). The studies

reviewed show that students can develop a meaningful and accurate cognitive structure related to the subject in inquiry-based, research-based, and collaborative learning environments. Therefore, to support and develop students' cognitive structures, it is crucial to organize and develop learning environments, curricula, instructional materials and activities, and textbook contents (Yıldırır & Kızmaz, 2024). Learning will be more successful if the weaknesses in students' subject-related cognitive structures are recognized, and a teaching strategy is implemented accordingly.

In this study, the trends of cognitive structure studies published in the field of science education in Turkey were identified. However, cognitive structure studies are not limited to Turkey. A descriptive content analysis of the studies investigating the cognitive structures of participants in Physics, Chemistry, Biology and Science subjects in the international arena will provide a broader perspective on cognitive structure studies. Thus, in the future, comparative analyses can be carried out by focusing on studies conducted in different countries. Examining similar studies conducted at the international level will contribute to a better understanding of the general approaches in education by revealing the global trends of cognitive structure studies.

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Current Trends in Teacher Education Research: A Thematic and Content Analysis of Articles Published in SSCI Q1 Indexed Journals

Fatih KARATAŞ[1]

[1] Nevsehir Haci Bektas Veli University, School of Foreign Languages, Department of Modern Languages. Nevsehir, Türkiye

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Corresponding author:
Fatih KARATAŞ.
E-mail: fatih.karatas@nvsehir.edu.tr

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ABSTRACT

Focusing on identifying current research trends and methodological approaches in teacher education, this study conducted content and thematic analysis of articles published in Web of Science Social Sciences Citation Index (SSCI) Q1 journals in 2024. The research examined 454 articles from 11 different journals using document analysis technique. Data were analyzed using Braun and Clarke's six-phase thematic analysis method. The findings revealed nine major themes in teacher education research. Among these, 'teacher professional development' emerged as the most comprehensive research area, followed by 'teaching profession and employment dynamics,' 'teacher beliefs, attitudes, and emotions,' 'teacher identity and roles,' and 'teaching practices'. Research results indicate that teacher education studies prioritize professional development processes, identity formation, employment, emotional factors, and classroom practices, while education policies, curriculum design, and student development receive relatively less attention. From a methodological perspective, qualitative research was predominant (58.81%), followed by quantitative (26.43%), theoretical/review (9.25%), and mixed methods studies (5.51%). In terms of participant profiles, in-service teachers (33.70%) and pre-service teachers (26.43%) were the most prominent. Overall, the research demonstrates that micro-level themes receive more attention than macro-level issues in teacher education, methodological diversity remains limited, and participant groups are predominantly restricted to teachers. These findings suggest a need for more comprehensive research approaches in teacher education that incorporate macro-level issues, greater methodological diversity, and broader participant inclusion beyond the teaching profession.

Keywords: Teacher education, research trends, thematic analysis, Web of Science, SSCI

Introduction

Teacher education research plays a critical role in addressing the contemporary challenges of educational systems and is considered a fundamental element in improving teacher preparation and professional development processes. Today, teacher education is regarded as a dynamic field that requires continuous investigation and updating due to the influence of technological advancements, globalization, changing student profiles, and new pedagogical approaches. In addition, it has demonstrated significant progress in recent years with increasing methodological diversity and expanding theoretical perspectives. Studies in this field have undergone various paradigmatic stages, conceptualized as a program issue (1920-1950), an education issue (1960-1980), a learning issue (1980-2000), and, more recently, a policy issue (Cochran-Smith & Villegas, 2014; Yücel-Toy, 2015). This transformation is characterized by a distinct shift from traditional approaches to more collaborative, reflective, and practice-oriented approaches (Avalos, 2011; Ball, 2013; Baumfield et al., 2022). Consequently, the scope of teacher education research has expanded to encompass various areas, such as curriculum concerns, theory-practice relationships, identity formation, and responsiveness to current developments and changes (Åkerlind, 2008; Ball, 2013). In a broader perspective, it can be said that teacher education research has extended to address current issues such as the integration of technology in the classroom and inclusive education skills, while also addressing teachers' professional identities, emotional well-being, and reflective practices (Grossman & McDonald, 2008; Hart et al., 2018).

Research in the field of teacher education has also demonstrated methodological diversity in recent years. While qualitative methods have long been dominant, the increasing use of quantitative and mixed-methods approaches offers the opportunity to reveal the multidimensional nature of teacher development processes in a more detailed manner (Bond, 2024; Borko et al., 2007; Zawacki-Richter & Naidu, 2016). Supporting this

view, Livingston and Flores (2017) found that qualitative approaches (47.7%) were more prevalent than quantitative (16.9%) and mixed-methods studies (35.5%). Furthermore, Borko et al. (2007) categorized teacher education research into four main categories: research on the effects of teacher education, interpretive research, practitioner research, and design research. However, König et al. (2023) state that, beyond the considerable methodological diversity, research in the field either lacks clear theoretical frameworks or fails to adequately connect findings to theoretical foundations.

Beyond methodological diversity, prominent themes frequently addressed in current research include teacher beliefs/cognition (Pipere et al., 2015; Yüksel, 2019), reflective practice (Bener & Yildiz, 2019; Gülden, 2020), teacher identity development (Dang, 2013; Trent, 2015), and mentoring practices (Koç, 2012). Furthermore, it is noteworthy that technology integration has become a significant focus in teacher education research. Quintana-Ordorika et al. (2024) highlight the increasing number of publications related to teachers' integration of maker education principles in classrooms. The COVID-19 pandemic, by necessitating a rapid transition from face-to-face instruction to online learning environments, has revealed both challenges and opportunities for preparing teachers in digital learning environments (Hrastinski, 2021; Kan et al., 2022). Among the challenges, diversifying the learning environment, integrating technology effectively, developing reflective practices, and creating research-based pedagogies (Crawford & Cifuentes-Faura, 2022) have become the main focus of teacher education research in the post-pandemic era.

Another prominent theme among the most frequently addressed topics is the gap between theoretical preparation and practical application. Research indicates that novice teachers often feel unprepared to face classroom realities, particularly student diversity (Ingvarson et al., 2014; Louden & Rohl, 2006; Rowan et al., 2021). This theory-practice disconnect can be seen, in part, as a sign that knowledge is conceptualized differently in academic and school-based contexts (Rowan et al., 2021). Other significant points highlighted in the literature include the geographically uneven distribution of research (Vanassche & Kelchtermans, 2015; Veletić et al., 2024), the insufficient consideration of complex sampling methods in large-scale assessment studies (Veletić et al., 2024), and the lack of research on collaboration processes between teacher educators and practicing teachers (Kelchtermans, 2006; Vanassche & Kelchtermans, 2015). Systematic review studies reveal an overemphasis on small-scale and fragmented studies, and an insufficient longitudinal perspective (Murray et al., 2008; Stephenson, 2018). Similarly, Sleeter (2014) notes that only 6% of research in the field of teacher education examines the effects of teacher education curricula on teaching practices or student learning. Therefore, for the future of teacher education research, the literature emphasizes the importance of expanding methodological diversity, developing larger-scale studies, and improving conceptual frameworks focusing on teacher education processes. Furthermore, increased professional development opportunities for teacher educators (Snoek et al., 2011), the development of digital and intercultural skills (Zhang & Tian, 2024), and the strengthening of the relationship between research and practice (Zeichner, 2005) are seen as significant strengths for future research.

In light of content and thematic analysis studies conducted in different periods and geographies, the teacher education literature focuses on multidimensional topics such as teacher preparation, professional development, teacher identity, and digital integration. Goktas et al. (2012) examined 2,115 articles published in 19 educational journals in Türkiye and found that instructional technology, science education, and mathematics education were the dominant research areas, and that quantitative approaches were prevalent. Similarly, Yücel-Toy (2015), in an analysis of teacher education research published in three long-established journals in Türkiye between 1970 and 2013, determined that the studies mainly focused on the characteristics of pre-service teachers (44.5%), teacher education curricula (22.3%), and information and communication technologies (12.9%). Hangul et al.'s (2022) bibliometric mapping study revealed that research has shown a steady increase since the early 2000s, but that most of this research was conducted by a limited network of researchers, primarily from Western countries. Likewise, Livingston and Flores (2017) and Zhang and Wang (2022) emphasized in their studies that the themes of teacher identity and professional development have an increasing importance in the teacher education literature. Cochran-Smith and Villegas (2014) examined more than 1,500 teacher education studies published between 2000 and 2012 and found that themes such as accountability, effectiveness, policy research, preparation for the information society, and preparation for equity came to the fore. On the other hand, Vangrieken et al. (2015) and Veletić et al. (2024) drew attention to geographical imbalances and Western-centric research trends, highlighting the need to strengthen the international perspective in the teacher education literature.

In terms of research methodology, meta-analyses and systematic reviews reveal significant methodological

differences in the teacher education literature. For example, Borko et al. (2007) identified methodological differences by categorizing teacher education research into four main categories: experimental research, interpretive studies, practice-based research, and design research. On the other hand, while qualitative approaches are dominant in teacher education research, the use of quantitative and mixed methods has been increasing in recent years (Shi & Cheng, 2020; Yan, 2024). Nguyen et al. (2019), analyzing 150 articles on teacher leadership, emphasized that qualitative methods were preferred in the research and that the number of quantitative and international comparative studies remained limited. Similarly, Cabaroğlu and Öz (2023) found that 31 of 48 studies on English language teaching practicum used qualitative approaches, and that semi-structured interviews were the most common data collection tool. However, the National Council on Teacher Quality (2013) report drew attention to the small number of well-designed studies examining the link between teacher preparation and classroom practices. The work of Grossman and McDonald (2008) is considered an important study in that it demonstrates the need to restructure the field both theoretically and practically, due to the disconnect between teacher education and classroom teaching practices. On the other hand, the studies of McEvoy et al. (2015) and Mazandarani (2021) revealed the philosophical and methodological shortcomings of teacher education research and stated that this situation limited the conceptual depth of the research. In terms of current developments, the innovations brought by the digital age have also manifested themselves in the field of teacher education. Many studies (Dyment & Downing, 2020; Jablonski & Ludwig, 2023) have emphasized the importance of online teacher education and digital tools in transforming teacher education processes and developing teachers' digital competencies.

Purpose of the Study

When the teacher education literature is examined above, it is seen that this field has a rich structure in terms of methodological diversity, theoretical development, and practical application. However, the field needs more methodologically rigorous, internationally comparative, and longitudinal studies (National Council on Teacher Quality, 2013; Nguyen et al., 2019). Furthermore, conducting a content and thematic analysis of published research is of great importance in determining the most frequently addressed themes, research methods used, and sample groups in the field of teacher education. Based on this gap and importance, the main purpose of this research is to conduct a content and thematic analysis of articles published in 2024 in journals in the first quartile (Q1) of the Web of Science Social Science Citation Index (SSCI) under the micro theme "teacher education" (code 6.11.190, which refers to the specific classification code used in the Web of Science Research Areas Classification System to categorize research publications in teacher education), and to examine the main focus areas, research methods, theoretical approaches, and study groups of these researches. Throughout this study, “teacher education” is operationalized as a comprehensive field encompassing both pre-service preparation of teacher candidates in formal education programs and continuing professional development of in-service teachers throughout their careers. This broad definition includes initial teacher training, induction programs, mentoring experiences, and ongoing professional learning opportunities aimed at enhancing teachers' knowledge, skills, and competencies. In line with this purpose, the following research questions were addressed:

Research Questions:

(i) What are the most frequently addressed themes and sub-themes within the micro theme of teacher education in articles published in 2024 in journals indexed in the Web of Science SSCI Q1 quartile?

(ii) What are the most frequently used research methods and research designs within the micro theme of teacher education in articles published in 2024 in journals indexed in the Web of Science SSCI Q1 quartile?

(iii) What are the most frequently studied sample groups within the micro theme of teacher education in articles published in 2024 in journals indexed in the Web of Science SSCI Q1 quartile?

Method

Research Model

This study employs document analysis, a qualitative research method, to determine current research trends in the field of teacher education. As defined by Bowen (2009), document analysis involves the systematic examination of written materials and, as stated by Yıldırım and Şimşek (2018), encompasses the processes of collecting, examining, and interpreting documents related to the research topic. In this context, the study examined articles published in 2024 in journals indexed in the Web of Science SSCI within the Q1 quartile and classified under the teacher education micro-theme (6.11.190 - teacher education). This micro theme explicitly covers scholarship on teacher learning across the entire career span, thereby including studies on both pre-service teacher preparation and in service professional development. Since the study is based

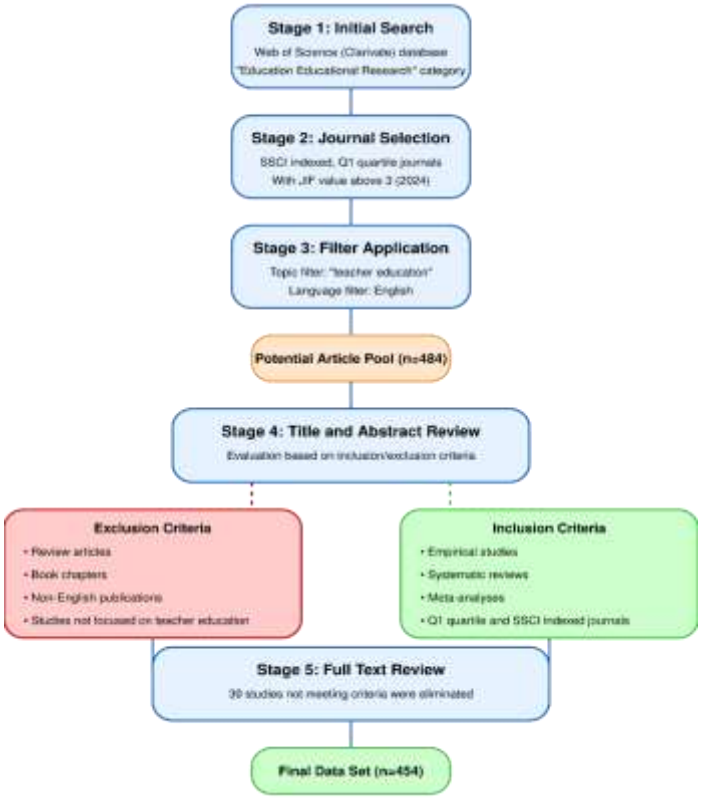
on the analysis of publicly available academic resources and does not involve human participants, it did not require ethics committee approval. The selected articles were systematically coded using content and thematic analysis methods; the main focus areas, research methods, theoretical approaches, and sample groups in the field of teacher education were determined.

Data Source Determination Criteria

The research's data source and article selection criteria adopt a systematic approach to ensure the international quality and accessibility of studies in the "teacher education" micro-subfield within the field of educational sciences. The process of determining the data source is visually presented in Figure 1 with a flowchart to ensure the transparency and replicability of the research.

Figure 1.

Data Source Research Determination Flowchart



As can be seen in Figure 1, the research's data source consists of peer-reviewed articles published in 2024 in journals indexed in the SSCI, located in the Q1 quartile, with a journal impact factor (JIF value) above 3, within the "Education & Educational Research" category of the Web of Science (Clarivate) database, and under the "teacher education" micro-category. The focus on Q1 journals with JIF values above 3 was deliberately chosen as these publications represent the highest impact and academic prestige in the field (Moher et al., 2009), thus providing strong indicators of current paradigms and trends in teacher education research. The JIF threshold of 3 was selected as it exceeds the average impact factor of journals in the Web of Science Education and Educational Research category based on 2023 JCR data. Additionally, limiting the study to articles published in 2024 enables a snapshot of current research trends, captures emerging approaches in the post-COVID era, and allows for in-depth analysis of a comprehensive dataset (n=454) from a specific timeframe. This selection criterion is based on the rationale that the vast majority of significant studies in the field are published in English, and easy access to international literature is provided. Table 1 presents the journal names and their respective publication counts from the final dataset, which contains 454 articles that met all selection criteria.

Table 1.

Distribution of Articles Within the Scope of the Research

Names of the journals	Number of articles (n)
Teaching and teacher education	89
European journal of teacher education	37
Journal of mathematics teacher education	35
Professional development in education	35
Educational studies in mathematics	34
Journal of teacher education	16
European journal of education	13
International journal of educational research	12
British educational research journal	10
Journal of curriculum studies	9
TESOL quarterly	1
Total	**454**

According to Table 1, a total of 454 articles from 11 different journals in the field of teacher education were examined. Despite the existence of 163 journals in the SSCI Q1 quartile for educational sciences according to the 2023 Journal Citation Reports (JCR) data, it was observed that research in the field of teacher education was published in only 11 journals based on the research criteria. The number of journals and articles examined indicates that the research was conducted on a comprehensive and highly representative dataset.

Content and Thematic Analysis Process

The analysis process began with presenting descriptive data (journals, article counts, research methods, and sample groups) in table with frequencies and percentages (see Table 1). This was followed by an in-depth thematic analysis specifically focused on the teacher education micro-theme. Within this scope, the main and sub-themes, recurring patterns of meaning, discussion topics, theoretical approaches, and proposed application models that teacher education research focused on were systematically examined and interpreted. The sub-themes were primarily developed through analysis of the research articles' titles, abstracts, keywords, and research questions. Additionally, when classifying articles into sub-themes, we examined the stated purpose, methodological focus, and central findings of each study. For instance, an article with keywords such as "professional identity" and "teacher development" that primarily investigated the formation of teaching identity would be categorized under the "professional identity formation" sub-theme. This content-based approach ensured that the categorization reflected the actual research focus rather than solely relying on predetermined categories. Thus, current research trends and directions in the teacher education literature were evaluated in a comprehensive and holistic manner. In the analysis, a phased analysis design was developed based on the thematic analysis method proposed by Braun and Clarke (2019) and the integrated analysis approaches of Mayring (2000) and Schreier (2012). This design allowed for a holistic evaluation of both the surface-level characteristics and the in-depth meanings of teacher education research. The integrated coding framework used in the analysis process includes descriptive categories and interpretive themes. Descriptive categories were used to systematically classify the methods, data collection tools, and sample groups of the articles examined. Specifically, within the scope of the 2nd and 3rd research questions, information on methods and participants/samples was analyzed using percentage and frequency distributions. Thematic analysis, on the other hand, was used to examine the research focus points, main research topics, and theoretical frameworks in line with the 1st research question in depth.

Within the scope of the thematic analysis, the six-phase thematic analysis method developed by Braun and Clarke (2019) was applied. In the first phase, the familiarization with the data process, the coded article texts were read repeatedly, notes were taken, and a general familiarity with the data was ensured. Subsequently, in the initial codes generation phase, meaningful and recurring sections within the data were systematically coded using the open coding method, and conceptual labels were determined. In the third phase, the relationships, similarities, and differences between the generated codes were examined, common patterns and potential themes were identified, and thematic maps were created. In the themes reviewing phase, the identified themes were revisited by returning to the data set, and their validity and consistency were checked; in this phase, some themes were divided into sub-themes, merged, or redefined. In the fifth phase, each theme was comprehensively defined, its content was clarified, and concise, meaningful names were given; the relationships between themes were elaborated. Finally, in the reporting phase, the obtained themes, sub-themes, and inter-theme relationships were systematically presented with graphics and tables in the findings section of the research. NVivo software was used during the qualitative data analysis process.

Although inter-coder reliability calculation is not possible in single-researcher qualitative research, various strategies were implemented to enhance the reliability, consistency, and validity of the coding process. In this research, the following steps were taken to ensure the quality and reliability of single-researcher coding:

(i) Developing a detailed and comprehensive coding framework: Braun and Clarke (2019) emphasize that comprehensive coding frameworks help researchers maintain analytical consistency during the coding process. These frameworks provide clear guidelines for classification and pattern identification decisions. In this research, the coding framework, which forms the basis of the coding process, was prepared in an extremely detailed, clear, and understandable manner. The framework included clear definitions, scope boundaries, inclusion/exclusion criteria, and example codes for each category and theme.

(ii) Pilot coding and framework iteration: DeCuir-Gunby et al. (2011) state that the process of developing and improving codebooks through pilot application is critically important for ensuring integrity and applicability before full-scale analysis. After the coding framework was created, pilot coding was conducted by selecting a small sample from the data set (e.g., 25-30 research). During the pilot coding process, the researcher practically tested the framework, and any uncertainties, difficulties, and inconsistencies encountered were carefully noted.

(iii) Detailing and documenting coding guidelines: Creswell and Poth (2018) indicate that comprehensive coding guidelines supported by examples create a systematic approach to data interpretation, thereby increasing the reliability of qualitative findings. Within the scope of this research, detailed coding guidelines were prepared during this process. The guidelines supported the researcher

before the analysis by providing ease of understanding on how to apply each category and theme, and which types of statements or discourses would be labeled with which codes. Regarding this, example detailed coding items include: (i) Themes and Sub-Themes: For example: under "Teacher competencies (main theme)" sub-themes such as "technological pedagogical content knowledge", "inclusive education competencies", "emotional intelligence competencies" etc. (ii) Research Methods: Under the "Methods used" theme: quantitative, qualitative, mixed also research designs such as experimental, descriptive, longitudinal, case study, action research, etc.

(iv) Expert review and feedback (peer debriefing): Smith and McGannon (2018), within the scope of alternative approaches to inter-coder reliability, state that critical friend arrangements and peer debriefing methods are valuable mechanisms for increasing rigor in qualitative analyses conducted by a single researcher. The single researcher shared the coding framework and examples of coded data (e.g., 25-30 coded articles) with a colleague who is an expert in qualitative research methodology (an expert with prior qualitative data coding experience in their research and holding a doctoral degree) to receive feedback. The aim of the expert review was to evaluate the validity, scope, and clarity of the coding framework and to support the researcher in recognizing potential blind spots or methodological deficiencies in the coding process. This process is seen as an important step towards increasing reliability and validity by providing an external perspective on the research.

Results

The content and thematic analysis of articles published in 2024 in educational sciences journals within the SSCI Q1 quartile, indexed in Web of Science, is presented below. The articles examined within the scope of the research are categorized under the teacher education micro-theme and systematically presented in tables in terms of thematic trends, methodological approaches, and sample profiles.

1. Thematic Trends of Research in Teacher Education

An in-depth analysis of articles published in the "teacher education" sub-field within the SSCI Q1 quartile systematically classifies the research themes and focus areas. Nine main themes, ranging from teachers' professional development to education policies, and the sub-themes associated with them are presented in Table 2 with frequency and percentage.

Table 2.
Research Themes and Focus Areas in Teacher Education

Main theme	Sub-theme	Frequency	Percentage (%)
Teacher professional development & growth	Processes and models of professional development	45	27.27
	Teacher learning communities & collaboration	33	20
	Teacher reflection & self-directed learning	27	16.36
	Innovations in professional development	20	12.12
	Teacher recruitment & preparation (pre-service)	19	11.52
	Impact and effectiveness of professional development	14	8.48
	Coaching & mentoring	4	2.42
	Assessment & evaluation of teacher preparation	2	1.22
	General/meta professional development research	1	0.61
Curriculum, instruction, & assessment design	Instructional planning, strategies, methods, & technologies	5	33.33
	Curriculum design & development	3	20
	Culturally responsive & inclusive curriculum	3	20
	Assessment & evaluation practices	3	20
	Curriculum integration & interdisciplinarity	1	6.67
Educational policy, systems, & leadership	Systemic issues & equity in education	10	58.82
	Educational policy analysis & reform	3	17.65
	Educational leadership & administration	2	11.76
	Contextual & societal influences on policy	1	5.88
	Governance &	1	5.88

	accountability in education		
Language, literacy, & communication in education	Multilingualism & multimodal communication	4	44.44
	Classroom communication & discourse	3	33.33
	Academic language & disciplinary literacy	1	11.11
	Language development & acquisition	1	11.11
Teacher workforce & the profession	Teacher recruitment & preparation	38	66.67
	Teacher retention & attrition	9	15.79
	Teacher supply & demand issues	6	10.53
	Teacher career paths & advancement	2	3.51
	Teacher diversity & equity in the workforce	2	3.51
Teaching practices and pedagogy	Instructional methods	33	82.5
	Technology-enhanced pedagogies	6	15
	Classroom management	1	2.5
Teacher beliefs, attitudes, and emotions	Emotional well-being and stress	36	46.75
	Self-efficacy and motivation	24	31.17
	Attitudes toward teaching and learning	17	22.08
Teacher identity and roles	Professional identity formation	36	73.47
	Role negotiation and responsibilities	9	18.37
	Societal expectations and status	4	8.16
Student learning, development, outcomes & well-being	Cognitive development & higher-order thinking	13	50
	Academic achievement & learning outcomes	8	30.77
	Social & emotional development / socio-emotional learning	3	11.54
	Student motivation, engagement, & agency	2	7.69

Table 2 classifies research focuses into nine main themes and their sub-themes, providing a comprehensive view of literature trends. The patterns emerging within each main theme are interpreted in the following sections.

Teacher professional development and growth. The theme of "teachers' professional development and growth" stands out as the most comprehensive area of study in the analyzed research. Under this theme, it is observed that researchers primarily focused on the sub-themes of "processes and models of professional development" (27.27%) and "teacher learning communities and collaboration" (20%). However, "teachers' reflection and self-directed learning" (16.36%) reveal how critical roles teachers play in their own development in the literature. Furthermore, topics such as "impact and effectiveness of professional development" (8.48%) and "innovative approaches" (12.12%) focus on improving current practices and increasing teachers' professional satisfaction. These indicators show that there is a very high interest in professional development and teachers' collaborative learning environments in the teacher education, but they also suggest a need for more comprehensive research on "assessment and evaluation of teacher preparation" (1.22%) and "meta-research" (0.61%) in the future.

Curriculum, instruction, and assessment design. It is noteworthy that approximately one-third (33.33%) of the research within this theme focuses on the sub-theme of "instructional planning, strategies, methods, and technologies". The sub-themes of "curriculum design and development", "assessment and evaluation practices", and "culturally responsive and inclusive curriculum" being represented at almost equal rates (20%) indicates that researchers have a balanced approach to these issues. In contrast, the sub-theme of "curriculum integration and interdisciplinarity" having a rather low rate (6.67%) suggests that interdisciplinary approaches, which are increasingly gaining importance in today's understanding of education, do not receive sufficient attention at the research level.

Educational policy, systems, and leadership. The fact that more than half of the research within this theme (58.82%) focuses on the sub-theme of "systemic issues and equity in education" indicates that social justice and equity issues form a dominant priority in education policy research. The relatively less study of the sub-themes "educational policy analysis and reform" (17.65%) and "educational leadership and administration" (11.76%) suggests that policy development and leadership dimensions are of secondary importance. The low representation of the sub-themes "contextual and societal influences on policy" and "governance and accountability in education" (5.88%) compared to other sub-themes suggests that policy research is conducted somewhat in isolation from the social context and accountability mechanisms. This finding reveals that while education researchers focus on equity-oriented systemic problems, there are research gaps in addressing policy development, implementation, and evaluation processes with a holistic approach.

Language, literacy, and communication in education. Within this theme, the fact that nearly half of the research

(44.44%) focuses on the sub-theme of "multilingualism and multimodal communication" reflects the increasing importance of multilingualism and different communication channels in a globalizing world. The sub-theme of "classroom communication and discourse" (33.33%), ranking second, shows the importance given to the quality of classroom interactions. In contrast, the low rates of the sub-themes "language development and acquisition" and "academic language and disciplinary literacy" (11.11%) indicate that language acquisition processes and domain-specific language skills are not sufficiently researched. This distribution highlights the increasing importance of multilingual and multi-modal communication skills in contemporary educational settings.

Teacher workforce and the profession. Under the theme of "teaching profession and employment dynamics", the fact that approximately two-thirds of the publications (66.67%) focus on the sub-theme of "teacher recruitment and preparation" shows that teacher training processes have a significant weight in the research priority. Topics such as "teachers' retention and attrition processes" (15.79%), "supply and demand issues" (10.53%), and "career paths and advancement" (3.51%) are among the primary focus areas providing important insights for the sustainability of the teaching profession. This emphasis on teachers' entry and initial processes into the profession suggests that teacher shortages and the challenges of training qualified teachers are seen as priorities in the field.

Teaching practices and pedagogy. A large portion of the studies within this theme directly focuses on "instructional methods" (82.50%). "Technology-enhanced pedagogies" (15%) are considered to have a key role in providing a learning environment suitable for the requirements of the age. In contrast, the relatively less attention given to "classroom management" (2.5%) indicates a lack of comprehensive studies in this area. This finding suggests that despite the importance of the variety of teaching methods and the integration of technological innovations, more research on management and interaction is needed to sustain a successful classroom environment.

Teachers' beliefs, attitudes, and emotions. Within this theme, teachers' levels of "emotional well-being and stress" (46.75%) stand out as the relatively highest area of interest. "Self-efficacy and motivation" (31.17%) and "attitudes towards teaching and learning" (22.08%) may indicate a direct impact on teacher-student interaction. This finding shows that teachers' emotional and cognitive states can significantly shape both their professional performance and students' learning experiences. From another perspective, the research distribution indicates that teaching is not just a technical endeavor but is considered a complex profession where beliefs, attitudes, and emotional processes interact.

Teacher identity and roles. Within the theme of "teacher identity and roles", the fact that a large majority of the research (73.47%) focuses on the sub-theme of "professional identity formation" shows that identity development forms a dominant priority in this research area. The relatively low rate of the sub-theme "role negotiation and responsibilities" (18.37%) and the less frequent study of the sub-theme "societal expectations and status" (8.16%) suggest that identity development is mostly focused on individual dimensions, and the social and institutional context is not sufficiently considered. This distribution reveals that teacher identity research emphasizes the teacher's subjective experience and identity formation, but external factors such as the social status of teaching, changing roles, and institutional expectations are neglected.

Student learning, development, outcomes, and well-being. The fact that approximately half of the research within this theme (50%) focuses on the sub-theme of "cognitive development and higher-order thinking" reflects the importance given to teacher candidates' thinking skills. The sub-theme of "academic achievement and learning outcomes" (30.77%) ranking second shows that traditional success criteria are still an important area of research, while the low rates of the sub-themes "social and emotional development" (11.54%) and "student motivation, engagement, and agency" (7.69%) indicate that teacher candidates' social-emotional development and motivational processes receive less attention compared to other sub-themes. This finding shows that in teacher education research, educational outcomes are still largely conceptualized predominantly through the cognitive domain and academic achievement, and it suggests that the amount of research focusing on teacher candidates' social and emotional needs beyond academic performance should increase.

2. Methodological Distribution in Teacher Education Research

The analysis of methodological approaches used in teacher education research is based on the frequency of use of research designs associated with these methods. The data presented in Table 3 illustrates which methodological approaches are dominant in the field of teacher education, which research designs are preferred, and the extent to which methodological diversity is achieved.

Table 3.
Distribution of Methods and Research Designs

Research Method	Research Design	Frequency (n)	Percentage (%)
Qualitative Research	Basic qualitative research	131	28.85
	Case study	53	11.67
	Content and discourse analysis	41	9.03
	Narrative research	18	3.96
	Action research	12	2.64
	Phenomenological research	6	1.32
	Ethnographic research	3	0.66
	Grounded theory research	3	0.66
	Total	**267**	**58.81**
Quantitative Research	Survey research designs	39	8.59
	Other quantitative approaches	37	8.15
	Experimental and quasi-experimental designs	23	5.07
	Longitudinal and cross-sectional studies	17	3.74
	Meta-analysis	4	0.88
	Total	**120**	**26.43**
Mixed Methods Research	Mixed methods approach	25	5.51
	Total	25	5.51
Other Research	Conceptual and theoretical analysis	30	6.61
	Systematic reviews and meta-syntheses	8	1.76
	Literature/theoretical policy analysis	4	0.88
	Total	**42**	**9.25**
	Grand Total	**454**	**100**

When Table 3 is examined, it is observed that qualitative studies (58.81%) are quite dominant among the 454 studies included in the research. This situation suggests that researchers in the field of teacher education generally prefer in-depth and contextual examination. The relatively lower rate of quantitative studies (26.43%) may suggest that the effort to obtain generalizable findings or to reveal causal relationships through experimental designs is relatively less. On the other hand, the limited interest in the mixed methods approach (5.51%) indicates that the interdisciplinary or multi-dimensional research potential in the field has not yet been adequately explored. While the presence of theoretical/review studies (9.25%) suggests an effort to enrich the conceptual framework and theoretical foundation of the field, the fact that this rate remains relatively low indicates that comprehensive approaches such as systematic reviews and meta-syntheses need to be further developed.

Qualitative Research. Among the qualitative research designs, the basic qualitative research approach (28.85%) is observed to be predominantly preferred. The findings indicate that researchers generally rely on qualitative methods and have made limited progress in developing original methodological approaches. When the studies in the basic qualitative research category are examined methodologically, they generally use standard data collection methods such as semi-structured interviews, focus groups, and document analysis, but a specific qualitative research design such as phenomenology, case study, or grounded theory is not explicitly positioned. In these studies, researchers adopt a simple interpretative approach to understand the experiences and perspectives of the participants.

Following the basic qualitative research approach, the relatively more common use of “case study” (11.67%) and “content and discourse analysis” (9.03%) reflects the importance given to contextual understanding and text analysis. However, the quite limited use of more advanced qualitative approaches that can provide deeper understanding, such as action research (2.64%), phenomenological research (1.32%), ethnographic research (0.66%), and grounded theory research (0.66%), is noteworthy. In particular, the scarcity of designs such as action research, which has transformative potential in teacher education and can strengthen the link between practice and research, can be said to indicate a research-practice gap. The near absence of ethnographic approaches shows that the cultural and social dimensions of teacher education are not sufficiently examined. This distribution reveals that although the number of qualitative studies is high, they contain significant limitations in terms of methodological depth and diversity.

Quantitative Research. When the distribution of quantitative research designs is examined, it is observed that survey research designs (8.59%) and other quantitative approaches (8.15%) are the most commonly preferred methods. While the prevalence of survey research can be explained by the ease of data collection and the advantages of reaching large samples, this approach carries the risk of methodological uniformity and superficial analyses. When the studies in the "other quantitative approaches" category are examined in detail, they can be classified methodologically as "advanced statistical analysis" or "complex quantitative methods”. Research in this category employs advanced techniques that go beyond basic descriptive or inferential statistics.

These include specialized analytical techniques such as latent profile analysis, structural equation modeling, hierarchical linear modeling, advanced psychometric methods (Rasch modeling, factor analysis), and epistemic network analysis. These studies generally involve large sample sizes and focus on complex relationships between variables.

The relatively limited use of experimental and quasi-experimental designs (5.07%) indicates that studies examining cause-and-effect relationships and evaluating the effectiveness of intervention research in teacher education are less preferred by researchers. The scarcity of longitudinal and cross-sectional studies (3.74%) suggests that the temporal dimension of teacher development and developmental changes are not adequately investigated. The low percentage of meta-analysis studies (0.88%) is seen as a significant weakness in terms of synthesizing the accumulated knowledge in the literature and developing evidence-based practices.

Mixed Methods Research. The fact that mixed methods (integrative approaches) are considered as a single category with a rate of 5.51% (n=25) within all research (n=454) indicates a limited interest in the integration of qualitative and quantitative paradigms in teacher education research. The lack of subcategories for these methods suggests a lack of information about the design diversity and implementation details of mixed methods research. The limited number of mixed methods approaches is seen as a significant methodological limitation in a field like teacher education, which involves complex processes and requires a multi-dimensional understanding.

Other Research. When the research under this heading is examined, it is observed that conceptual and theoretical analyses (6.61%) are the most common approach within this category, but remain quite limited within the overall research landscape. The very low rate of systematic reviews and meta-syntheses (1.76%) reveals the lack of efforts towards systematically evaluating and synthesizing the accumulated knowledge in the literature. The near lack of literature/theoretical policy analyses (0.88%) indicates a significant gap in establishing the research-policy link and in the scientific evaluation of policy processes. The general inadequacy of theoretical studies suggests that conceptual frameworks and theoretical foundations are not sufficiently developed in the field of teacher education, and that research focuses more on data collection.

3. Participant Profiles in Teacher Education Research

The teacher education research was systematically evaluated to determine which participant groups were included and their representation rates. The frequency and percentage distributions of participant profiles presented in Table 4 illustrate which groups the research focuses on, which groups are more represented, and which potential participant groups are insufficiently included in the research.

Table 4.
Participant Profiles of the Research

Category	Frequency (n)	Percentage (%)
Pre-service Teachers	153	33.70
In-service Teachers	120	26.43
Mixed Groups	68	14.98
Teacher Educators	36	7.93
K-12 Students	26	5.73
Expert Panels/Specialists	20	4.41
Out of scope (systematic review, theoretical research etc.)	18	3.96
University Students (Non-Teacher Education)	10	2.20
Administrator	3	0.66
Total	**454**	**100.00**

When the distribution of participant profiles in the research is examined in Table 4, it is observed that the "in-service teachers" category has the highest rate (33.70%). This is followed by the "pre-service teachers" category (26.43%). The fact that these two categories constitute approximately 60% of the research in total indicates that teacher education research largely centers directly on teachers. While this situation reflects a strong connection between the research and the field of practice, it also shows that the research perspective adopts a teacher-focused understanding. In particular, the higher representation of in-service teachers suggests that professional experience and knowledge from the field are considered important variables in the research. The third-place ranking of the "mixed groups" category (14.98%) demonstrates researchers' efforts to integrate multiple perspectives beyond a single participant group. Although this approach reflects a tendency to understand the interaction of different stakeholders in a complex field like teacher education, the fact that it constitutes approximately one-sixth of the total research reveals that the multi-stakeholder perspective remains limited. Another noteworthy group is the "teacher educators" category, which has a considerably low rate (7.93%), indicating that one of the most critical actors in the teacher training process is insufficiently represented in the research. This situation can be seen as a significant sample group gap, considering that a stakeholder group directly

affecting the quality of teacher education is underrepresented. The low rate of the "K-12 students" category (5.73%) again reveals that students, one of the ultimate target audiences of teacher education research, are largely neglected. Considering that the most fundamental aim of teacher education is to support student learning and development, the limited representation of students in the research indicates a significant disconnect in the research-practice link. This situation can also be interpreted as teacher education research being limited in investigating its impact on student outcomes. The low rate of the "expert panels/experts" category (4.41%) suggests that the knowledge and experience of field experts are not sufficiently utilized. Given that expert opinions are of critical importance, especially in policy development and program evaluation processes, the limited representation of this participant group may lead to a weakening of the research-policy-practice connection. The considerably low rate of the "out of scope (systematic review or theoretical research)" category (3.96%) shows that studies developing theoretical frameworks and synthesizing existing knowledge in the literature are insufficient. This situation reveals that teacher education research is more focused on data collection and analysis, and efforts to strengthen theoretical foundations are limited. The very low rate of the "university students (excluding teacher education programs)" category (2.20%) also reflects the limited interaction of teacher education research with other disciplines and students outside the faculty of education. This situation suggests that the interdisciplinary connections of teacher education are weak, and the research largely confines itself to its own field. The near lack of the "administrator" category (0.66%) indicates that the perspective of educational leadership and management is seriously neglected in teacher education research. Considering the critical role of administrators in teachers' professional development and shaping school climate, the insufficient representation of this stakeholder group suggests that the research does not adequately address the interaction between educational leadership and teacher development.

Discussion

In this research, a content and thematic analysis was conducted in 2024 on teacher education-themed articles published in Q1 journals indexed in the Web of Science SSCI. The research focused on identifying the prominent themes in teacher education, the research methods used, and the sample groups. The findings obtained reveal both the ongoing fundamental problems and the newly emerging professional challenges in the field of teacher education.

Regarding the first research question, the analysis of prominent themes reveals a notable imbalance in teacher education research. While micro-level themes (teacher professional development, teacher identity, beliefs, and attitudes) are intensely studied, macro-level issues (education policy, systemic reform, accountability) receive limited attention. This situation indicates that teacher education research prioritizes individual development and experiences but does not sufficiently examine the structural and institutional context that shapes them. The themes identified largely align with previous literature and overlap with the themes of "preparing teachers for a knowledge society" and "preparing teachers for diversity and equity", as expressed by Cochran-Smith and Villegas (2014). Similarly, the prominence of themes related to diversity and equity in the 2024 research demonstrates a significant advancement in the field compared to Busey and Waters' (2016) critique of a "lack of diversity". In other words, it can be said that diversity and inclusion issues have become a mainstream research focus in leading Q1 journals in the field of teacher education, rather than secondary or side topics. On the other hand, as Livingston and Flores (2017) pointed out, themes such as the theory-practice connection, university-school collaborations, and technology use appear to persist as recurring "wicked problems" across all periods. However, contrary to initial expectations, the number of studies focusing on teacher education policies and systemic reform is lower than anticipated, indicating that research focuses more on individual and professional development processes. Furthermore, the surprisingly low number of studies on teacher preparation for remote/hybrid learning environments or technology integration following the COVID-19 pandemic is noteworthy.

Turning to the second research question, our analysis of methodological approaches, it is observed that qualitative research methods (58.81%) are significantly preferred. In contrast, quantitative, theoretical/review, and mixed methods approaches have been used more limitedly. Among qualitative studies, basic qualitative research and case studies stand out, while survey applications and advanced statistical analyses are preferred in quantitative research. This preference indicates that the field of teacher education has adopted a methodological approach aimed at deeply understanding teachers' subjective experiences and contextual interactions. This approach is consistent with the view that many fundamental issues in teacher education (e.g., identity formation, belief change, classroom interaction dynamics) require an in-depth examination of subjective experiences and complex social environments (Beauchamp & Thomas, 2009). On the other hand, the research findings are also consistent with the dominance of qualitative approaches highlighted by

Livingston and Flores (2017) and Tatto (2021). Similarly, as stated by Borko et al. (2007), qualitative methods have long been preferred in the field of teacher education.

The insufficient progress to meet expectations in quantitative research can also be explained by limitations such as funding, data collection methods, and difficulty in accessing samples. Furthermore, our initial personal prediction that mixed methods research would be widespread has not been confirmed, which is inconsistent with the trend of using different research methods together in educational research. According to the research findings, there is still a clear distinction between qualitative and quantitative approaches, and the integration of methodologies within the framework of mixed methods research is progressing slower than we expected. Another unexpected finding is the scarcity of observational and classroom-based measures. It is noteworthy that few studies among the reviewed articles directly observed teaching or used objective performance measures. This implies that the outcomes of teacher education are largely evaluated through subjective perceptions or indirect indicators.

Examining the third research question concerning sample and study groups, it has been observed that the most common sample groups are in-service teachers and pre-service teachers (teacher candidates). This indicates that teacher education research predominantly focuses on teachers at different stages of their professional development. The achieved sample distribution is also consistent with the literature, which suggests that teacher education research largely focuses on pre-service teacher education. The concentration of teacher educators operating particularly in university settings on their own students reflects the traditional approach of the field (Livingston & Flores, 2017). As Murray and Male (2005) emphasized, teacher educators themselves are a less studied and understood group as research subjects. On the other hand, contrary to our initial personal expectations at the beginning of the research, the number of studies involving a more holistic participant group that centers the voices of school administrators, policymakers, and students has been quite limited.

Conclusion and Recommendations

The analysis of the teacher education research examined within the scope of this study highlights that this field is developing but still in the process of maturing. As Cochran-Smith et al. (2015) stated, identifying the strengths and weaknesses of the field will help to determine the gaps that will lay the groundwork for future research. This research makes significant contributions to the field of teacher education at both theoretical and practical levels. At the theoretical level, this study provides a roadmap by identifying current trends and shortcomings in teacher education research. Furthermore, by highlighting the strengths of the field and the areas that need development, it contributes to shaping future research topics. At the practical level, this research offers valuable perspectives for the design and implementation of teacher education curricula. While the findings indicate the issues that need to be addressed primarily, the methodological conclusions show how research can be made more effective.

Drawing upon the prominent themes, significant implications can be derived for the field of teacher education research. It is believed that placing greater emphasis on emerging focus areas such as digital pedagogy, data-driven practices, and teacher emotional well-being will strengthen both the theoretical and practical contributions of the field. In this context, adopting critical and reflective approaches that align with the existing literature can be considered important steps towards deepening teacher education research and achieving generalizable results. These issues are seen as crucial in developing teachers' abilities to adapt to changing educational environments and maintain their professional resilience.

The findings fundamentally demonstrate the necessity of increasing sample diversity in teacher education research. Expanding research beyond just pre-service and in-service teachers to include other stakeholder groups such as teacher educators, K-12 students, school administrators, and policymakers will contribute to the enrichment of the field's knowledge base. Increasing research on the professional development of teacher educators is considered critically important in improving the quality of teacher training processes. As Vanassche and Kelchtermans (2015) stated, teacher educators' development of their own practices is seen as a promising research direction for this developing field. In this regard, more holistic and collaborative research designs will allow for a more comprehensive evaluation of teacher education.

For methodological advancement, we recommend increasing the use of mixed methods approaches to bridge the gap between qualitative and quantitative research paradigms. The integration of these methodologies would provide more comprehensive insights into the complex phenomena of teacher education. Additionally, there is a clear need for more observational and classroom-based measures to directly assess teaching practices and performance, moving beyond the current reliance on subjective perceptions and indirect indicators. Furthermore, future studies could employ bibliometric

visualization tools such as VOSviewer or similar data visualization programs to create more comprehensive word networks and co-citation analyses of the teacher education literature. Extending such analyses over multiple years, rather than focusing on a single year as in the present study, would likely reveal more subtle evolutionary patterns and intellectual turning points in the field. This longitudinal perspective could provide deeper insights into how research themes, methodological approaches, and collaborative networks have developed over time. Finally, future research should aim to balance the current focus on micro-level themes with increased attention to macro-level issues such as education policy, systemic reform, and accountability structures. This balance would provide a more holistic understanding of the field and better inform both theory and practice in teacher education. Particular attention should be given to emerging challenges such as preparing teachers for remote/hybrid learning environments and technology integration, especially in light of lessons learned from the COVID-19 pandemic.

Ethics Committee Approval: This research did not require ethics committee approval as it is based on theoretical analysis and review of existing literature on educational technology implementation. The study does not involve human subjects, experimental interventions, collection of personal data, or any procedures that would necessitate ethical review. It exclusively focuses on analyzing publicly available academic resources and technological frameworks without engaging human participants.

Declaration of generative AI and AI-assisted technologies in the writing process. During the preparation of this research, generative AI tools were used to improve language and readability, with caution. The authors used Paperpal and Quillbot (AI tools) to paraphrase their writing for more academic enhancement, and ChatGPT and DeepL (AI tools) for language translation and text reduction. After using these AI tools, the authors reviewed and edited the content as necessary, and take full responsibility for the content of the publication. Alongside using AI tools for language tasks, the authors thoroughly reviewed and accurately cited all references in this research. They verified each reference's authenticity, including DOI links. It's crucial to note that all data and findings come from properly cited sources, not AI-generated. The authors fully ensure the research's integrity and accuracy.

Informed Consent: Informed consent was not required for this study as it does not involve human participants, interviews, surveys, observations, or collection of personal data. The research is entirely based on theoretical analysis and review of existing academic literature and technological frameworks in the field of educational technology.

Peer-review: Externally peer-reviewed.

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