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CONTENTS

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What I Have Not Learned

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ABSTRACT

As I approach retirement and reflect on nearly 80 years of life and over 50 years as an educator, I am struck by a humbling realization: the more I learn, the less I seem to know. Influenced by Wittgenstein's Tractatus Logico-Philosophicus and its final proposition—"Whereof one cannot speak, thereof one must remain silent"—I have come to appreciate the limits of knowledge and the importance of humility in scholarship and life. My career, though unplanned, has taken me across diverse roles in philosophy, computer science, and instructional systems, yet the most profound lesson came not from academic achievements but from the realization that knowledge alone is insufficient without care for others. Echoing my professor's advice to think for oneself but live for others, I have grown to believe that the true purpose of education extends beyond skill acquisition; it lies in fostering compassion, intellectual humility, and meaningful contributions to humanity. I lament that I may have done too little to instill these ideals but hope that my students will surpass me in advancing lives centered on peace, service, and community. Ultimately, as my father once said, what remains is not what you say but what you do, and it is my earnest desire that education continues to inspire action toward the betterment of others.

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As I approach retirement and my 80th year wandering around this planet lost in space, I wonder what I have learned. I have been a teacher for more than 50 years so it seems natural to wonder if I have learned anything in all those years of teaching. I come to a conclusion that occurred to me in my studies as a doctoral student at the University of Texas in the 1970s: I am inclined to believe that I know less than I thought I knew. I was a new doctoral student without a master's degree in a top philosophy program among my fellow students most of whom had a master's degree in philosophy. At that point in my career I was unaware of a short book by an Austrian philosopher that would have a large impact on me. The book was entitled *Tractatus Logico-Philosphicus*; the author was Ludwig Wittgenstein; it was the only book he published in his lifetime although he left behind a number of manuscripts on a variety of topics (1998; first published in 1992; see https://www.gutenberg.org/ebooks/5740). That short book contains 7 numbered statements all of which have sub-statements except for the last one, which was this: "Whereof one cannot speak, thereof one must remain silent" (from the Gurenberg edition). If only politicians would learn that simply stated conclusion.

However, it was not a conclusion that pleased Wittgenstein. There was much he wanted to say that fell outside the boundaries created in the *Tractatus*. He wanted to understand why three of his four brothers committed suicide, for example. He wanted to understand why countries went to war and why he had to leave Austria and live abroad away from his homeland. How could his brilliant teacher, Bertrand Russell, and Russell's co-author, Alfred North Whitehead (1925-1926), make such a mistake or overstatement in *Principia Mathematica* concerning the relationship between pure and applied logic. Wittygenstein's critique resulted in an anti-foundationalist view of mathematics. Mathematics, in a sense, is a kind of language game understood by a community of mathematicians but has no provable relationship to the physical world we inhabit. Wittgenstein is not questioning the utility of mathematics, which is clearly well established. He is questioning its logical status. One might argue that one should accept a two-valued logic, which Wittgenstein elagorates in a footnote in the *Tractatus*, but accepting a two-valued logic does not rule out other logics, including multi-valued logics, which date back at least to Aristotle.

Why this early dive into logic and mathematics? I wanted to suggest that my ideas are provisional and subject to serious questioning, If one can question the foundations of mathematics and logic, then we ought to be somewhat more humble with regard to our own thoughts and beliefs. These initial words are aimed especially at those who blatantly ignore them – that is to say, politicians.

That last remark brought to mind many memories … memories of how I have changed over the years. When I was much younger, say 60 years ago, I used to think a lot about adventures and things I wanted that made me feel good. Now I think I wasted most of my youth. As J. Alfred Prufrock said (in a poem by T. S. Eliot): "I should have been a pair of ragged claws, scuttling across the floors of silent seas … Do I dare disturb the universe? … I shall wear the bottoms of my trousers rolled …" (see https://www.poetryfoundation.org/poetrymagazine/poems/44212/the-love-song-of-j-alfred-prufrock).

When I was a graduate student in philosophy at the University of Texas, one of my professors, Oets Kolk Bouwsma (see https://en.wikipedia.org/wiki/Oets_Kolk_Bouwsma) told me to think for myself but think of others first. It has taken me almost 60 years to learn that lesson. My professors never tried to get me to adopt their thoughts or their way of thinking … that seems so different from what my colleagues do and what so many students are experiencing these days. Perhaps my experiences are too limited. My memory is probably faulty. I remember my older brother, Daniel Earl Spector an historian, once told me when I was practicing a talk on Adolph Eidchmann in junior high school (called middle schools these days). Danny said that the history of mankind could be told as the history of war. I thought he was crazy at the time. Now I think how sad that he was right.

Oh yes … this was supposed to be about learning technologies and I was just focused on things I have learned so late in life. We go to school and university and learn many things. But when and where and how do we learn to live as decent human beings? Many professors want their students to think like them and continue the work they began. When I assess my own work as a professor, I think I have wanted my students to think and do meaningful work … especially work for others and not to advance their own careers. I have failed.

When I think of my own career, I have to admit that it was unplanned and mostly coincidental. I first wanted to teach philosophy nine months a year and spend three months hiking and backpacking in the mountains. That never happened. I was the only one of my classmates to find a job teaching philosophy and it was at a community college. My job was later eliminated by cutbacks in funding under the Reagan administration. I then resorted to going back to programming having trained as a programmer previously when I worked for IBM. My brother, the historian, convinced me to move to Jacksonville State University to teach computer science, which I did. I tried to get the faculty there interested in software engineering but they were too wedded to their current courses, so I left for the Air Force Human Resources Laboratory in San Antonio where I because the senior scientist for instructional systems research. When the governments labs were being shut down, I went to the University of Bergen in Norway as the Director of Instructional Systems Research and managed to learn a bit about system dynamics.

From Norway, I returned to academicia at Syracuse University and then Florida State University and then the University of Georgia and eventually to the University of North Texas. Once a Texan, always a Texan … I think Willie Nelson might have said that (see https://en.wikipedia.org/wiki/Willie_Nelson).

Such has been my unplanned life of unplanned adventures and unplanned learning. In closing, I can only say that I have yet to learn how to be a peace loving, other directed, caring person. What remains is not way you say, as my father used to say … what matters and what remains is what you do. I admit to having done too little and learned that lesson too late in life. My remaining desire is that a few of my students will do much more than I managed to do with regard to loving peace and caring for others. We do not live our lives alone and in isolation from others.

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Generative Artificial Intelligence as a Lifelong Learning Self Efficacy: Usage and Competence Scale

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ABSTRACT

The aim of this study is to develop a scale to measure the usage and competence levels of generative artificial intelligence as a lifelong learning self-efficacy among young and adult lifelong learners. Research data were collected from 248 individuals aged between 18 and 55. After a thorough review of the literature and theoretical frameworks such as the Technology Acceptance Model, Self-Efficacy Theory and Connectivism, an item pool for the scale was created. Similar scales in the related field were examined, and the item pool was developed accordingly. The items were reviewed by experts in educational technology, lifelong learning, and scale development. After making the necessary revisions, the trial form of the scale was presented to the participants. To determine the construct validity of the scale, exploratory factor analysis was conducted. The results of the exploratory factor analysis indicated that the scale consisted of two factors. The first factor comprises 10 items, while the second factor consists of 9 items. Confirmatory factor analysis was performed to reveal the relationships within the factors, the relationships between the variables and the factors, and the explanatory power of the factors on the model. The internal consistency coefficient, Cronbach's alpha reliability value, was determined to be .833, and the Spearman-Brown coefficient was found to be .711, both of which indicate acceptable reliability. In conclusion, the Generative Artificial Intelligence Usage and Competence (GAIUC) Scale is expected to fill a gap in the literature by providing a validated tool to measure both the usage and competence of lifelong learners in using AI. This scale can serve as a foundation for future studies exploring AI-supported learning in various educational contexts.

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INTRODUCTION

Despite rapid advancements in the field of artificial intelligence, practical research on artificial intelligence, especially in the field of education and lifelong learning, is still in its early stages. In this context, the utilization of available innovative tools and associated research efforts becomes significantly important. However, questions surrounding innovations such as artificial intelligence -like whether AI will take over our jobs- arouse curiosity but also raise concerns among individuals (Ersöz, 2020). Such concerns may lead to avoidance of the subject, indecision, and even foster antipathy. It is evident that there is a notable gap in scale studies related to artificial intelligence. The primary objective of this study is to develop a scale that evaluates the level of usage and competence in artificial intelligence among lifelong learners, aiming to facilitate steps to enhance this level for rapid adaptation to the future world. This study aims to fill the gap in scale development related to artificial intelligence usage and competence among lifelong learners -specifically focusing on educators, students, teachers, and professionals in various sectors- and to make a significant contribution to the academic literature.

Artificial intelligence has become an integral part of our lives in many fields (Aslan, 2019). Artificial intelligence (AI) has indeed become a significant part of daily life and numerous industries, driving advancements and improvements across various fields. AI is used to improve diagnostic accuracy, personalize treatment plans, and speed up drug discovery processes (Semenov, Baranova & Yagya, 2022; Bohr & Memarzadeh, 2020; Bhattad & Jain, 2020). AI systems analyze vast amounts of financial data in real-time to optimize trading decisions and detect unusual patterns that may indicate fraud (Singh, Garg & Tiwari, 2019; Xie, 2019; Baranidharan, 2023). Smart factories use AI to adjust production schedules and inventory levels in real-time (Staš, Tolnay & Magdolen, 2009; Hrnjica & Softic, 2020; Li, Hou, Yu, Lu & Yang, 2017). AI systems are also used for traffic management, reducing congestion, and optimizing the flow of vehicles on busy streets (Duan et al., 2021). And especially AI is reshaping education by offering personalized learning experiences, automating grading systems, and providing virtual tutoring through intelligent chatbots (Shen, 2020; Li et al., 2021; Qin & Wang, 2022; Medvedev, Golovyatenko & Podymova, 2022). However, this integration has led to the disappearance of many professions and changes in the job descriptions of others. According to Facebook artificial intelligence experts, artificial intelligence is expected to take on new roles in human activities in many areas, ranging from production to education, sales to maintenance and repair, and even the management of smart robots. Additionally, artificial intelligence and robots will enable the emergence of new service sectors. This increasing digitization of industries is also transforming the field of education, particularly through the integration of artificial intelligence technologies, hence artificial intelligence awareness holds significant importance for educators. Aslan (2019) states, “If advanced technologies usher in more effective and constructive educational models, then qualified and productive individuals can be nurtured for the future.” It is evident that artificial intelligence, by integrating theories and technologies, brings about significant changes in the educational process and will continue to do so (Arslan, 2020). For example, AI-driven personalized learning systems are already enabling teachers to tailor educational experiences to individual student needs, while AI-powered analytics are helping educators track and improve student performance (Fan, Wu, Zheng, Zhang & Jiao, 2023; Zhu, 2019; Maseleno et al., 2018; Azcona, 2019). In this process, educators especially need to develop professional awareness to effectively adapt to a digitized society and meet the evolving needs of students. Tools such as ‘Generative Artificial Intelligence as a Lifelong Learning Self Efficacy: Usage and Competence Scale’ can provide data on how educators adapt to AI technologies and their professional competence, offering guidance for future studies.

Machines began to take over tasks that required human physical strength, and humanity, by adapting to this transformation, created opportunities for gains from this new situation with the onset of the Industrial Revolution. However, by the 21st century, the question arose of how tasks achievable with human intelligence could be performed by machines (Tegmark, 2019).

Examining the origins of artificial intelligence, it is evident that the scientist Alan Turing played a significant role. In his 1950 paper "Computing Machinery and Intelligence," Turing posed the question "Can machines think?" and refuted objections to this idea (Pirim, 2006). Additionally, Turing is renowned for deciphering the Enigma code used by the German military and for his involvement in the construction of the first electronic computers in London. Turing investigated whether machines could perform decision-making and problem-solving tasks, similar to humans, and developed the Turing test for this purpose (Say, 2018; Arslan, 2020).

While humans can access information through their five senses, artificial intelligence can access information more quickly and extensively through internet connectivity (Tunç & Sanduvaç, 2020). This advantage has enabled AI to play a role in various industries such as healthcare, banking, communication, commerce, video games, the military, automotive, and robotics (Gunkel, 2012; Safadi, Fonteneau & Ernst, 2015; Stanciu & Rindaşu, 2021).

Bandura's Self-Efficacy Theory (Bandura, 1977) suggests that individuals' beliefs in their capabilities to perform tasks are critical for motivation and persistence in learning. This theory provides the framework for assessing how lifelong learners view their competence and confidence in using artificial intelligence tools. According to the Technology Acceptance Model (TAM) (Davis, 1989), individuals' perceived ease of use and perceived usefulness significantly influence their acceptance of new technologies. In the context of artificial intelligence, this model provides a foundation for understanding how lifelong learners perceive and develop competence in using AI technologies. Siemens' Connectivism Theory (2005) posits that learning occurs through networks and connections facilitated by digital technologies. This theory underpins the concept of AI-supported lifelong learning, where learners continuously adapt to new technologies and information through their engagement with AI systems.

The rapid development and proliferation of artificial intelligence technology necessitate the identification of appropriate competencies to enable individuals and societies to use this technology effectively and safely. The use of artificial intelligence and machine learning techniques is increasingly prevalent across many professions, making the ability to effectively use AI technologies crucial for professional success. AI technologies also play a significant role in education and training, and an AI usage and competence scale can be an important tool for assessing the knowledge and skills of students, teachers, and educators in the field of AI. There is growing societal awareness of the impacts and potential risks of AI technologies; hence, an AI usage and competence scale can help individuals use AI systems more consciously and better understand potential risks. For these reasons, the study of AI usage and competence as a lifelong learning self-efficacy is considered significant.

As a result, this study aims to investigate individuals' usage and competence levels in artificial intelligence. In line with this objective, the following sub-objectives have been pursued:

➔ What is the construct validity status of the Generative Artificial Intelligence Usage and Competence (GAIUC) Scale?

➔ What is the reliability status of the Generative Artificial Intelligence Usage and Competence (GAIUC) Scale?

METHOD

This study is research on scale development. Below, the process of validity and reliability testing of the scale for usage and competence in artificial intelligence, along with the characteristics of the study group, are presented.

Research design

Our study, aiming to develop a valid and reliable scale to assess the usage and competence of artificial intelligence tools by lifelong learners, adopts a descriptive survey model. The descriptive survey model allows for the direct depiction of current or ongoing situations and summarizes the characteristics of the collected data (Karasar, 2007). Therefore, in this study, a descriptive survey model has been employed.

The scale was developed based on a multi-theoretical framework. The 'AI Usage Competence' dimension is grounded in the Technology Acceptance Model (Davis, 1989), which emphasizes the importance of perceived ease of use and usefulness in technology adoption. The 'Self-Efficacy in AI Usage' dimension is rooted in Bandura's (1977) Self-Efficacy Theory, reflecting the confidence individuals feel in their ability to use AI tools effectively. Finally, the 'AI-Supported Lifelong Learning' dimension is informed by Siemens' (2005) Connectivism Theory, which highlights the role of digital networks in ongoing learning processes.

Research Universe and Sample

In the initial stage of item pool development, there were 76 items. Following eliminations due to redundancy, divergence from conceptual boundaries, and factors loading below certain thresholds, a decision was made to start working with 33 items as draft items. After review by educational technology experts, counseling psychologists, and language specialists, 22 items were selected for implementation. The research data were obtained from 248 participants in the first half of the year 2024. Basic information regarding the participants is provided in the table below.

Table 1. *Participant Data*

Gender	Male	Female	Total
18-25 years	23	26	49
26-35 years	28	44	72
36-45 years	49	35	84
46-55 years	25	18	43
Total	**125**	**123**	**248**

Participants were selected based on their engagement in lifelong learning activities, with age ranges reflecting the end of compulsory education up to the pre-retirement period. This selection was made to capture a broad spectrum of AI usage and competence levels in various stages of adult learning. Accordingly, the number of male and female participants in the study was balanced. In terms of age distribution, the majority of the participants were middle-aged individuals.

Data Analysis

In this process, JAMOVI software was used for data analysis. Principal component analysis was conducted to determine the construct validity of the scale developed to measure lifelong learners' usage and competence in artificial intelligence (Büyüköztürk, 2002). The suitability of the data for factor analysis was examined based on the Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy and Bartlett's Test of Sphericity. Following exploratory factor analysis, 3 negative items out of 19 were recoded, and a minimum factor loading criterion of 0.40 was considered for model fit (Büyüköztürk, 2002; Hair, Hult, Ringle & Sarstedt, 2021; Hair, Risher, Sarstedt & Ringle; 2019; Wieland, Durach, Kembro & Treiblmaier, 2017; Ali, Rasoolimanesh, Sarstedt, Ringle & Ryu, 2018). The number of factors was determined using eigenvalues and a scree plot. The discriminant validity of the 19 items was examined through the independent samples t-test. Additionally, the significance of the lower and upper 27% group item scores was investigated to observe how lifelong learners' usage and competence in artificial intelligence were influenced through the scale items. The validity of the scale consisting of 19 items was established. Following exploratory factor analysis, confirmatory factor analysis was performed. In confirming the

acceptability of the entire scale, RMSEA, S-RMR, GFI, AGFI, CFI, NFI, and IFI values were considered (Byrne, 2011; Çokluk, Şekercioğlu & Büyüköztürk, 2010). To determine the reliability of the scale, internal consistency coefficients Cronbach's alpha and Spearman-Brown values were examined.

FINDINGS / RESULTS

Findings Related to Validity

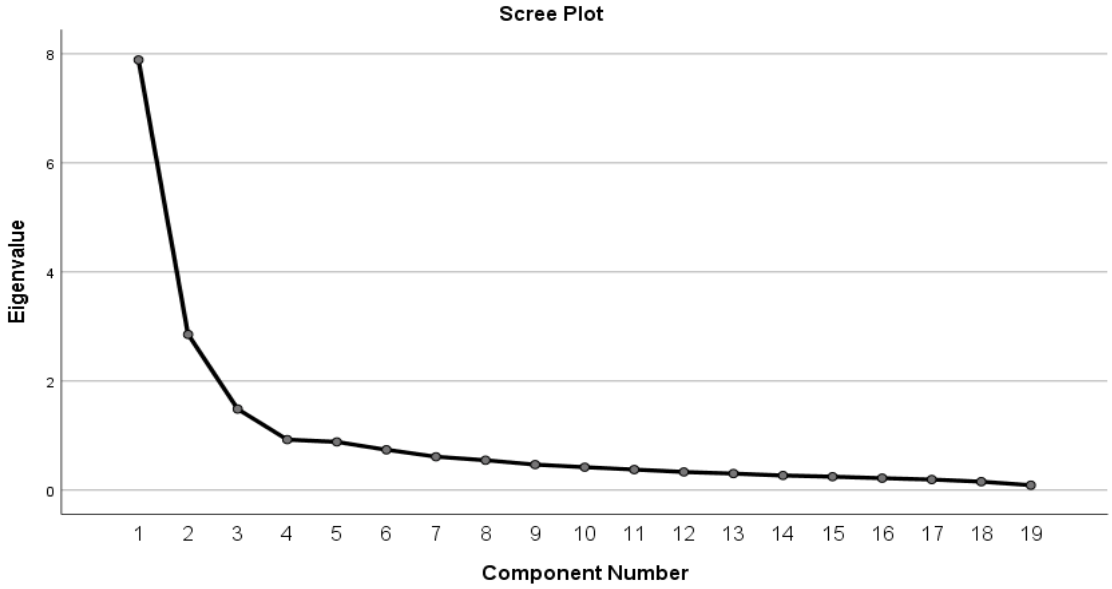
The construct validity of the Artificial Intelligence Usage and Competence Scale was evaluated through item-factor correlations and item discriminant validity values. The results are as follows:

Construct Validity

Findings Regarding Exploratory Factor Analysis (EFA)

The items in the scale were initially developed based on the theoretical frameworks of the Technology Acceptance Model (Davis, 1989), Self-Efficacy Theory (Bandura, 1977), and Connectivism (Siemens, 2005). These frameworks provided the foundation for understanding how lifelong learners engage with AI tools and how AI supports their learning processes. During the exploratory factor analysis, items with low factor loadings (below 0.40) were systematically removed to ensure content validity. Items that exhibited collinearity or redundancy were also excluded based on a thorough re-examination of the data.

For exploratory factor analysis, the Kaiser-Meyer-Olkin (KMO) measure and Bartlett's test are examined. A KMO value greater than 0.60 and a significant Bartlett's test ($p < 0.05$) indicate suitability for factor analysis (Büyüköztürk, 2002). In this analysis, KMO = 0.825 and the Bartlett test yielded a significant result with $p = 0.000$. As a result, a structure consisting of two components was obtained. The factor loadings were examined, and items with loadings below 0.40 were excluded from the analysis. To ensure that content validity was not compromised, a re-examination was conducted based on a difference of 0.1 between factor loadings for collinearity control. Ultimately, it was determined that the items were grouped under 2 factors, explaining 61.43% of the total variance. The distribution of factor eigenvalues is provided in Graph 1.



Graph 1. *Scree Plot*

Exploratory factor analysis is presented in Table 2. As shown in the table, a two-factor structure has been analyzed. The factor loadings and the amount of variance explained by each factor are displayed in the table.

Table 2. *Factor loading distribution table for exploratory factor analysis*

Number	Items	Factor 1	Factor 2
I7	I can use AI-assisted learning tools effectively.	-0.70	
I3	I have no trouble coping with difficulties in my learning process by using AI tools.	-0.68	
I5	I can customize/personalize my learning process by using AI tools.	-0.66	
I8	I can organize my learning process by using AI-assisted learning tools.	-0.66	
I19	I think the use of AI-based learning applications helps me use my time more efficiently.	-0.60	
I27	I believe that AI-assisted learning processes increase my access to learning resources.	-0.52	
I18	I think AI-assisted learning processes restrict my freedom (-).	-0.51	
I12	I can manage AI-based learning materials efficiently.	-0.50	
I25	I find the accuracy of the learning content suggested by AI sufficient.	-0.48	
I1	I can understand the algorithm of AI tools.	-0.46	
I11	I can comprehend complex subjects by using AI-based learning tools.		-0.60
I15	I find AI-assisted personalized learning experiences effective.		-0.58
I23	I believe that AI-assisted learning processes increase my learning speed.		-0.54
I10	I can keep up with current developments in my learning process by using AI.		-0.50
I24	I believe that the use of AI-based learning applications reduces my stress in the learning process.		-0.50
I26	I think the use of AI reduces learning barriers in my learning process.		-0.49
I21	I believe that the use of AI-based learning applications decreases my motivation in the learning process (-).		-0.47
I22	I think the use of AI-based learning applications reduces my social interactions (-).		-0.44
I13	I have the competence to evaluate and select the learning content provided by AI.		-0.41
	Varience explained	20.614	40.186
	Eigenvalue	1.741	1.465

As seen in Table 2, the first factor of the scale consists of 10 items, with factor loadings ranging from 0.46 to 0.70. The eigenvalue of this factor is observed to be 1.741. It is noted that this factor accounts for 20.614% of the total variance. The second factor of the scale comprises 9 items, with factor loadings ranging from 0.41 to 0.60 and an eigenvalue of 1.465, explaining a variance of 40.816%.

The development of the scale items was guided by established theoretical frameworks. The AI Usage Competence dimension is grounded in the Technology Acceptance Model (Davis, 1989), which posits that perceived ease of use and usefulness are key factors in determining individuals' competence in using technology. The items in this dimension were crafted to assess how lifelong learners perceive and engage with AI tools. Similarly, the AI-Supported Learning Motivation dimension draws from Bandura's Self-Efficacy Theory (1977), emphasizing the role of confidence in one's ability to use AI tools, and Siemens' Connectivism Theory (2005), which highlights the importance of networked learning environments supported by AI technologies.

Findings Regarding Confirmatory Factor Analysis (CFA)

Following exploratory factor analysis, a scale comprising 19 items distributed across 2 factors was derived. Subsequently, confirmatory factor analysis was performed utilizing the obtained data. Confirmatory factor analysis serves to ascertain the interrelation between factors, the association between variables and factors, and the degree to which the factors elucidate the model (Brown, 2015). Findings in the literature suggest that both EFA and CFA cannot be conducted using the same dataset. However, in this study, due to the unavailability of a different dataset, both EFA and CFA were performed using the same dataset, with EFA solely employed to strengthen the CFA results.

Table 3. *Standard fit goodness criteria and obtained values*

Fit Dimensions	Perfect Fit	Acceptable Compliance	Research Data
χ2/sd	0 ≤ χ2/sd ≤ 2	2 ≤ χ2/d<5	1.762
RMSEA	0 ≤ RMSEA ≤ .05	.05 ≤ RMSEA ≤ .08	0.047
S-RMR	0 ≤ S-RMR ≤ .05	.05 ≤ S-RMR ≤ .10	0.076
GFI	.95 ≤ GFI ≤ 1	.90 ≤ GFI ≤ .95	0.921
AGFI	.95 ≤ AGFI ≤ 1	.90 ≤ AGFI ≤ .95	0.951
CFI	.97 ≤ CFI ≤ 1	.95 ≤ CFI ≤ .97	0.954
NFI	.95 ≤ NFI ≤ 1	.90 ≤ NFI ≤ .95	0.896
IFI	.95 ≤ IFI ≤ 1	.90 ≤ IFI ≤ .95	0.927

Table 3 presents the results of confirmatory factor analysis. Upon examination of the goodness-of-fit indices of the CFA model established with 248 data points, it can be inferred that the model exhibits excellent fit as indicated by a chi-square value of 1.762 (Byrne, 2013). Additionally, both RMSEA and AGFI values meet the criteria for excellent fit. Further scrutiny of the remaining indices including S-RMR, GFI, CFI, NFI, and IFI reveals acceptable fit according to critical thresholds (Marsh, Balla & McDonald, 1988; Schermelleh-Engel, Moosbrugger & Müller, 2003; Byrne, 2013).

Item Factor Correlations and Item Discrimination

The correlation between the items within each factor and the scores obtained from these items was calculated using the item-factor correlation method. This analysis aimed to determine the extent to which the items in the scale serve the overall purposes, the relationship between the presence or absence of each item in the scale, and consequently, the contribution of each item to the scale. The calculated item-factor correlation values are presented in Table 4.

Table 4. *Item-factor correlation values*

Factor 1	r	Factor 2	r
I1	0.61	I10	0.70
I3	0.42	I11	0.58
I5	0.68	I13	0.72
I7	0.72	I15	0.60
I8	0.69	I21	0.76
I12	0.73	I22	0.73
I18	0.43	I23	0.75
I19	0.62	I24	0.69
I25	0.49	I26	0.78
I27	0.42		

The values provided in the table represent the Pearson correlation coefficients between each item and each factor. These coefficients quantitatively express the relationship between each item and each factor. Accordingly, the item-factor correlations for the items in the first factor range from .42 to .73, while those for the items in the second factor range from .58 to .78. It is observed that the relationship between the items in the scale and their respective factors is positive and significant ($p < .000$). Based on these results, it can be stated that the items contribute to the purpose of their respective factors and the scale.

To assess the discriminant power of the scale items, the results obtained from each item were sorted in descending order, and groups consisting of the bottom 27% and top 27% of participants (124 individuals each) were identified. Subsequently, independent samples t-test analysis was conducted between the bottom and top groups, and the t-values indicating the discriminant power and significance levels were presented in Table 5.

Table 5. *Item discriminant validity powers*

Factor 1	t	p	Factor 2	t	p
I1	9.56	<0.001	I10	6.70	<0.001
I3	8.12	<0.001	I11	7.80	<0.001
I5	7.89	<0.001	I13	7.55	<0.001
I7	6.34	<0.001	I15	8.10	<0.001
I8	8.21	<0.001	I21	7.35	<0.001
I12	7.65	<0.001	I22	6.90	<0.001
I18	7.30	<0.001	I23	8.00	<0.001
I19	6.75	<0.001	I24	7.45	<0.001
I25	8.50	<0.001	I26	8.25	<0.001
I27	7.90	<0.001			

An examination of Table 5 reveals that the values obtained from the independent samples t-test regarding the 17 items, factors, and total score in the scale range from 6.34 to 9.56. The differences identified in the analysis are found to be significant (p<.001). Thus, it can be said that both the items and the overall scale demonstrate a high level of discriminant validity.

Scale Reliability

To determine the reliability of the scale, the results of the following analyses were examined. Spearman Brown and Cronbach's Alpha coefficients were examined for the two factors and the whole. Table 6 shows the reliability coefficients.

Table 6. *Reliability coefficients*

Factors	Item Number	Spearman Brown	Cronbach's Alpha
Artificial Intelligence Usage Competence	10	.734	.846
Artificial Intelligence Learning Motivation	9	.715	.870
The Whole Scale	**19**	**.711**	**.833**

Table 6 reveals that the Spearman–Brown coefficient of the scale comprising 19 items and two factors is 0.711, while the Cronbach alpha value is 0.833. The reliability coefficients of both individual items and the scale as a whole fall within the acceptable range (Eroğlu, 2008; Kline, 1994), indicating that both the items and the overall scale demonstrate reliability and consistency.

DISCUSSION, CONCLUSION, RECOMMENDATIONS

In this research, a scale was created and validated to assess usage and competence of lifelong learning self-efficacy in artificial intelligence (AI). The outcome of this study led to the development of the Generative Artificial Intelligence Usage and Competence Scale, which includes 2 factors and 19 items. The first factor encompasses 10 items, whereas the second factor comprises 9 items.

The scale reflects positive items completely (5), significantly (4), moderately (3), slightly (2), and not at all (1) based on Likert-type responses. For negative items, the coding is reversed. Following exploratory factor analysis, a two-factor scale was identified. Several scales in the related field were examined for factor naming, and original names were assigned (Kaya et al., 2022; Çelebi, Yılmaz, Demir & Karakuş, 2023; Polatgil & Güler, 2023; Karaoğlan Yılmaz, Yılmaz & Ceylan, 2023; Karaoğlan Yılmaz & Yılmaz, 2023). In this context, Factor 1 was labeled as AI Usage Competence, and Factor 2 was named AI-Supported Learning Motivation.

In the distribution of factors, items with factor loadings less than 0.40 were excluded from the analysis, along with redundant items. In the stage of construct validity analysis, factor loadings, variance explained, and eigenvalues were considered, indicating that the scale's construct validity is at an appropriate level. After the exploratory factor analysis revealed a two-factor structure of the scale, confirmatory factor analysis was conducted to confirm the factor structures. The results of confirmatory factor analysis showed that the scale model was supported by the data. The validity and reliability studies of the scale were conducted with 248

individuals aged between 18 and 50. The reliability analysis of the scale was examined using Spearman Brown and Cronbach's alpha values, which indicated that the scale could provide reliable measurements. Independent samples t-test was conducted to determine the difference between the top and bottom 27% groups in item discrimination. The results showed that the discriminative power of both the scale items and the scale as a whole was high. This scale is considered to provide a measurement tool for assessing levels of generative artificial intelligence usage and competence as a lifelong learning self-efficacy in the literature. Lifelong learning is one of the attitudes expected from students in primary, secondary, and tertiary education today. We can say that our education system is shaped based on this phenomenon to some extent. However, for this process to shed light on all learning activities, it is necessary to examine it more thoroughly in terms of generative artificial intelligence.

Following exploratory factor analysis, confirmatory factor analysis was conducted on the scale data to confirm the factor structures of the scale, which was divided into two factors. The results of the applied confirmatory factor analysis indicated that the generated scale model was supported by the data. Item-factor correlations were examined to determine the extent to which items composing the scale could measure the characteristic they intended to measure with their respective factors. The values obtained from the examined item-factor correlations suggest that the items and factors in the scale significantly serve the purpose of measuring the desired characteristic of the scale as a whole.

Reviewing the literature, several scale studies related to artificial intelligence (AI) can be observed. For instance, the study by Ferikoğlu and Akgün (2022) developed the Artificial Intelligence Awareness Level Scale for Teachers to analyze teachers' awareness of AI integration in education and to determine their tendencies in developing the concept of AI and its sub-branches. This scale consists of 4 dimensions and 27 items, namely Theoretical Knowledge, Practical Knowledge, Associative Ability, and Belief-Attitude. The Artificial Intelligence Anxiety Scale developed by Akkaya, Özkan, and Özkan (2021) is an adaptation of the scale developed by Wang and Wang (2019) into Turkish. This scale, comprising 16 items, is composed of 4 factors: Learning, Job Change, Sociotechnical Blindness, and AI Structuring. On the other hand, the Generative Artificial Intelligence Acceptance Scale developed by Karaoğlan Yılmaz et al. (2023) consists of 4 factors and 20 items, named Performance Expectancy, Effort Expectancy, Facilitating Conditions, and Social Impact. Additionally, Çelebi et al. (2023) conducted the adaptation of the Artificial Intelligence Literacy Scale, developed by Wang, Rau and Yuan (2023), into Turkish. This scale, designed for non-expert adult individuals in AI, comprises four dimensions: Awareness, Usage, Evaluation, and Ethics, with a total of 12 items. These scales in the literature have been examined in terms of their specific subject area, target audience, and the number of factors and items. As seen, these scales developed in the literature have focused on dimensions such as AI literacy, AI anxiety, acceptance of generative AI, and awareness. In contrast, in this study, the scale developed aims to explain the dimensions of AI usage and competence, conceptualized as a lifelong learning self-efficacy, with two factors: AI Usage Competence and AI-Supported Learning Motivation. This attempt aims to provide a more comprehensive and inclusive framework. Hence, it can be argued that this scale differs from others in the literature and contributes to the existing body of knowledge.

The advancement of AI technology has profoundly impacted our lives. With the widespread adoption of smart devices and AI-based applications, even ordinary users have found themselves using AI and becoming aware of its implications. This technology has found extensive use in various fields such as education, healthcare, and finance, making it challenging for individuals to fully grasp its integral role in their lives (Wang et al., 2023). The number of AI tools developed today is rapidly increasing, making it increasingly difficult to precisely determine their exact numbers. This surge indicates the beginning of a new era; in other words, the current state of technology symbolizes the onset of a new age known as the AI era, necessitating individuals to adapt to the changes it brings, becoming an inevitable necessity for people. Although specific foundational competencies have been identified for using AI, evaluating these competencies is also crucial. In the information age, technology undergoes continuous and irreversible change and transformation. The rapid adoption and use of digital technologies in our daily lives have brought about significant changes in our

learning, time management, communication, and work methods, significantly influencing the skills individuals need to acquire. Particularly, with the increasing prominence of generative AI applications in various fields such as healthcare, finance, education, transportation, and production, AI literacy has become a crucial literacy skill that individuals need to acquire across all sectors (Mertala, Fagerlund & Calderon, 2020). Considering lifelong learning as an aspect that students need to develop throughout their educational journey (Usta, 2023), it is essential to recognize the close association between generative AI and lifelong learning. Formal education alone will not suffice to acquire this competency. Therefore, the philosophy of lifelong learning should be adopted at every level of education, starting from preschool, with a focus on learning to learn. Additionally, values such as effective and efficient use of learning resources, setting, and achieving learning goals, and valuing knowledge and personal development should be integral parts of educational practices and learning experiences. Since the philosophy of lifelong learning underpins all educational environments, the use of generative AI should also be seen within this context. However, while supporting lifelong learning, it is important to bear in mind that every virtual world harbors both threats and opportunities, as evidenced in previous studies (Arslankara & Usta, 2018; Arslankara, Demir, Öztaş & Usta, 2022; Korkmaz, Vergili & Karadaş, 2021; Şahin, Asal Özkan & Turan, 2022).

The AI Usage Competence dimension is directly influenced by Davis's (1989) Technology Acceptance Model, which suggests that individuals' perceived usefulness and ease of use determine their engagement with new technologies. This model helps explain why participants with higher perceptions of AI's usefulness and ease of use showed higher competence in AI tools. Meanwhile, the AI-Supported Learning Motivation dimension is grounded in Bandura's (1977) Self-Efficacy Theory, which posits that individuals with higher confidence in their abilities are more likely to succeed in using AI tools effectively. Participants who expressed greater self-efficacy also demonstrated stronger motivation to engage in AI-supported learning, supporting this theoretical connection.

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APPENDIX:

Num	GENERATIVE ARTIFICIAL INTELLIGENCE USAGE AND COMPETENCE (GAIUC) SCALE (ENGLISH)	Doesn't reflect at all	Less reflective	Moderately reflective	Very reflective	Fully reflective
	Factor 1: AI Usage Competence					
1	I can use AI-assisted learning tools effectively.	1	2	3	4	5
2	I have no trouble coping with difficulties in my learning process by using AI tools.	1	2	3	4	5
3	I can customize/personalize my learning process by using AI tools.	1	2	3	4	5
4	I can organize my learning process by using AI-assisted learning tools.	1	2	3	4	5
5	I think the use of AI-based learning applications helps me use my time more efficiently.	1	2	3	4	5
6	I believe that AI-assisted learning processes increase my access to learning resources.	1	2	3	4	5
7	I think AI-assisted learning processes restrict my freedom (-).	1	2	3	4	5
8	I can manage AI-based learning materials efficiently.	1	2	3	4	5
9	I find the accuracy of the learning content suggested by AI sufficient.	1	2	3	4	5
10	I can understand the algorithm of AI tools.	1	2	3	4	5
	Factor 2: AI-Supported Learning Motivation					
11	I can comprehend complex subjects by using AI-based learning tools.	1	2	3	4	5
12	I find AI-assisted personalized learning experiences effective.	1	2	3	4	5
13	I believe that AI-assisted learning processes increase my learning speed.	1	2	3	4	5
14	I can keep up with current developments in my learning process by using AI.	1	2	3	4	5
15	I believe that the use of AI-based learning applications reduces my stress in the learning process.	1	2	3	4	5
16	I think the use of AI reduces learning barriers in my learning process.	1	2	3	4	5
17	I believe that the use of AI-based learning applications decreases my motivation in the learning process (-).	1	2	3	4	5
18	I think the use of AI-based learning applications reduces my social interactions (-).	1	2	3	4	5
19	I have the competence to evaluate and select the learning content provided by AI.	1	2	3	4	5

No	ÜRETKEN YAPAY ZEKA KULLANIM VE YETERLİK (ÜYZKY) ÖLÇEĞİ (TÜRKÇE)	Hiç yansıtmıyor	Az yansıtıyor	Orta düzeyde	Çok yansıtıyor	Tamamen yansıtıyor
	Faktör 1: Yapay Zeka Kullanım Yeterliği					
1	Yapay zeka destekli öğrenme araçlarını etkili bir şekilde kullanabilirim	1	2	3	4	5
2	Yapay zeka araçlarını kullanarak öğrenme sürecimdeki zorluklarla başa çıkmada sorunum yoktur	1	2	3	4	5
3	Yapay zeka araçlarını kullanarak öğrenme sürecimi özelleştirebilirim / kişiselleştirebilirim	1	2	3	4	5
4	Yapay zeka destekli öğrenme araçlarını kullanarak öğrenme sürecimi düzenleyebilirim	1	2	3	4	5
5	Yapay zeka tabanlı öğrenme uygulamalarının kullanımının zamanımı daha etkin kullanmama yardımcı olduğunu düşünüyorum	1	2	3	4	5
6	Yapay zeka destekli öğrenme sürecinin öğrenme kaynaklarına erişimimi artırdığını düşünüyorum	1	2	3	4	5
7	Yapay zeka destekli öğrenme sürecinin özgürlüğümü kısıtladığını düşünüyorum (-)	1	2	3	4	5
8	Yapay zeka tabanlı öğrenme materyallerini verimli bir şekilde yönetebilirim	1	2	3	4	5
9	Yapay zeka tarafından önerilen öğrenme içeriklerinin doğruluğunu yeterli buluyorum	1	2	3	4	5
10	Yapay zeka araçlarının algoritmasını anlayabilirim.	1	2	3	4	5
	Faktör 2: Yapay Zeka Destekli Öğrenme Motivasyonu					
11	Yapay zeka tabanlı öğrenme araçlarını kullanarak karmaşık konuları anlayabilirim	1	2	3	4	5
12	Yapay zeka destekli kişiselleştirilmiş öğrenme deneyimlerini etkili buluyorum	1	2	3	4	5
13	Yapay zeka destekli öğrenme sürecinin öğrenme hızımı artırdığını düşünüyorum	1	2	3	4	5
14	Yapay zeka kullanarak öğrenme sürecimdeki güncel gelişmeleri takip edebilirim	1	2	3	4	5
15	Yapay zeka tabanlı öğrenme uygulamalarının kullanımının öğrenme sürecimdeki stresimi azalttığını düşünüyorum	1	2	3	4	5
16	Yapay zeka kullanımının öğrenme sürecimdeki öğrenme engellerini azalttığını düşünüyorum	1	2	3	4	5
17	Yapay zeka tabanlı öğrenme uygulamalarının kullanımının öğrenme sürecimdeki motivasyonumu azalttığını düşünüyorum (-)	1	2	3	4	5
18	Yapay zeka tabanlı öğrenme uygulamalarının kullanımının sosyal etkileşimlerimi azalttığını düşünüyorum (-)	1	2	3	4	5
19	Yapay zeka tarafından sağlanan öğrenme içeriklerini değerlendirme ve seçme yeterliğine sahibim	1	2	3	4	5

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Assistive Technology Integration for Students with Speech and Language Impairments: A Mixed Method Study

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ABSTRACT

This study examines a large urban public school (UPS) district in the Midwest USA that has faced bankruptcy, state takeover of public education, and financial scams. As a result, UPS's capacity to integrate assistive technologies (AT) has been limited and is declining. This study investigates the UPS teachers' technological pedagogical content knowledge (TPACK) and how the UPS teachers integrate AT for students with speech and language impairments (SLI). This article details the UPS special education and general education teachers' TPACK across grade levels, content, and classroom settings. This article reports the UPS teachers' current integration of AT, instructional practices, implementation, and experiences integrating AT in the classroom for students with SLI. 94 UPS teachers participated in the online survey. The study found no significant differences in the UPS teachers' TPACK across classroom settings or grade levels. Results show no significant differences between the UPS teachers' TPACK in mathematics, social studies, science, or literacy content knowledge. The study revealed that UPS teachers utilize various AT tools, from basic tools like [calculators, audio/video recording devices, and voice amplifiers] to more advanced tools like [iPads, SmartBoards, and computers], for diagnostic, formative, and summative assessments. Results indicate that the UPS teachers utilize similar instructional methods across content and express mostly positive experiences integrating AT for SLI students

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INTRODUCTION

Students with Speech and Language Impairments (SLI) are the second largest group of students with disabilities receiving special education services in the United States, and the urban public schools (UPS) district investigated the most significant group receiving these services. Sadly, little attention has been paid to how students with disabilities use technology daily (Fernández-Batanero, 2022). It is unclear which specific Assistive Technology (AT) tools, such as speech-to-text software, communication boards, and text-to-speech applications, are utilized by students with disabilities based on age, grade, type of disability, and severity. AT is the technology used by individuals with disabilities to perform functions that may otherwise be difficult or impossible under the Individuals with Disability Act (IDEA, 2024). Students with disabilities require increased educational opportunities and encounter underrepresentation in research, use, and access to AT. Additionally, teachers of students with disabilities have limited access to, use of, and knowledge about AT as well (Edyburn, 2001; Alper & Raharinirina, 2006; Quinn et al., 2009; Alkahtani, 2013; Wu et al., 2018; Mohamed, 2018; Siyam, 2019; Fernández-Batanero, 2022). Moreover, teachers' perceptions and experiences of technology also impact AT use (Nam et al., 2013; Liu et al., 2017). As a result, students with disabilities experience achievement gaps due to the digital and pedagogical divide stemming from teachers' limited knowledge, experiences, attitudes, training, and access to AT (David, 2012; Flanagan et al., 2013; Nam et al., 2013; Connor & Beard, 2015; Liu et al., 2017; Mohamed, 2018). These barriers can negatively impact teachers' AT integration for SLI students. Hence, this study explored the UPS teachers' Technological Pedagogical Content Knowledge (TPACK). This framework examines the knowledge and skills teachers need to integrate technology effectively into their teaching and the variances in special and general education classrooms.

Technological Pedagogical Content Knowledge (TPACK)

The Technological Pedagogical Content Knowledge (TPACK) framework, a product of Shulman's (1987) pedagogical content knowledge (PCK), is not just a theoretical construct but also a practical tool for teachers. Mishra and Koehler (2006) expanded PCK by incorporating technological knowledge (TK) as an essential component of teachers' knowledge, as illustrated in Figure 1. Mishra and Koehler proposed the TPACK framework to identify how teachers combine technology, pedagogy, and content knowledge for teaching and learning (Kong et al., 2023). TPACK is not only a theoretical framework but also a critical one for examining technology integration (Wu, 2013; Engelbrecht et al., 2020; Saubern et al., 2020; Kholid et al., 2023; Su, 2023; Teichert et al., 2023). TPACK provides a structure to organize the development of work around pedagogy, content, and technology (Koehler & Mishra, 2009). The TPACK framework has been widely published in research on teacher education, teacher beliefs, and classroom practices (Saubern et al., 2020, p. 1). Cox and Graham's (2009) study confirmed the boundaries between TPACK and the combinations of its seven elements and suggested that TPACK is a "sliding" framework based on emerging technologies and the ongoing dialogue about the growing definition of technology.

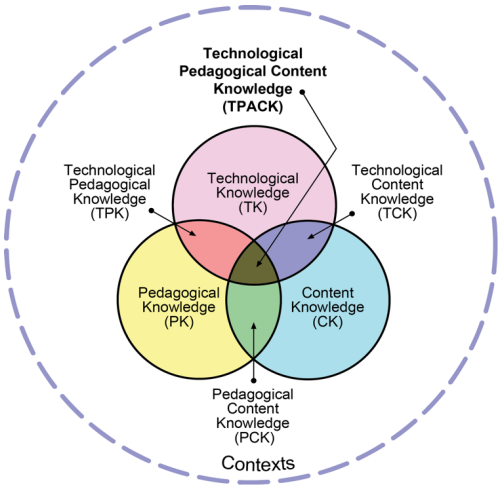

Figure 1. *TPACK (Koehler and Mishra, 2006, p. 1025)*

Over the last twenty years, various researchers have analyzed the TPACK model from many epistemological and methodological positions (Jimenez et al., 2023). Research has revealed that the use of technology in education is criticized for lacking theoretical foundations (Buckingham, 2013; Kholid et al., 2023). TPACK is criticized as weak in its theoretical use (Saubern et al., 2020). TPACK survey methods have commonly assessed teachers' technological knowledge (Baran et al., 2011; Willermark, 2018; Su, 2023). Most surveys have examined preservice teachers' self-assessment of TPACK and related knowledge domains (Schmidt et al., 2009; Willermark, 2018). Since existing surveys on TPACK have focused on teachers' self-assessment of technological knowledge, the challenges of creating and validating an instrument to measure teachers' TPACK application in multiple contexts, including different content areas, are complicated (Archambault & Barnett, 2010; Teichert et al., 2023). Former research on TPACK has distracted researchers from addressing the goal of TPACK and advancing the recognition of effective teaching with technology. A review of twenty-two TPACK studies indicates that researchers must address what teachers need to know to integrate technology effectively and how to develop their knowledge best (Saubern et al., 2020).

Research Questions

The study investigated how the UPS teachers integrate AT into their teaching and learning and their experiences integrating AT for students with SLI. More specifically, the following research questions guided the research inquiry:

1. What are the differences between the Pre-K-12 special education teachers and general education teachers in their use of TPACK in special education self-contained and general education non-self-contained classrooms for students with speech and language impairments (SLI)?

2. What are the differences in the Pre-K-12 special education teachers' and general education teachers' use of TPACK in elementary, middle, and high school grade levels for students with SLI?

3. What are the differences between the Pre-K-12 special education teachers' and general education teachers' use of TPACK during science, social studies, literacy, and math instruction for students with SLI?

In addition, the study explored teachers' experiences in integrating AT to support students with SLI, including:

- The AT commonly used in both general and special education settings for SLI learners,
- Teachers' assessments of the effectiveness of the AT and content delivered and
- Teachers' experiences integrating AT into classroom instruction for students with SLI.

The Context of the Study

The UPS district examined services for about 53,406 students. The UPS has about 7,116 employees, including 3,227 teachers, all 100% certified, and 50 or more hold National Board Certification. Seventy-eight percent of the students are eligible for free or reduced lunch. Eighty-two percent of the students are African American, and 14% of the students have a disability, with SLI students being the largest group receiving special education services. The COVID-19 pandemic hit the UPS district hard, revealing inadequate education for students in the USA and globally (Teichert et al., 2023). During the pandemic, the UPS district fed 2 million families; with COVID relief funding, the UPS expanded summer and after-school programming, provided mental health support for students, and developed a virtual school. The UPS district opened all its schools in 2020-21, allowing teachers and students to teach and learn in person or online. Twenty million dollars in additional funding provided all students with laptops and internet connections to learn from home. However, children with disabilities require more individualized instruction and support that they cannot access at home. Thus, COVID negatively impacted disabled learners' access to the programs and services critical for their educational development (Mete et al., 2022).

Furthermore, teachers experienced challenges in online learning during the pandemic, making it difficult for them to do their jobs (Page, 2020, as cited in Teichert et al., 2023). Teachers' workloads increased as they transitioned to teaching online. Teachers encountered pedagogical challenges as they adapted familiar teaching methods to new media, forcing them to operate in virtual classrooms (Teichert et al., 2023). Teachers also reported difficulties meeting their students' needs online, needing more training to integrate technology effectively, and requiring help communicating between schools and homes. Some students needed access to reliable internet and digital devices.

Research Method

Mixed methods research, a comprehensive approach that has been in practice since the 1950s but was officially recognized in the late 1980s (McKim, 2017), combines qualitative and quantitative methods into a single study. This integration allows us to harness the benefits of both methods while minimizing their weaknesses (Fetters & Molina-Azorin, 2017). By linking qualitative and quantitative approaches, mixed methods research creates a more holistic understanding that cannot be achieved alone (Fetters & Molina-Azorin, 2017; McKim, 2017). In the context of our study, a mixed-methods approach was employed. A quantitative survey of 48 5-point Likert scale items collected teachers' self-reported Technological Pedagogical Content Knowledge (TPACK). The quantitative portion of the survey addressed the seven domains of TPACK. Qualitative data about the teachers' current practices, implementation, and experiences integrating AT were collected using three open-ended questions. Demographic and professional information, including email address, age, gender, degrees obtained, number of years teaching, number of years teaching SLI students, grade level currently being taught, and current classroom setting (i.e., special education self-contained or general education non-self-contained), was collected.

Context and Participants

The Urban Public School (UPS) district is one of the largest public school systems in the Midwest of the USA, serving 53,406 students. The UPS district currently employs around 3,227 teachers. Using the UPS student and employee database management system, a search of all special education teachers in the UPS district identified 594 special education teachers. However, 36 of these teachers were excluded from the study as transition center teachers who worked with adults aged 18 to 26, leaving 556 teachers as potential participants. From the UPS database management system, five special education program supervisors were identified and associated with these teachers and thus received correspondence from the researcher. A sample of 94 special education teachers from this target population provided data for the study. The adequacy of this sample was evaluated using a survey validation section on internal consistency analysis and the discriminant validity of the survey using the data collected from the sample.

Recruiting and Sampling Strategies

The UPS district teachers were recruited using the schoolwide database management system. The UPS database management system provides up-to-date district-wide student and staff information. The UPS district Regional Educational Service Agency maintains all the UPS student and staff data for the district. A search was conducted to identify all certified special educators who provide direct instructional support to Pre-K-12 self-contained and non-self-contained special education and general classrooms that have students receiving speech and language services. From this search of the UPS database system, an alpha report was generated identifying all the UPS district special education teachers by first and last name as potential participants, along with their school location number, program, and program supervisor, and entered into a Microsoft Excel spreadsheet. Teachers' email addresses were secured from the UPS database and district employee email system and linked to their names on the Microsoft Excel spreadsheet. Email addresses were used to send the TPACK survey and correspondence. All teachers' and supervisors' email addresses are public records secured from the UPS district website. Once all teachers' information was added to the Microsoft Excel spreadsheet, teachers' email addresses were added by linking the teachers' school location numbers to the program supervisor. It is important to note that all identifying information was kept strictly anonymous and destroyed at the study's end, ensuring confidentiality.

Data Collection Instrument

Qualtrics was used for the online survey. The survey gathered participants' demographic and professional data, including age, number of years teaching, number of years teaching students with SLI, gender, current grade level, classroom setting (e.g., special education/self-contained, general education/non-self-contained classroom, number of students with SLI), and degrees held. After carefully considering multiple instruments, the Survey of Preservice Teachers' Knowledge of Teaching and Technology (Schmidt et al., 2009, pp. 145-148) was modified for this study with permission from the publisher, as it closely aligns with the TPACK seven domains. One item was added to the TK subscale: "I have sufficient knowledge of assistive technology for speech and language instruction." The modified TPACK instrument consisted of 48 five-point Likert rating scales anchored as follows: 1 = strongly disagree, 2 = disagree, 3 = neither agree nor disagree, 4 = agree, and 5 = strongly agree. A small pilot study involving five teachers was used to pretest the survey, and the participants reported no difficulties understanding the survey instructions or the individual survey questions, which further validated the survey's effectiveness.

Validity & Reliability

Although Schmidt et al. (2009) have reported on their extensive efforts to construct a reliable and valid TPACK instrument, this instrument was slightly modified for use in the present study, necessitating a reexamination of its psychometric qualities. The 48 TPACK rating scale items were analyzed along with their Cronbach Alphas and Corrected Total-Item Correlation, which generally supported the hypothesized seven-subscale structure of the TPACK instrument. The internal consistency reliability of each subscale was evaluated using Cronbach's alpha coefficient. The values of Cronbach's alpha met DeVellis' (2012) and Nunally's (1978) standards for "good" to "excellent" reliability for all subscales. Some correlations among the constructs exceed 0.50, indicating low discriminant validity for the instrument. A TPACK score of 0.74 was indicated, which is relatively high. TPACK and TPK appear to measure the same knowledge construct observed in the findings. These two levels of knowledge may be combined to reflect one domain in future studies. TPACK and PCK scores of 0.70 were also relatively high. The Corrected Total-Item Correlation can be used to measure the convergent validity of a construct. If the correlation is high, above 0.50, between a given item and the construct, it possesses convergent validity. Most items possess high correlations, indicating a high convergent validity for the instrument. Therefore, the instrument is confidently said to have sufficient reliability and validity.

Discriminate Validity and TPACK

The TPACK instrument, a key focus of our study, has been extensively validated in numerous previous studies. However, some correlations among the constructs in our specific study exceeded 0.50, which could indicate low discriminant validity for the instrument. This is based on the data we collected from the UPS district teachers. A construct is considered valid if it is independent and not perfectly correlated with other constructs. Therefore, low correlations among the composed constructs below 0.50 are necessary to conclude that the instrument possesses discriminant validity (Campbell & Fiske, 1959). Table 1, for instance, reflects a TPACK score of 0.74, which is relatively high. This suggests that TPACK and TPK measure the same knowledge construct observed in our findings. These two knowledge levels could be combined to reflect one domain in future studies. Additionally, the TCK and PCK scores of 0.70 were relatively high, indicating that these two sub-domains may measure the same knowledge construct as observed in our findings. However, it is important to note that these findings could be influenced by the small size, social desirability bias, and acquiescence bias of the UPS district teachers' responses in our study.

One of the disadvantages of teacher self-reporting on TPACK is that research shows that accurately evaluating one's abilities is difficult (Lawless & Pellegrino, 2007; Willermark, 2018). Many individuals are unaware of their lack of knowledge, skills, or abilities. As a result, teachers' self-assessment or self-reporting of knowledge often reflects increased confidence rather than increased knowledge in practice, which raises questions

about the validity of the approach. For example, some of the TPACK self-assessment questions are vague. For instance, the statement "I have sufficient knowledge about mathematics" involves uncertainty for the self-reporter; that is, what constitutes "sufficient"? In what situation? Also, what "technologies" are involved? These types of statements allow the self-reporter to interpret the questions and his or her abilities (Willermark, 2018).

Table 1 presents the inter-item correlations among the TPACK scales. Some correlations among the constructs exceed 0.50, indicating low discriminant validity for the instrument based on the data collected from the UPS district teachers.

Table 1. *Discriminant Validity Analysis*

	Mean	SD	TK	CK	PK	PCK	TCK	TPK	TPACK
TK	3.78	0.65	1.00						
CK	4.09	0.60	0.50	1.00					
PK	4.64	0.52	0.41	0.64	1.00				
PCK	3.95	0.87	0.39	0.54	0.46	1.00			
TCK	3.56	1.01	0.45	0.51	0.39	0.70	1.00		
TPK	4.23	0.70	0.60	0.45	0.56	0.37	0.50	1.00	
TPACK	4.17	0.68	0.60	0.52	0.59	0.47	0.51	0.74	1.00

Participants Profile

Survey responses were received from 94 respondents out of 556 teachers who participated in the study, resulting in a 17.0% response rate. A total of 94 cases remained for analysis. The data were downloaded from Qualtrics as an Excel file and then imported into IBM SPSS (Version 23.0). All data analysis was conducted using IBM SPSS (Version 23.0) statistical software. The majority of respondents were female, at 92.4% (n=85). Sixty-five percent (n=61) of respondents hold a master's degree, whereas 17% (n=16) possess a bachelor's degree. The current grade levels taught by teachers are more evenly distributed, with 40% (n=37) teaching in the Pre-K elementary setting, 25% (n=24) in middle schools, and 35% (n=32) in high schools. Seventy percent (n=66) of respondents indicated teaching in special education settings, and 30% (n=28) reported teaching in general education settings. About 75% (n=78) of the sample reported having ten or more years of teaching experience. Approximately 65% (n=69) of respondents indicated they have ten or more years of experience teaching SLI students.

Not all participants responded to every survey question. Thus, missing or incomplete responses to specific questions were excluded from the data analysis and not included in the results, either.

Data Analysis Methods

A range of selected statistical analyses were conducted to examine the relationships among the different variables, including descriptive statistics, the Mann-Whitney U test, the Kruskal-Wallis H test, and more, based on the distributional characteristics of the survey data and the research questions.

Table 2 presents the skewness and kurtosis values for each dimension of the TPACK instrument based on the collected data. These statistics reveal that the distributions of the constructs exhibit left skewness, suggesting that most responses tend to cluster around the "agree" and "strongly agree" categories. This distributional pattern informs the selection of hypothesis testing techniques to assess the statistical significance of differences between classroom settings, grade levels taught, and the means of the TPACK instrument. When the assumption of normality is violated, non-parametric tests are generally more suitable for testing mean differences. Consequently, the present analysis employs the Mann-Whitney U test to compare the means of two independent samples and the Kruskal-Wallis H test for comparing means across more than two independent samples.

Table 2. *Distribution of Constructs Analysis*

	n	Skewness		Kurtosis	
	Statistic	Statistic	Std. Error	Statistic	Std. Error
TK	90	-.421	.254	-.338	.503
CK	91	-.823	.253	1.358	.500
PK	94	-1.896	.249	4.118	.493
PCK	94	-.995	.249	1.184	.493
TCK	92	-.510	.251	.012	.498
TPK	94	-.825	.249	.175	.493
TPACK	87	-.494	.258	-.092	.511

Data Analysis Results

The following summarizes the statistical analyses and presents the results by research question.

1. What are the differences between the UPS district Pre-K-12 special education teachers and general education teachers in their use of TPACK in special education self-contained and general education non-self-contained classrooms for students with SLI?

Table 3 displays the means of UPS district special education, general education, and classroom settings for their TPACK and indicates that both groups of teachers have no noticeable mean differences.

Table 3. *TPACK Means and Classroom Setting*

Current Classroom Setting		TK	CK	PK	PCK	TCK	TPK	TPACK
Special education	Mean	3.72	4.08	4.62	4.01	3.63	4.26	4.24
	n	63	64	66	66	65	66	62
	Std. Deviation	0.71	0.62	0.55	0.83	0.94	0.68	0.64
General education	Mean	3.80	4.16	4.72	3.84	3.33	4.07	4.00
	n	27	27	28	28	27	28	25
	Std. Deviation	0.60	0.48	0.33	0.91	1.16	0.75	0.73
Total	Mean	3.74	4.10	4.63	3.96	3.54	4.21	4.17
	n	90	91	94	94	92	94	87
	Std. Deviation	0.68	0.58	0.50	0.85	1.01	0.70	0.67

Table 4 displays the results of the Mann-Whitney U test, confirming that the data above, presented in a tabular format, indicates no statistical differences in TPACK dimensions based on the UPS district teacher and classroom setting at the 0.05 level.

Table 4. *Mann-Whitney U Test Results (Classroom Setting on TPACK)*

	TK	CK	PK	PCK	TCK	TPK	TPACK
Mann-Whitney U	803.500	813.500	906.500	828.000	751.000	795.500	613.000
Wilcoxon W	2819.500	2893.500	1312.500	1234.000	1129.000	1201.500	938.000
Z	-.415	-.441	-.153	-.825	-1.104	-1.075	-1.533
P-value	.678	.659	.879	.410	.270	.282	.125

2. What are the differences in the UPS district's Pre-K-12 special education teachers' and general education teachers' use of TPACK in elementary, middle, and high school grade levels for students with SLI?

Table 5 displays the means of the UPS district teachers' special education, general education, and current grade levels across the various domains of TPACK. The UPS teachers exhibit similar self-assessments on the TPACK instrument, regardless of their grade level or classroom setting.

Table 5. *Current Grade Level and TPACK Self-Assessment*

Current grade level teaching		TK	CK	PK	PCK	TCK	TPK	TPACK
Pre-K Elementary	Mean	3.69	4.08	4.57	3.97	3.60	4.18	4.20
	n	36	36	37	37	37	37	33
	Std. Deviation	0.68	0.56	0.53	0.88	0.80	0.66	0.70
Middle School	Mean	3.80	4.17	4.63	3.94	3.61	4.12	4.13
	n	22	24	24	24	22	24	23
	Std. Deviation	0.70	0.69	0.61	0.79	1.07	0.81	0.71
High School	Mean	3.76	4.08	4.75	3.97	3.42	4.30	4.17
	n	31	30	32	32	32	32	30
	Std. Deviation	0.70	0.53	0.34	0.90	1.21	0.68	0.64
Total	Mean	3.74	4.10	4.65	3.96	3.54	4.20	4.17
	n	89	90	93	93	91	93	86
	Std. Deviation	0.68	0.58	0.50	0.86	1.02	0.71	0.67

Table 6 presents the results from a Kruskal-Wallis H test statistic. There are no statistical differences in the TPACK dimensions based on grade level at the 0.05 level for the UPS district teachers and grade levels across TPACK.

Table 6. *Kruskal-Wallis H Test Results (Grade Level and TPACK)*

	TK	CK	PK	PCK	TCK	TPK	TPACK
Kruskal-Wallis H	.512	1.119	1.790	.090	.300	.925	.162
Df	2	2	2	2	2	2	2
P-value	.774	.571	.409	.956	.861	.630	.922

3. What are the differences between the UPS district Pre-K-12 special education teachers' and general education teachers' use of TPACK during science, social studies, literacy, and math instruction for students with SLI?

Table 7 indicates that the UPS district teachers' TPACK means across the four indicators of content knowledge in mathematics, social studies, science, and literacy did not display any significant mean differences.

Table 7. *TPACK and Content Knowledge (mathematics, social studies, science, and literacy)*

Descriptive Statistic	Mean	n	SD
Mathematics			
9. I have sufficient knowledge of mathematics.	4.18	94	.816
10. I can use a mathematical way of thinking.	4.14	94	.837
11. I have various ways and strategies for developing my understanding of mathematics.	4.16	94	.794
Social Studies			
12. I have various ways and strategies of developing my understanding of social studies.	4.18	94	.775
13. I have sufficient knowledge about social studies.	4.05	94	.896
14. I can use a historical way of thinking.	3.97	91	.809
Science			
15. I have various ways and strategies of developing my understanding of science.	3.98	94	.672
16. I can use a scientific way of thinking.	3.95	94	.753
17. I have sufficient knowledge of science.	3.82	94	.803
Literacy			
18. I have various ways and strategies for developing my understanding of literacy.	4.36	94	.701
19. I can use a literary way of thinking.	4.36	94	.701
20. I have sufficient knowledge about literacy.	4.29	94	.742

Note: The content knowledge question items above are numbered in the order in which they appear on the TPACK survey instrument.

Table 8 displays the results of the Mann-Whitney U test, finding no statistical relationship between any mathematics indicators and the classroom setting at the 0.05 observed significance level.

Table 8. *Mann-Whitney U Test Results (Mathematics and Classroom Setting)*

Test Statistics

	I have sufficient knowledge about mathematics.	I can use a mathematical way of thinking.	I have various ways and strategies of developing my understanding of mathematics.
Mann-Whitney U	889.500	863.500	859.500

Wilcoxon W	1295.500	1269.500	1265.500
Z	-.311	-.545	-.576
P-Value	.756	.586	.564

Table 9 displays the results of the Mann-Whitney U test, finding no statistical relationship between any social studies indicators and classroom settings at the 0.05 observed significance level.

Table 9. *Mann-Whitney U Test Results (Classroom Setting and Social Studies)*

Test Statistics			
	I have various ways and strategies of developing my understanding of social studies.	I have sufficient knowledge about social studies.	I can use a historical way of thinking.
Mann-Whitney U	808.000	868.000	718.500
Wilcoxon W	3019.000	3079.000	2798.500
Z	-1.063	-.507	-1.415
P-value	.288	.612	.157

Table 10 displays the results of the Mann-Whitney U test, finding no statistical relationship between any science indicators and the classroom setting at the 0.05 observed significance level.

Table 10. *Mann-Whitney U test Results (Science and Classroom Setting)*

Test Statistics			
	I have various ways and strategies of developing my understanding of science.	I can use a scientific way of thinking.	I have sufficient knowledge about science.
Mann-Whitney U	862.000	895.000	859.000
Wilcoxon W	3073.000	1301.000	1265.000
Z	-.605	-.271	-.602
P-value	*.545*	*.787*	*.547*

Table 11 displays the results of the Mann-Whitney U test, finding no statistical relationship between literacy indicators and the classroom setting at the 0.05 observed significance level.

Table 11. *Mann-Whitney U Test Results (Literacy and Classroom Setting)*

Test Statistics

	I have various ways and strategies of developing my understanding of literacy.	I can use a literary way of thinking.	I have sufficient knowledge about literacy.
Mann-Whitney U	721.000	788.000	795.500
Wilcoxon W	2932.000	2999.000	3006.500
Z	-1.867	-1.251	-1.173
P-value	*.062*	*.211*	*.241*

Qualitative Data Analysis Results

Qualitative data were collected and analyzed to build a deeper understanding of teachers' practice of AT integration in the classroom for students with SLI. Open-ended questions were used to gather data about teachers' use of AT in their educational practices. The qualitative analyses focus on the UPS teachers' implementation of assistive technology in their classrooms, the tools they use, their assessments of effectiveness, and their experiences with integration. Specific analysis was conducted to identify and compare their practices across content areas at various grade levels in either special education or general education classroom settings. The following were explored in detail through qualitative analyses:

- The assistive technology tools commonly used in both general and special education settings for SLI learners,
- Teachers' assessments of the effectiveness of the assistive technology and content delivered and
- Teachers' experiences integrating assistive technology into classroom instruction for students with SLI.

Qualitative responses to the open-ended questions were recorded, coded, categorized, and then analyzed. The types of assistive technology tools used by both general education and special education teachers for students with SLI were compiled into a Word document. Next, the teachers' assessments of the effectiveness of the assistive technology and the content delivered were also documented. Finally, the experiences of teachers integrating AT into the classroom for SLI learners were collected. After initial data coding and categorization, themes and patterns were identified. Further analysis was conducted as guided by the research questions.

The following sections report the key findings.

Teachers' use of AT

Table 12 displays the AT commonly utilized in general and special education classrooms by UPS district teachers.

Table 12. *Assistive Technology in the Classrooms*

Type	**Frequency**
Computers	25
Audio/Video Recordings (Elmo, Voice Output Device, Voice Amplifier and Camera, Projector and Radio)	10
Calculators	2

iPad	15
Smart boards (Communication and Neo Boards)	16
Computer Programs, Software and Online Applications for SLI	4
Educational Games (Leapfrog and Others)	4
Voice to text (text to speech)	5

Only 40% (n=37) of the participants responded to the question. However, using AT devices in UPS classrooms for SLI students is significant. Computers, laptops, and desktops are the most utilized AT devices, demonstrating their crucial role in facilitating learning. Many UPS teachers also show a high rate of using smart boards, another important AT tool. Smart boards are the second most used AT tool in the classroom to increase SLI students' communication and participation in class. iPads for reading and other activities are cited as UPS's most utilized AT tool. UPS teachers also use audio/video recording devices such as cameras, projectors, YouTube, and voice-activated devices. A small percentage of teachers indicated their use of educational games and educational websites in their instruction in UPS district classrooms.

The UPS teachers reported using special computer programs and software during instruction and assessment. 40% (n=37) of teachers reported Math, Science, English/Language Arts, and Social Studies as the most commonly shared content taught. The state mandated the content taught utilizing AT for SLI students identified by the UPS teachers (e.g., Math, Science, and Language Arts). The most frequently used instructional strategies by teachers for SLI students using AT occurred during direct instruction, individual instruction, group instruction, and mini-lessons. They evaluated SLI student learning through diagnostic, formative, and summative assessments. The teachers expressed that these instructional methods help SLI students communicate, practice, and master new skills.

Teachers were asked to describe how they assessed the effectiveness of the content using AT and the teaching methods utilized in the classroom during a lesson. Thus, teachers include the content, the AT tool(s) used, and the instructional approaches implemented. Teachers in the UPS district identified common types of low-tech to high-tech AT tools when instructing students with SLI. Teachers also identified similar types of AT tools as part of their daily instructional program. The UPS teachers identify commonly used standard AT technologies across core content and on state tests. The UPS utilizes AT during content—direct, group, and mini-lessons. Few teachers identify educational games and educational websites as aids to their instruction. The UPS identified diagnostic formative and summative assessments to evaluate mastery of content material when instructing learners with SLI.

Teachers' Assessment of AT and Content Effectiveness

Table 13 summarizes the methods UPS teachers use to assess the effectiveness of the content delivered through AT-facilitated instruction.

Table 13 reports the three types of assessment used by the UPS teachers to evaluate the effectiveness of content delivered through assistive technology-facilitated instruction: formative, summative, and diagnostic assessments.

Table 13. *Assessment of Assistive Technology and Content Effectiveness*

Assessment Type	Description	Examples	Frequency

Formative	Formal and informal testing by teachers during the learning process to collect baseline data in order to modify instructions for learners.	Removing the iPad to test students' recall ability for words, pictures, songs and colors (2). Using how many times a student activates a voice-output device to measure their achievement (3). 15 minutes of math activities while the teacher walks around the classroom evaluating students' progress (3). Daily living assessments using hands' movement instruction (2). Utilize daily living skills' assessment like sweeping, mopping or organizing through observation (2). Use of the internet to research independent projects (2).	14
Diagnostic	Baseline data that allows teachers to identify a learner's prior knowledge and to identify misconceptions the learner may have before formal instruction begin.	Use of iPad to assess students' ability before the test (1). Use of Kahoot app for assessing students' prior knowledge on apples before the apple orchard annual trip (2). Use of students' attentiveness to assistive technology as a measure of assistive technology effectiveness (1). Use of computers to pre-test students' ability in various topics and subjects (3).	7

Summative	Used to evaluate what a student has learned at the end of the learning period.	Use of iPad to assess students' ability at the end of intended to be covered course material (2). Subjective created scales were used based on final examinations to assess students' performance during a class (2). Students' performance was assessed through teachers' observations of students' achievement during class (1). Listening to students' verbal answers and observing their progress throughout the class (3).	8

Note that the numbers above in parentheses represent the number of teachers utilizing the method mentioned.

Only 47% (n=44) of the sample responded to this question. Three main types of assessment were identified across the teachers' answers: formative, summative, and diagnostic. Teachers' observations of students' progress were among the most common methods emerging from the responses. Furthermore, AT, such as an iPad, the internet, and voice recorders, were all used to deliver class assessments. Students spent out-of-class time on their computers searching the internet for relevant material to perform assigned assessments. In-class reading assignments were also delivered through the iPad. Many teachers also mentioned using applications to teach students new topics or to test their abilities on covered material. The UPS teachers were finally asked to provide information about their experiences integrating assistive technology for SLI students. The UPS utilized formative assessment to test student recall, responses, performance, fine motor skills, and independent living skills as indicators of success or mastery using AT. The UPS utilizes diagnostic assessment techniques to assess prior knowledge, measure the SLI students' current level of mastery, and listen to and observe students' verbal responses. The UPS utilized summative assessment to assess abilities, evaluate student performance, and listen to verbal responses by answering questions to evaluate SLI students' overall learning using AT.

Teachers' experiences integrating AT for students with SLI in the classroom

42% (n=39) of special education teachers responded to the question, and 11% (n=10) of general education teachers responded. The use of AT, computers, Picture Exchange Communication Systems, Text-to-Speech, and various applications and software for SLI education were reported to have a positive impact on students. It helped them better understand the material, increased their motivation to learn, and encouraged their class participation. Teachers identified participation in daily lessons, curriculum, and daily activities as the most commonly recognized teacher experiences with integrating AT for students with SLI. A few teachers mentioned that AT improves SLI students' self-esteem, is beneficial, enhances overall morale, and allows SLI students to participate in lessons and actively communicate with others with whom they would otherwise be unable to engage. One of the most prominent challenges facing the UPS teachers was that many respondents lacked formal training and experience in instructing students with SLIs using AT. Some teachers expressed learning how to use AT through trial and error. Furthermore, the available training, funding, and assistive technology in many schools, along with teachers' awareness, do not provide sufficient support for delivering adequate education for SLI in the UPS district.

Discussion

The COVID-19 pandemic revealed inadequate education for students in the USA and globally (Teichert et al., 2023). Over 1.38 billion students were deprived of in-person learning due to social mandates and requirements (Su, 2023). Social isolation, the economic downturn, and lockdowns had a deleterious impact on children with special needs (Mete et al., 2022). Preliminary data suggested that teachers faced various challenges with online learning during the pandemic. One report indicated that 83% of 505 educators surveyed across the US had difficulty doing their jobs (Page, 2020, cited in Teichert et al., 2023). Teachers' workloads intensified as they transitioned to teaching content and materials online. They encountered pedagogical challenges as they adapted familiar teaching methods to new media, forcing them to operate in virtual classrooms (Teichert et al., 2023). Teichert et al.'s (2023) study of 389 Midwest teachers unveiled that they reported difficulties in meeting their students' needs as they transitioned to online learning. A lack of training hindered teachers' ability to integrate technology effectively, and communication between schools and homes needed improvement. Students required access to reliable internet and digital devices, even when access was not a problem. Students' limited digital literacy skills in navigating online platforms were identified as a challenge. Teachers recognized student engagement, communication, and the shift to online pedagogy as significant challenges during the pandemic. The pandemic pushed teachers to learn new technologies and expand their technological knowledge to meet learners' needs (Teichert et al., 2023). Technological knowledge, training, and access to digital devices and assistive technology tools to support learners with disabilities online became crucial for students during times of crisis.

The COVID-19 pandemic school closures impacted the daily lives of families and children (Mete et al., 2022). The pandemic affected the emotional and mental health of young children in general (Jiao et al., 2020). Children's mental health suffers during times of disaster, and they often exhibit high levels of stress, anxiety, and emotional and behavioral difficulties as their special education programs and services cannot be adequately supported during school closures (Mete et al., 2022). One study examined 116 families of students in Turkey receiving special education programs and services and the effects of COVID-19 infection on their family life (Mete et al., 2022). It was found that the pandemic adversely affected 94.6% of families (Mete et al., 2022). Students' daily routines worsened; time with their parents, reading, and playtime activities decreased. Screen time increased from 1 to 3 hours, indicating an overall regression in child development. Certain special education practices in the home ceased.

Children with special needs require more individualized instruction that they cannot access at home. COVID-19 adversely impacted their ability to obtain these programs and services that are critical for their educational development (Mete et al., 2022). Losing access to educational services and AT may negatively affect students' learning outcomes. Maintaining a daily routine is essential for students with disabilities during disasters (Mete et al., 2022). A routine is vital because it prevents children with disabilities from experiencing additional emotional and behavioral difficulties, making access to special educational services and AT crucial. More studies addressing the impact of COVID-19 on students with disabilities are needed. The pandemic disrupted education during and after its occurrence and has become a new normal in education that will most likely continue (Mete et al., 2022). The pandemic may have significant implications for these learners in the future.

Recent decades have seen an explosion in educational development due to advancements in digital technology. Teachers' digital literacy increased because of COVID-19, and obstacles for both teachers and students also grew (Shuqiong & Di, 2022; Su, 2023). The pandemic's impact allowed teachers to utilize their technological knowledge and skills. Due to social distancing requirements, the pandemic influenced and accelerated the development of online educational platforms and digital technologies for teaching and learning (Shuqiong & Di, 2022; Su, 2023). There are concerns that the requirements for technology integration, prompted by the pandemic, may have further implications for education (Engelbrecht et al., 2020; Kholid et al., 2023). These critical changes impacted how students with disabilities were educated using technology, negatively affecting their access to technology and support services. Research examining the impact of teachers' technological knowledge during the COVID-19 pandemic should be considered in future scholarship.

Urban Public School (UPS) TPACK Study

This timely study explored an Urban Public School (UPS) district's teachers' TPACK and the current integration of AT for students with SLI. Teachers were asked about the types of AT tools, the effectiveness of these tools, and the extent to which such technologies are integrated into their classrooms. Teachers are expected to have adequate knowledge of integrating technology, yet special education teachers are expected to possess more technological knowledge (Demirok & Baglama, 2018). Special education teachers receive various technology training in their special education programs that address the needs of students with disabilities, which general education teachers do not. Regardless of the classroom setting, TPACK scores do not differ; special education and general education teachers are prepared to integrate technology in the classroom for teaching students with SLI. General education teachers have sufficient TPACK knowledge to support students with SLI in general education settings. One study by McGregor and Pachuski (2009) reported that the use of AT by experienced general education teachers could be more satisfactory due to their ability to utilize AT in the classroom and the fact that they require additional technology training to use technology across content in their education programs.

The TPACK survey questions reported teachers' self-assessment during science, social studies, literacy, and math instruction for students with SLI. UPS teachers' TPACK knowledge is consistent regardless of the grade level taught. Both special and general education teachers demonstrate the same level of TPACK knowledge. Both special education and general teachers possess sufficient TPACK knowledge to support students with SLI and disabilities at all grade levels. Regardless of their content, teachers are comparable; they have adequate TPACK knowledge to teach across content areas. Teachers reported similar technology knowledge, content knowledge, pedagogy content knowledge, technology content knowledge, and technological and pedagogical content knowledge among UPS teachers. This research has found no differences between teachers in special or general education classrooms concerning technology knowledge (TK). This result is inconsistent with the expected outcome, where special education teachers are believed to have a higher command of technology use, alteration, and incorporation into classroom instruction. The findings of this study may be explained by the nature of the items presented on the TPACK instrument. The language of the eight items comprising technology knowledge is general, so any teacher, regardless of their classroom setting, is expected to exhibit high self-reported agreement with all items. If another survey instrument featured specific types of technology used by students with disabilities, such as particular software or applications widely utilized by students with SLI, the results might differ. General education teachers are rarely exposed to specialized programs, devices, computer software, and applications that assist students with disabilities in their educational journey. Therefore, they are expected to score low on items featuring information regarding specific classroom technologies for learners with disabilities.

This research found that special and general education teachers have the same content knowledge (CK). This finding is consistent with the expected outcome that teachers, regardless of their classroom setting, should exhibit the same content knowledge in their specific areas and the general education requirements in their completed programs of study. Nevertheless, the items on the instrument are generic, and teachers are likely to agree with the presented statements. Results might have differed if each area featured specific items from its domain. For instance, if the area devoted to mathematics included an item like “I utilize concepts of calculus, matrix algebra, and discrete mathematics in my instructional materials," teachers of social studies and literacy would be expected to answer "strongly disagree” or "disagree." This research found no pedagogical knowledge (PK) differences between special and general education teachers. This finding is expected to be the outcome of the research since both groups of teachers are anticipated to master a certain standard of classroom pedagogy. More importantly, the TPACK instrument lacks specific items featuring pedagogical approaches in special education settings. General education teachers are expected to exhibit a lower understanding and utilization of special education pedagogy.

Nevertheless, this research did not investigate any specific instructional or assessment design pertinent to special education students. Since both groups of teachers take courses in similar domains covering concepts and practices of pedagogy, they are expected to exhibit similar trends regarding the construct. While the TPACK

construct of pedagogical content knowledge (PCK) aimed to measure specific pedagogical approaches for SLI students, the wording of items was vague and generic, lacking specific markers where general education teachers could pinpoint and disagree with the statements. Items of PCK did not inquire about specific practices, behaviors, or actions teachers took in or outside the classroom to guide SLI students in learning. They asked whether teachers applied promising pedagogical approaches for SLI students in various subjects. Indeed, teachers are likely to agree with the statements presented. This research found no difference between special and general education teachers' technology content knowledge (TCK). This result is inconsistent with the expected outcome, where special education teachers are held to a higher standard, and their specific knowledge of the technology used for SLI students is greater than that of general education teachers. The primary driver for this result is the poor operationalization of the construct provided by the TPACK instrument, which is one of the criticisms identified in the literature (Willermark, 2018). No specific technology or technical skill type was mentioned in the four items measuring TCK. Therefore, it took considerable effort for general education teachers to disagree with any of the statements presented to them.

This analysis found no difference between teachers' self-assessments of technology pedagogical knowledge (TPK). Such a result is inconsistent with the expected outcome that special education teachers should possess higher levels of TPK compared to general education teachers due to the specialized training and work expectations regarding instruction, assessment, and lesson delivery that special education teachers receive for preparing SLI students compared to the general population of students. One potential explanation for this finding is the inadequate specificity provided by the TPACK framework for measuring the intended constructs. There has been no mention of any specific application or software used by SLI students in the instrument. Teachers recognize the complex interplay between CK, PK, and TK when teaching content using appropriate methods and technology. Finally, teachers' self-assessment of TPACK was similar to their classroom settings. However, one study shows that special education teachers have higher levels of TPACK than general education teachers (Demirok & Baglama, 2018). Therefore, general education teachers' TPACK scores are expected to be lower than those of special education teachers. This finding is contrary to expected results, where special education teachers are anticipated to exhibit higher abilities and use of TPACK compared to general education teachers due to their specialized knowledge and expertise in differentiated instruction for the non-traditional student population, SLI students, and because special education teachers are certified to teach all populations of learners.

In contrast, general education teachers are not trained to deliver educational services to special education learners or required to modify or differentiate instruction for these learners. The unexpected result is explained by the inadequate information on TPACK provided by the questionnaire. None of the items featured a specific technology, pedagogical approach, or combined method for students with disabilities. This led to the expected outcome that all teachers reported high agreement rates with all presented items, regardless of their field. The qualitative finding indicated that UPS teachers utilized various common low-to-high-tech Assistive Technology (AT) tools in the classroom. For example, computers, iPads, Smartboards, audiobooks, video recording devices, calculators, and iPads were standard teaching tools across grade levels and subject content. Computers and audiobooks improve the lives of students with disabilities (Erdem, 2017; Demirok & Baglama, 2018). The UPS teachers use AT tools to assess the effectiveness of instruction during group instruction, direct instruction, and many other lessons. Teachers also utilize AT for SLI learners in diagnostic, formative, and summative assessments. They use AT to check for prior knowledge, recall, student responses, and observations during diagnostic assessments. For informal assessments, UPS teachers utilize AT to evaluate the effectiveness of instruction through recall, performance, and verbal responses from SLI learners.

Moreover, summative effectiveness assessment using AT focuses on student mastery of content, performance indicators, scales, and verbal responses on assessments. For example, two teachers identified using iPads to conduct formative assessments to test students' recall of words or pictures. Three teachers reported using iPads and observing how often students activated voice-output options to measure achievement. UPS teachers use formative assessments to gather baseline information about a student to modify or differentiate instruction. Regarding summative assessments, two teachers used iPads to assess students' abilities at the end of covered

course materials, and two teachers used teacher-made scales on a final examination. Formative and summative assessments are two tools that UPS teachers utilize to ensure that students with SLI achieve. UPS teachers utilize AT tools for diagnostic purposes as well. Diagnostic data allow teachers to identify students' prior knowledge and any misconceptions the students may have before formal instruction begins. Three teachers reported using computers to pre-test SLI students on content, and two assessed students' attention spans using AT to measure AT effectiveness on instruction. Often, UPS teachers utilize AT devices and observe SLI students' attention spans, responsiveness to the tools, and non-verbal gestures (e.g., clapping, smiling, singing, and pointing) to determine academic growth and student engagement as a diagnostic measure. It was shown that UPS teachers' experiences with implementing AT in the classroom revealed many similarities and some complexities. All UPS teacher respondents were familiar with the AT tools and used some form of AT in the classroom. However, only some general education teachers responded to this question, which may suggest that general education teachers require more opportunities and training to integrate AT.

UPS teachers said they were integrating assistive technology in the classroom for SLI learners. UPS teachers expressed mostly positive experiences integrating AT for SLI students. Teachers reported that their experiences were beneficial for motivating students with disabilities and improving learning outcomes. UPS teachers reported that AT tools allow students to collaborate with others, boost student morale, and build students' self-esteem. UPS teachers reported that AT tools improve students' participation in daily lessons and activities, enhance communication skills, and allow students to interact with technology. UPS teachers expressed the need for more AT training and financial resources in the school to support and encourage the use of AT. Furthermore, with the development of AI and the impact of the pandemic on students with disabilities, the need for technology integration in the classroom is essential. Teachers are critical to technology integration for students with speech and language impairments and are vital to all learners' success and learning outcomes. Providing resources and training to teachers can directly impact student achievement. Unfortunately, many technology tools are not designed for educational purposes, which requires teachers to adjust or modify tools for teaching and learning, making teaching with technology difficult. Thus, technology developers should address student needs and abilities when developing technologies for students with disabilities, as these learners are the most vulnerable and require the most help and support in school.

Additionally, this study provides a unique contribution to the field by examining the integration of AT in a large UPS district that has experienced significant challenges, including bankruptcy, state takeover, and financial mismanagement. These challenges have hindered the district's ability to effectively incorporate AT into educational practices. By focusing on the TPACK of teachers in a context of resource scarcity and organizational instability, the study offers new insights into how teachers adapt and utilize available technologies for students with SLI. A key contribution of this study is its focus on the specific integration of AT for students with SLI, a population that often faces unique barriers to learning. The study's findings provide a detailed understanding of the instructional practices, tools, and experiences of both general and special education teachers in the integration of AT across grade levels and content areas. Despite the absence of significant differences in teachers' TPACK across various classroom settings and content knowledge areas, the study reveals the widespread use of a diverse range of AT tools, from basic assistive devices to more advanced technologies, indicating a broad, albeit varied, approach to supporting students with SLI.

This research is significant because it fills a gap in the literature regarding how teachers in financially and administratively strained districts implement AT, particularly for students with disabilities. The study also sheds light on the realities of technology integration in classrooms where resources are limited, offering valuable insights for policymakers, administrators, and educators who are seeking to enhance AT integration in similar contexts. The findings suggest that, even in challenging circumstances, teachers demonstrate adaptability and positive engagement with AT, highlighting the potential for AT to support student learning even in resource-constrained environments. In sum, this study contributes to the field by providing empirical evidence on the state of AT integration in a struggling district, offering important implications for both the practice and future research

related to technology integration in special education. This approach emphasizes the study's unique context (a district facing financial instability and state takeover) and its contribution to understanding the integration of AT in such settings. It also positions your findings as offering new insights into how teachers in challenging circumstances manage to implement AT for students with speech and language impairments despite limited resources.

Artificial Intelligence (AI) and Emerging Learning Technologies in K-12

Although this study did not address any research questions related to AI, it is apparent that AI in education and emerging technology has transformed teaching and learning (Zhang & Aslan, 2021; Casal-Otero et al., 2023; Gillani et al., 2023; Hopcan et al., 2023; Marino et al., 2023; Su et al., 2023). AI is an ambiguous term that references a collection of methods, capabilities, and limitations that may not be explicitly articulated by researchers, educational technology companies, or AI developers (Gillani et al., 2023). Coined in 1956, various disciplines (e.g., computer science, psychology, mathematics) have contributed to AI development (Casal-Otero et al., 2023). AI is a system of computers or machines working in unison to emulate or reproduce human cognition (Tai, 2020, as cited in Marino, 2023; Gillani et al., 2023; Hopcan et al., 2023). AI tools and systems are designed to deal with complex human actions: learning, analyzing, synthesizing, and adapting. AI machines imitate human behavior. AI is used for work that requires human intelligence to be performed by a computer. AI is oriented to comprehend, model, and replicate human intelligence, encouraging machine learning, perception, natural language processing, knowledge representation, reasoning, and more.

Scholars have studied AI in education (AIEd) and claim that AIEd techniques may personalize learning, increase the efficiency of the learning environment, guide teachers and students through the teaching and learning process, and enhance interactive experiences at school and in the classroom. Studies suggest that AIEd fosters creativity and critical thinking in students, enabling the monitoring and evaluation of complex skills. AI may support learners in their representation, expression, engagement, and learning activities (Hopcan et al., 2023). AI may also help humans understand instructional approaches to teaching and learning in various contexts. Although AI technology cannot work anonymously, it is excellent for routine and repetitive tasks, which is especially important for students with cognitive impairments. However, more methodological proposals for introducing AI in K-12 education are needed (Casal-Otero et al., 2023). Many educational professionals and researchers tend to think of technology exclusively as machines; however, Finn (1960) notes, "In addition to machinery, technology includes processes, systems, management, and control mechanisms, both human and non-human, and a way of looking at problems as to their interest and difficulty, the feasibility of the technical solution, and the economic values considered of those solutions" (Finn, 1960, p. 10). Over the past several years, AI has raised many questions about machines' roles in promoting humanity (Casal-Otero et al., 2023; Gillani et al., 2023; Su et al., 2023).

AI is changing education and the traditional role of a teacher. AI education is becoming necessary in K-12 classrooms to prepare learners early for the social and technological changes it will bring. AI innovations remain experimental in education, and new collaborations with educational institutions are forming in related interventions, such as AI-enabling adaptive systems. Understanding AI to develop AI-related teaching methods is essential for both teaching and learning. AI applications will require future generations of learners to have the skills to utilize technologies effectively in society (Casal-Otero et al., 2023; Su et al., 2023). AI literacy competencies are essential to communicate, work, and live with others and machines (Su et al., 2023). Zhang and Aslan's (2021) review of selected studies on artificial intelligence in education, published between 1993 and 2020, indicated that some AI technology applications benefit education. For example, chatbots, expert systems, intelligent tutors or agents, machine learning, personalized learning systems or environments, and visualizations

offer various AI tools that may enhance teaching and learning in K-12 education. AI has limitations, such as failing to generalize and identify causal relationships. More research is needed to detail how AI should be taught. Uncovering this knowledge may inform the design and development of curricula for emerging AI technologies (Su et al., 2023). There needs to be more clarity between what AI technologies can do and how they are implemented in authentic educational learning environments (Zhang & Aslan, 2021; Gillani et al., 2023; Hopcan et al., 2023). Emerging AI technology has sparked debates about these technologies' political, pedagogical, and practical implications in an educational context. AI is critical for machines to serve humanity better (Gillani et al., 2023).

Students with disabilities may significantly benefit from AI technology due to its various applications, such as learner profiling, performance prediction, assessment, evaluation, personalization, and adapting learning to meet the student's needs. Machine learning may support students with disabilities and at-risk students by providing feedback to measure student learning early on (Hopcan et al., 2023). Hence, more AI technology and its implementation in education are essential (Zhang & Aslan, 2021; Marino et al., 2023; Gillani et al., 2023; Hopcan et al., 2023). These emerging technologies may have significant implications for students with disabilities as AI brings a wide range of technologies, features, and functions to provide exciting opportunities to learners with disabilities. Bridging the gaps between AI technology development and educational applications in K-12 and special education classrooms is critical. AI has facilitated varied instruction, increased learner engagement, generated adaptive learning materials, provided enriching learning environments, and improved learning outcomes. AI technologies are also capable of addressing learners' effective and emotional needs, which is essential for students who are emotionally impaired or have disabilities. AI may offer exclusive design technology to address students' needs. Unfortunately, there is a lack of educational perspective in AI development and implementation (Zhang & Aslan, 2021; Gillani et al., 2023; Hopcan et al., 2023). AI is expected to proliferate (Zhang & Aslan, 2021; Casal-Otero et al., 2023; Gillani et al., 2023; Hopcan et al., 2023; Su et al., 2023). The implications of AI in special education remain unclear (Marino et al., 2023; Gillani et al., 2023; Hopcan et al., 2023). Therefore, AI policy considerations and future research are necessary (Marino et al., 2023).

Teachers recognize that technology is critical to instruction; however, most technologies have limited designs for educational purposes. Teachers are often required to transform technology tools into educational tools by redesigning or modifying them from their original use (Koehler et al., 2011). This can negatively impact the learning outcomes of students with disabilities, which is why AI tools are vital due to their functionality and capabilities in supporting these learners. AI may provide students with disabilities access to assistive technology (AT) tools with enhanced features and applications, helping them access the curriculum, improve their mobility, and assist students who are visually impaired and have speech and language deficits. New developments in AT (e.g., eye-gazing AI tools, digital tutors, digital alarms, remind-me, supervised learning, and reinforcement learning) may be essential in supporting students with specific language impairment (SLI) and other disabilities, enabling them to function, adapt to their learning environments, and access curricula. AI applications are crucial for these learners, as many ATs use features that are technology-enhanced devices interacting with their environment (Hopcan et al., 2023; Marino, 2023).

AI may support these learners' representation, expression, engagement, and learning activities (Rao, 2021; Hopcan et al., 2023). AT tools may also be utilized to promote universal learning design (UDL), supporting learners with disabilities and students in K-12 (Rao, 2021; Hopcan et al., 2023). UDL is a framework that accommodates individuals with disabilities by eliminating unnecessary barriers in the learning process and environment. Mainstream and special education students benefit from UDL, for which AI digital tools provide individualized and personalized support for students with disabilities (Hopcan et al., 2023). Digital tools (e.g., vocabulary look-up, text-to-speech, digital portfolios) have instructional and assistive features that aid learners

with disabilities and others. AI tools like chatbots can facilitate personalized learning (e.g., Happy Numbers) and support students with special needs in the learning environment. AI can also streamline administrative tasks, and AI applications in education have led to new web-based systems such as educational data mining and learning analytics. Teachers can use digital technology in alignment with the principles of UDL, AT, and AI technology to reduce barriers and support learners in achieving their learning goals. AI has rapidly developed and made life more accessible for people in many areas; thus, adopting new technologies that benefit both teachers and students is essential.

As mentioned earlier, AI, AIEd, and AT in special education can provide personalized learning tailored to meet the needs of individuals with disabilities by offering personal learning and individual knowledge at their level and interests. Students with disabilities can explore content more deeply based on their learning needs. Personalized learning environments can guide and support these students. AI tools allow individuals to contribute significantly to the educational environment and provide immediate and constructive feedback (Hopcan et al., 2023). For instance, a game-based approach to AI for teaching and learning in K-12 offers fun learning and enjoyable lessons that may be effective in the context of AI in education (Su et al., 2023). Other important uses of AI and AIEd in education include facilitating administrative tasks like managing office-related database systems, tracking attendance, predicting student dropout rates, identifying students at risk for special education, and finding solutions for those who may drop out early or have been identified as needing special education services, all of which are critical applications of these emerging technologies. These tools can also facilitate assessments, provide embedded evaluations, monitor student skill acquisition in real-time, determine whether students have learned a subject through moment-by-moment assessments, evaluate how students think and react during learning, and provide summative and formative evaluation measures using game-based assessments—all capabilities of AI and emerging technologies (Hopcan et al., 2023). AI literacy must be considered at the K-12 grade levels as a set of skills that enable learners to recognize AI by learning about how it works and learning to live with AI. Hence, it is vital to incorporate AT teaching at the early stages of education (Casal-Otero et al., 2023). AI at the K-12 level is not prevalent in formal educational settings, which presents a challenge.

Traditionally, teaching AI has occurred at the university level in disciplines closely related to computer science. Research may integrate machine learning into subjects beyond computer science. Additionally, acquiring knowledge in AI poses a significant pedagogical challenge for researchers and teachers and a cognitive challenge for students (Casal-Otero et al., 2023). With the rapid growth of AI, there needs to be a better understanding of how teachers can leverage AI methodology for teaching and learning, so educators and AI experts must collaborate to bridge the gaps in techniques and pedagogy (Casal-Otero et al., 2023).

Recommendations

The findings provide critical information to support education policymakers, stakeholders, the State Departments of Education, special educators, technology supervisors, universities, colleges, and state, county, and district officials. Teachers are essential to the successful use of AT for teaching and learning. They are the critical factor in technology integration and students' success. Most educators in this study mainly reported positive experiences with integrating AT; however, a few teachers expressed that they still do not have adequate access to AT at their current jobs. Teachers reported that they use a variety of low- to high-tech AT tools; however, more specialized AT tools for SLI learners need to be developed. While teachers expressed that they understand AT, most still need clarification about what AT is. For example, most teachers reported all technology as AT. According to the definition, AT is any device that students use to increase, maintain, and develop their ability to access the curriculum. However, in many cases, teachers identified technology tools not specified for SLI as AT. While research shows that AAC devices are the most commonly used type of AT by students with SLI, few

teachers in this study have selected augmentative and alternative communication (AAC) tools to support these learners. Therefore, an intensive evaluation process should be implemented to assist with the evaluation and selection of AT tools for students.

Teachers require training in the selection, evaluation, and implementation of AT for it to benefit end users. They must learn to use and integrate AT across content areas, as many subjects require in-depth knowledge and integration of AT. One teacher expressed that she enjoys using AT but finds it tricky to teach across subjects since you have to instruct students on how to use the AT while also covering the content area. With a basic understanding of AT and how to utilize it in various content areas (PCK and TCK), most teachers can effectively apply AT for its intended purposes. 21st-century educators must be aware of the variety of specialized AT tools available for students with SLI and other disabilities. Teachers should be allowed to practice using AT to demonstrate self-efficacy and confidence when integrating it across content. At the state and district levels, stakeholders must provide educators with essential opportunities to explore AT during professional development and collaborative networking to improve its use in schools for students with disabilities. Teaching preparation programs should develop coursework designed to educate teachers on effective integration. Future teachers must be flexible and willing to utilize AT for teaching and learning. Teachers should be willing to be lifelong AT and technology users. A thorough review of AI and AIEd technologies in schools must be conducted. The types of tools teachers use in the classroom need to be identified. Additionally, research and authentic settings of teachers using emerging technologies must be examined to ascertain what teachers are using for teaching and learning with students with disabilities and precisely how these AI tools are being utilized. More intense research in data mining and learning analytics is needed regarding disabilities. With all the benefits of AI, we understand how to effectively integrate AI and emerging technologies in the classroom based on empirical research and studies. of this study, I included some recommendations on how teachers can enhance their awareness and improve technology integration. Six recommendations were included to provide clarity to the reader. Scholarships need to tease out all of the tenets of AI in educational research to provide support for teachers, students, and special education classrooms.

The study provides a valuable baseline for understanding how teachers in a large urban public school district integrate AT for students with SLI. To enhance teachers' awareness and improve the integration of AT in their classrooms, several strategies could be considered.

1. Professional Development and Training: One of the key ways to improve teachers' awareness and effective use of AT is through targeted, ongoing professional development. While the study indicates that teachers are utilizing various AT tools, there may be gaps in their understanding of how to optimize these tools for specific student needs. Offering specialized workshops on the range of AT tools available—ranging from basic devices to more complex technologies like iPads and SmartBoards—could increase teachers' confidence and competence in using these tools effectively. This training could be differentiated based on the teachers' familiarity with technology and specific subject areas, helping them better tailor AT to students with SLI across different content areas (e.g., literacy, mathematics, social studies, etc.).

2. Collaborative Learning Communities: Encouraging collaboration between special education and general education teachers could improve the collective knowledge of AT usage. Forming learning communities or collaborative teams where teachers can share strategies, successes, and challenges when using AT tools would foster an environment of continuous improvement. Teachers could benefit from discussing how they have adapted AT for specific classroom settings, grade levels, and content areas, and this could lead to more effective and personalized instruction for students with SLI.

3. Increasing Awareness of Specialized AT for SLI: While the study suggests that UPS teachers use a variety of AT tools, it would be helpful to emphasize more specialized technologies specifically designed for students with speech and language impairments. For instance, speech-to-text software, communication boards, or advanced text-to-speech programs may be underutilized or underappreciated by teachers who are not fully aware of their potential benefits. Regular training on such specialized tools, as well as case studies or demonstrations of their successful integration in the classroom, could increase teachers' awareness and understanding of how these technologies can support the individual needs of SLI students.

4. Clear Guidelines for AT Integration: Teachers may benefit from more structured guidelines or best practice frameworks for integrating AT into their teaching. While the study found that teachers across grade levels and content areas reported using similar instructional methods, more concrete, evidence-based strategies for using AT could help bridge any gaps in knowledge. For example, creating simple checklists or resource kits that outline how specific AT tools can be used for various assessment purposes (diagnostic, formative, or summative) would help teachers feel more equipped to implement AT effectively.

5. Teacher Feedback and Reflection: Teachers' awareness and understanding of AT could also be enhanced by establishing a system for regular feedback and reflection on how AT is supporting students with SLI. Structured opportunities for teachers to reflect on their experiences and the effectiveness of the AT tools they are using could lead to greater self-awareness and refinement of instructional practices. These reflections could be shared in professional learning communities or one-on-one meetings with support staff to create a culture of improvement and innovation.

6. Leveraging Peer Mentoring: Pairing more experienced or tech-savvy teachers with those less familiar with AT could create mentorship opportunities that build teachers' capacity for integrating technology in the classroom. This peer mentoring model would allow less-experienced teachers to learn from their colleagues' successful strategies and gain more confidence in utilizing AT tools.

In conclusion, improving teachers' awareness of assistive technologies requires not only providing access to a variety of tools but also offering clear, ongoing support through training, collaboration, reflection, and mentorship. These steps would ensure that teachers have the necessary knowledge and resources to use AT effectively to support the learning needs of students with speech and language impairments.

Conclusion

This study investigated UPS teachers' technological pedagogical content knowledge (TPACK) and how they integrate assistive technology (AT) in the classroom. This article details UPS special education and general education teachers' TPACK across grade levels, content, and classroom settings. It reports UPS teachers' current integration of AT, instructional practices, implementation, and experiences integrating AT in the classroom for students with speech and language impairments (SLI). 94 UPS teachers participated in the online survey. This study found no significant differences in teachers' TPACK across classroom settings or grade levels. Results show no significant differences between teachers' TPACK in mathematics, social studies, science, or literacy content knowledge. The study revealed that UPS teachers utilize low- to high-tech AT tools for diagnostic, formative, and summative assessments. Results indicate that UPS teachers employ similar instructional methods across content areas and express mostly positive experiences integrating AT for SLI students. Teachers are essential to technology integration. They require training in integrating AT, utilizing various AT technologies, and fostering positive experiences teaching students with disabilities. Teacher training and assistive technology should adapt as technologies emerge and AI applications increase. Educational policymakers play a critical role in supporting

school districts, while district leaders provide teachers of students with disabilities access to training on emerging technology tools to improve these learners' educational outcomes.

The COVID-19 pandemic revealed inadequate education for students in Michigan, the U.S., and globally. Teachers face many challenges adapting teaching methods to new online mediums. Meeting students' needs as they transitioned to online learning was the biggest challenge during the pandemic. The lack of training and teachers' inability to integrate technology effectively online must be addressed. Digital literacy skills in navigating online platforms were identified as challenging. The pandemic pushed teachers to learn new technologies and expand their technological knowledge. Access to digital devices and AI and AT tools for learners with disabilities online became crucial during times of crisis. Teachers need to be open to using AI and AT together. AI has been shown to benefit learners in education (Zhang & Aslan, 2021; Hopcan et al., 2023; Su et al., 2023). Teachers must develop their technological knowledge by integrating AI into the classroom (Hopcan et al., 2023; Marino et al., 2023). More research is necessary to ensure these emerging technologies are available to learners with disabilities. Applying AI and emerging technologies in education, specifically for students with disabilities, is essential for enhancing their functional, adaptive, and academic skills. Research must be conducted on AI technologies in educational settings for learners with disabilities who use AT. AI and educational researchers must work collaboratively to actively answer questions and better understand the theory and practice of AI and emerging technologies in education (Gillani et al., 2023).

We are at the infancy level of AI in K-12 education, not to mention the limitations of AI in special education classrooms. Some efforts are being made to design models that frame AI literacy proposals in education. However, limited AI learning experiences exist in education. Guidelines on what students are expected to know and learn about AI in K-12 settings are needed. Developing a conceptual framework of didactic proposals for AI literacy is a critical benchmark that describes competency areas for AI and K-12. Ethics and legal norms, along with social and security issues linked to AI and technology, are also crucial. AI technologies must address and collaborate with other AI experts to understand pedagogical and problem-solving strategies to improve teaching and learning. AI literacy should be based on an interdisciplinary, competency-based approach and integrated into the school curriculum (Casal-Otero et al., 2023). Building on the competency and content of disciplinary subjects, it should be integrated with AI literacy into those subjects. AI literacy must support teachers and their active participation in designing didactic proposals alongside pedagogy and AI experts. (Casal-Otero et al., 2023). Finally, teachers must be digitally competent in integrating technology into the classroom for learners with disabilities.

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NA

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Helping EFL teachers build capacity for effective curriculum implementation: A case study[1]

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ABSTRACT

The study presents the outcomes of capacity-building training that aims to facilitate and enhance Turkish EFL teachers' curriculum fidelity in the state school context and provides in-depth insights into the issue in this context. After the training, all the participants developed positive perceptions about the curriculum. Five participants' stages of concern evolved to concerned about and not resistant to the curriculum. One participant's concerns altered to not resistant but unconcerned, whereas five participants' concerns remained resistant. Only one participant showed ideal development, both in her stages of concern and instructional practices. As well as the insufficiency of curriculum-specific formal training, school-level institutional support, and individual and collective sense-making out of the curriculum were found to lack in the context. Whereas explicit grammar teaching and assessment were revealed to form a comfort zone, teaching and assessing language skills, especially speaking and writing, presented a challenge for the teachers. The ineffectiveness of train-the-trainers, and the need for curriculum maps and mentors were also asserted in the study.

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INTRODUCTION

In the 21st century, knowledge and education are seen as the primary drivers of social and economic change (Muhammad, 2020). Education, which is provided through curriculum, aims to enable students to produce intellectual artifacts, innovations, and/or actions by learning better/deeper, thinking critically and creatively, and collaborating. The curricula are shaped/reshaped by the national educational authorities to integrate the knowledge, skills, and competencies required by the century (Alismail & Mcguire, 2015; Gouëdard et al., 2020; Nnabuike et al., 2016).

The implementation of a curriculum as intended by its developers is called curriculum fidelity and is considered to play a critical role in achieving the objectives of an education system. As teachers are the key players in curriculum implementation (Baş & Şentürk, 2019; Bediako, 2019), their implementation fidelity has become a significant issue of research, especially since the 1970s. The studies investigating the impact of implementation on program outcomes have revealed that although the level of implementation affects educational outcomes and contributes to accomplishing the targets and student success (Durlak & DuPre, 2008), teachers' implementation of the school curricula lacked fidelity (Achinstein & Ogawa, 2006; Datnow & Castellano, 2000; Nawastheen, 2021; Nevenglosky et. al., 2019).

The concept of curriculum fidelity as a research field is relatively new in the Turkish context (Bümen et al., 2014); the issue has been addressed for a variety of subject curricula since the 2000s (Arslan Çelik & Gelmez Burakgazi, 2021; Cetin-Berber & Vásquez-Colina, 2016; Süer & Kinay, 2022). The studies on the English curriculum, which are not many, also show that the EFL teachers cannot implement the curriculum fully and faithfully; there is a gap between the objectives of the curriculum and teachers' implementations of it, which are cited as not having awareness of the curriculum's targeted outcomes, teaching and assessing the structural and linguistic elements of the language as separate topics, and not integrating them into four language skills that mimic the real-life uses of the language (Aksoy, 2020; An, 2020; Arslan Çelik, 2020; Karabacak & Kürüm-Yapıcıoğlu, 2020; Kırkgöz, 2008). The issue was also studied by Öztürk (2020) in an autoethnographic article that revealed the researcher's dilemmas stemming from the lack of alignment between the intended curriculum and teachers' instructional practices in the context.

Implementation fidelity has been addressed in the theoretical framework of change research, and some models and theories have been developed to understand the complex process of change (Olson et al., 2020; Reinholz & Andrews, 2020): the Concerns-Based Adoption Model (CBAM, hereafter), and the Theory of Educational Change are among them, which formed the conceptual frameworks of the present case study.

CBAM views curriculum fidelity as a matter of learning for change and having capacity for change and being receptive to change (George et al., 2006; Hall & Hord, 2015). The model asserts that change is a personal process, which can be facilitated through interventions, and it is highly affected by contextual factors. CBAM calls an individual's feelings, reactions, perceptions, and attitudes concerns based on Fuller's studies (1969) and asserts that these concerns follow a developmental path when they are understood and resolved with facilitative interventions. It has three diagnostic tools to predict, evaluate and facilitate the implementation of an innovation: the Stages of Concern Questionnaire (SoCQ)- survey, Levels of Use (LoU)- interviews, and Innovation Configuration Maps (ICM). CBAM has been used in educational settings for more than 40 years (Olson et al., 2020), and a large literature of CBAM studies that aim at facilitating and enhancing teachers' implementation fidelity exists (Apau, 2021; Haines, 2018; Nawastheen, 2021; Nevenglosky et al., 2019; Wang, 2014). In the Turkish context, the studies that utilise CBAM to facilitate teachers' adoption of educational innovations by understanding their concerns have been increasing (Gökçek & Baki, 2013; Kara & Bümen, 2023; Kayaduman & Delialioğlu, 2016; Kayaduman & Demirel, 2019).

Capacity building, one of the seven principles in the Theory of Educational Change (Fullan, 2006): a focus on motivation, learning in context, changing context, a bias for reflective action, tri-level engagement, and persistence and flexibility in staying the course, refers to "the process of assisting an individual or group to gain insights, knowledge, and experiences needed to solve problems and implement change" (UNESCO-IBE, 2013, p. 124). It entails "some kind of external intervention or support with the intention of facilitating or catalyzing change" (Simister & Smith, 2010, p. 4). Teachers' need for ongoing capacity building and institutional support for curriculum fidelity is underscored, and the lack of formal training on the curriculum is pointed out as one of the factors affecting the implementation fidelity (Gouëdard, et al., 2020; Kırkgöz, 2008; Pring, 2015).

Teachers' capacity-building needs are defined by UNESCO-IBE as follows: a) understand their changing roles as curriculum changes, b) comprehend curriculum objectives and national curriculum standards, c) master subject matter and pedagogical skills to deliver subject-specific content, d) have a positive attitude to curriculum change and be an agent of change, e) break down isolation and develop team spirit, f) engage in continued professional learning and development (2013, p. 126). OECD also emphasizes that teachers should be equipped with self-reflection and the research tools for action research to develop their capacities for effective curriculum implementation (2012).

Although, in the relevant literature, the Turkish EFL teachers' implementation fidelity and the factors affecting it were investigated by several studies (Bümen et al., 2014), there is no study addressing the question of how to facilitate and enhance their implementation fidelity. The present study intends to fill in this gap by seeking answers to the questions below:

1. To what extent are the Turkish EFL teachers in the state school context concerned about the current curriculum?

2. After the capacity-building training, will there be a change?

    a) In the Turkish EFL teachers' perceptions about the current curriculum,

    b) to the extent that they are concerned about it,

    c) in the way they implement it, and

    d) if there is no change in their implementations, what are the reasons behind it?

METHOD

Implementation fidelity is regarded as a complicated issue (Cheung & Wong, 2012). As case study methodology allows for examining complex, real-life issues and applying theories to practice for creating effective treatments (Cooley et al., 1997; Yin, 2009), a case study approach was adopted.

Research design

A multiple instrumental case study was designed and conducted by utilizing multiple methods in multiple phases over an educational year. In the initial phase, the survey data were collected to understand to what extent the Turkish EFL teachers in the state school context across Turkey were concerned about the current curriculum, if they had any formal training and instructional support regarding it. The findings showed the teachers' need to build capacity to accept and implement the current curriculum faithfully (see Figure 1).

Participants

In the initial phase, 149 Turkish EFL teachers working at state schools across Turkey and using the current English curriculum were purposively sampled to complete the SoCQ. The teachers' years of experience ranged from 0-15 (55%) to 16–30 (45%) (Table 1).

Table 1. *Teachers' demographics in phase I (n=149)*

School Types	AHS	PS	SS	RAHS	V&TAHS
	84 (56%)	3 (2%)	19 (13%)	17 (11%)	26 (18%)
Regions	Marmara	Black Sea	Aegean	Mediterranean	
	62 (41%)	11 (7%)	15 (10%)	13 (9%)	
	Central	Eastern	S.E. Anatolia		
	22 (15%)	4 (3%)	22 (16%)		
Gender	Male	Female			
	36 (24%)	113 (76%)			

*[AHS (Anatolian High School), PS (Primary School G 2-4), RAHS (Religious Anatolian High School), V&TAHS (Vocational&Technical Anatolian High School), SS (Secondary School G 5-8)

In the second phase, eleven Turkish EFL teachers working at the state schools in a district in Istanbul (Table 2) volunteered to participate in the capacity-building training. The training was organized by the District Directorate of Ministry of National Education (MoNE) upon examining the researcher's qualifications. The five-day theoretical part of the training was conducted at the library of one of the schools in the district. At the end of the theoretical part, the participants were summatively assessed by a multiple-choice test in accordance with the course specification of MoNE and were awarded certificates. None of the participants had a post-graduate degree and had taken any formal training specific to the current curriculum. Only one of them had attended two train-the-trainers concerning the previous curricular revisions.

Table 2. *Teachers' demographics in phase II (n=11)*

Teacher	Major (B.A)	Years of Exp.	Teaching Grade
Figen	ELL	21	9, 10, 12
Serap	ELL	21	9, 10, 12
Canan	ELE	22	11, 12
Elif	ELE	10	9, 10
Merve	PHIL in Eng.	20	5-8, 9, 10
Gül	ELL	15	4
Hülya	ELE	8	3
Zehra	ELL	25	2
Işıl	ELE	9	9, 10
Fatma	ELE	8	9, 10
Tülin	ELL	7	9, 10

* ELL (English Language and Literature), ELE (English Language Education), PHIL (Philosophy)

Research Instruments and Processes

The SoCQ, questions for reflection, semi-structured interviews, and the participants' exam papers comprised the data collection instruments. After having the legal permissions, in the first phase, the SoCQ data was collected online between June and September 2021. The respondents were informed about their rights in the cover letter of the questionnaire, which was administered in English.

In the second phase, the capacity-building training, devised based on the literature on capacity building discussed above, was administered in the last week of September 2021 by the researcher, who was a PhD candidate and trained as a trainer of the current curriculum. Throughout the thirty-hour theoretical part of the training that lasted for five days, the change in the participants' perceptions about the curriculum, the second question of the study, was qualitatively investigated through their reflective writings.

Upon completing the theoretical part, the participants were requested to conduct action research; thus, they were guided to become more involved with the learning outcomes, suggested materials (authentic materials such as websites, cartoons), and tasks of the current curriculum (blog or vlog keeping), which they had never experienced before. Five participants from four schools volunteered to conduct action research under the guidance of the researcher: Gül and Hülya wished to integrate authentic BBC cartoons into their classes and examined their effect on their 3rd and 4th graders' listening and speaking

skills. Figen had her students watch TED talk videos and keep a reflective writing blog, while Merve and Işıl asked their students to create a readers' vlog. The participants wrote narrative accounts of their research experiences. As the participants began and finished their action research attempts at different times at their schools, the practical part of the training was completed in twenty weeks. One participant from the fifth school did not wish to carry out any action research. Since CBAM allows the SoCQ to be administered twice a year, all the participants who completed the theoretical part of the training were requested to refill the questionnaire at the end of the educational year. So, the change in their stages of concern after the training, the third question of the study, was examined.

The change in the participants' implementations of the curriculum, the fourth question of the study, was investigated through individual semi-structured interviews and analysis of the samples of exam papers given by the participants over the educational year to assess the student learning. The interviews were conducted by the researcher following the interview protocol. Upon making appointments, the participants were requested to explain the changes they made in their instructional practices to implement the curriculum with fidelity, in the first week of June 2022. If they could not make any changes, they were also invited to elaborate on the reasons for not being able to, which answered the fifth question of the study. The interviews lasted for 20-30 minutes and were recorded with the participants' permission. The samples of exam papers were collected from the participants.

The Stages of Concern Questionnaire

The SoCQ consists of three parts: the cover letter, the questionnaire itself comprising 35 questions addressing the seven different stages of concern, and the demographic part. It is a Likert-type scale ranging from 0 to 7. It is widely accepted as the most rigorous technique for measuring concerns with strong reliability estimates (test/retest reliabilities range from .65 to .86) and internal consistency (alpha-coefficients range from .66 to .83). It displays teachers' concerns in a developmental path of seven stages: Unconcerned, concerns about Self (Informational, and Personal), concerns about Task (Management), concerns about Impact (Consequence, Collaboration, and Refocusing) (Hall & Hord, 2015).

Instructional Design of the Capacity-Building Training

The training was drawn from the literature on capacity building for educational change and shaped around the questions for reflection. It was intended to raise the participating teachers' awareness and knowledge of the current curriculum to assist them in its acceptance and implementation with fidelity. It also aimed at equipping the participants with teacher reflective practice and inquiry skills. For this purpose, questions for reflection were devised based on the concepts of teacher reflective practice: reflective self, reflective practitioner, and practical action (Pultorak, 2010), reflection on action (Schön, 1983), and reflection for action (Olteanu, 2017).

On day one, after a brief introduction, the participants were requested to give written answers to the questions about their reflective selves. Thus, the participants' perceptions about the current curriculum as well as their values about effective instruction in a foreign language were inquired about. After that, the relevant research article was read and discussed by the participants as a group. On the same day, a PowerPoint presentation providing knowledge about teacher reflective practice and research was delivered by the researcher.

On day two, the questions for reflection, drawing on the concept of reflective practitioners, inquired into the participants' knowledge about and experience with teacher reflective practice and inquiry. After their reflective writings were collected, the teachers were requested to read the relevant action research articles chosen by the researcher and share their reactions to them.

On day three, the questions for reflection drawing on the concept of practical action examined whether the participants' beliefs and instructional practices match or conflict with the current curriculum's philosophy and objectives. The major philosophy and general objectives pages of the English Curriculum

for Grades 2–8 and 9–12 were read. The participants had the opportunity to discuss the way they had been implementing the curriculum. Besides, the participants' attention was drawn to the learning outcomes specified in the four language skills and the suggested materials and tasks in the 3rd and 4th grade syllabuses. The researcher conducted a micro-teaching on the theme 7 "Food and Festivals" in the 10th grade syllabus to demonstrate the emphasis the current notional-functional, skills-based curriculum puts on the four language skills and its difference from explicit grammar instruction.

On day four, some excerpts exemplifying teacher narrative inquiry were read. The participants were requested to think about the problems they faced in the classroom during the implementation and what type of research they could conduct to deal with the problems. The learning outcomes and the suggested materials and tasks in the syllabus were reviewed again. The researcher made some suggestions regarding the action research the participants could conduct.

On day five, the participants reflected on the training and the instructional practices they planned to alter by writing their reflections on the relevant questions. They were also encouraged to plan the action research they would conduct.

The research articles, which the participants were requested to read throughout the training, were intended to develop the participants' research skills by learning about research conducted by teachers. The sample research articles were chosen based on the criteria that they were teacher-authored, conducted by practicing teachers in their classrooms, published in journals or books, and effectively exemplified the stages of teacher reflective practice and a variety of research types, including teacher narrative inquiry (Johnson, 2009) and qualitative and quantitative research studies (Dikilitaş & Griffiths, 2017).

Data Analysis

The SoC data were analyzed by SPSS 11.0, and descriptive statistics were computed. The item raw score means for each scale were converted into the percentile scores. Based on these percentile scores, the respondents' SoCQ profiles were constructed and displayed by a line graph. The valleys on the line graph showed the low stages of concern while the peaks meant the high stages of concern.

The participants' reflective writings and the transcripts of semi-structured interviews were analyzed by thematic analysis that followed the six-step approach of Braun and Clarke (2006). The researchers familiarized themselves with the data by reading and rereading them over. Thus, the initial codes were generated. While the themes were named, a deductive approach was adopted (Bingham, 2023) and the themes that already exist in the theoretical frameworks of the study, such as not having awareness of reflective practice, the lack of institutional support, and the lack of individual and collective sense-making out of the curriculum, were utilized. The deductive approach to coding enabled a complete intercoder agreement. The samples of exam papers were analysed by skills, parts, and grades to examine if the participants' assessments focused on the targeted learning outcomes of the current curriculum. As well as the utilization of theory, method, and data triangulation strategies (Yin, 2017), the data were validated through member-checking to ensure the validity of the study

Ethic

In conducting the study, which the present research article reports, the utmost importance was given to academic rules and ethical conduct

FINDINGS

Finding I. Teachers' Need for Capacity Building

The analysis of the SoC data collected from 149 Turkish EFL teachers working at state schools across Turkey showed that they were unconcerned about the current English curriculum with the highest percentile score 97 at Stage 0-Unconcerned, which was also 10 points higher than the nearest score. The second highest score 87 at Stage 2-Personal Concerns meant that the teachers were uncertain about the

demands of the curriculum, their adequacy to meet those demands, and how it might affect their instructional practices. Besides, the lowest score 63 at Stage 4-Consequence meant that the teachers' implementations did not focus on the current curriculum's impact on student learning. The tailing up with the score 87 at Stage 6-Refocusing indicated resistance to the current curriculum (Figure 1).

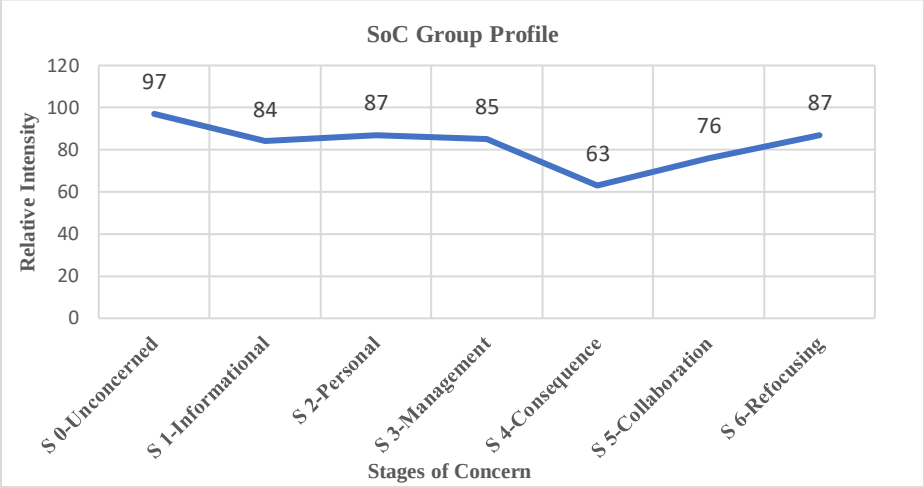

Figure 1. *Line graph of the participants' pre-study SoC group profile (n=149)*

The demographics part of the SoCQ showed that 84 % (n=125) of the respondents did not take any formal training on the current curriculum, while 16 % (n=24) of them had taken it. 72 % (n=108) of the respondents perceived that they were not instructionally supported to implement the curriculum with fidelity.

Finding II. Change in the Participants' Perceptions about the Curriculum

Throughout the theoretical part of the training, the participants were asked to conduct reflective practice. Their reflective writings allowed the researcher to understand how the participants' perceptions about the current curriculum altered. The stage reflective self guided the participants to reveal their beliefs and values about effective instruction of a foreign language and perceptions about the curriculum. The themes of negative attitudes towards the curriculum, lack of values, lack of motivation, and lack of competence came out of the analysis of their writings:

"It is too difficult to implement the current curriculum." (Elif)

"It is difficult to do listening and speaking activities in the classroom." (Tülin)

"I do not think that the current curriculum can be effectively implemented." (Gül)

"Even though I am a teacher who sometimes negatively criticizes the current curriculum, making its implementation possible actually depends on our agency. I realize the effects of the methods on the student that need to be applied, but somehow, which we are never able to apply." (Hülya)

The stage reflective practitioner probed into the participants' awareness of and experience with reflective practice and inquiry to solve the implementational problems. Analysis of their writings revealed the theme of not having awareness of reflective practice and research:

"I do not think that I have sufficient knowledge about teacher reflective practice and action research." (Hülya)

"I am not knowledgeable about it because we have never done it." (Elif)

The stage of practical action guided the participants to reflect on if their values and personal theories about foreign language instruction match or conflict with the current curriculum's philosophy and objectives. Analysis of their writings revealed the themes of lack of individual and collective sense-making out of the curriculum in the context as suggested by the following quotes:

"In our context, I had not seen that curriculum was read." (Merve)

"I was thinking of reading the curriculum; I hadn't read it before the training. Neither had I seen anyone else reading it." (Tülin)

The stage reflection on and for action guided the participants to reflect on the training and for the instructional practices they planned to alter after the training. The following themes came out of the analysis of their writings:

The participants developed positive attitudes toward the current curriculum as indicated by the quote below:

"With the training, I realized that I was prejudiced against the current curriculum and coursebook. I was transmitting too much grammatical knowledge. Now, I think that by finding ways to get the students to do the activities in the coursebook, I can help them learn English by using it for performing some functions." (Işıl)

The training increased the participants' motivation as indicated by the following quotes:

"The training helped me to revive my identity as a teacher who questions, does research and open to innovations, which I had shelved for a while. I realized that I could increase both my own and students' motivation by changing my teaching approach based on the curriculum's recommendations." (Gül)

"Now, I believe that the activities of four language skills can be done in the classroom despite all the negative factors. I will try." (Elif)

The participants had an opportunity to make sense of the curriculum as indicated by the following quotes:

"I understood that the curriculum asks me to develop the student's listening and speaking skills in the grades 2-4." (Gül)

"I intend to give more weight to the activities of four language skills instead of explicit grammar teaching." (Canan)

The participants' awareness of reflective practice and inquiry was raised thanks to the training as indicated by the quote below:

"The training enabled me to be empowered with the theoretical concepts of reflective self and practitioner. In addition, we learned about research. We analyzed the curriculum. I realized the importance given to the four language skills in the curriculum. I intend to integrate technology into my instructional practice to increase my students' exposure to English." (Tülin)

Finding III. Change in the Participants' Stages of Concern after the Training

The change in the participants' stages of concern was examined by readministering the SoCQ at the end of the study. Before the training, the participants were found unconcerned about and resistant to the curriculum as a group (Figure 1). This group profile did not change after the training. Thus, the change was individually examined by drawing each participant's pre- and post-study SoC profiles. The teachers Hülya, Merve, Canan, Serap, and Gül (Figure 2) were found concerned about and not resistant to the curriculum, whereas Işıl, Fatma, Tülin, Elif, and Figen (Figure 3) remained unconcerned about and resistant to it. Zehra was found unconcerned about, but not resistant to the curriculum (Figure 4).

Gül (T6) became concerned about and not resistant to the curriculum. Her S 2-Personal concerns remained high after the study; yet, her task (S 3), and impact concerns (S 4 and S 5) considerably increased, which is the expected ideal development. After the training, she also stated: *"The training had been a quite different, special experience for us. We questioned our instructional practices, and we were changed."*

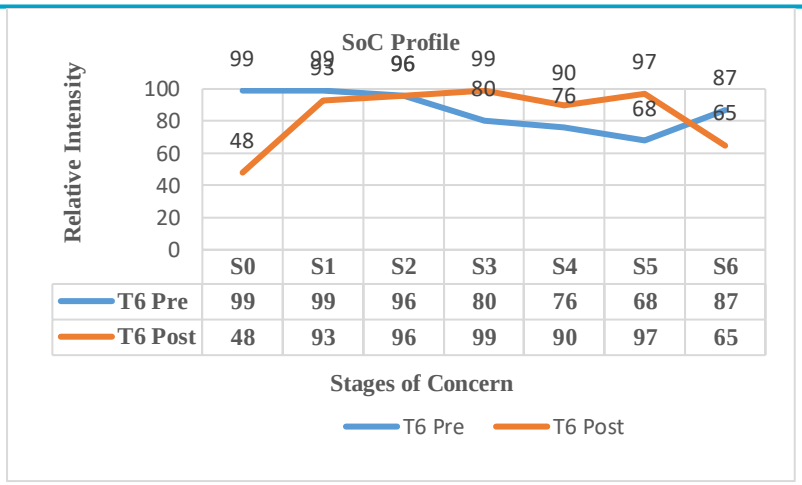

Figure 2. *Gül's (T6) pre- and post-study SoC profile*

Figen's (T1) remained unconcerned and resistant to the curriculum with high S 2-Personal Concerns with percentile score 89 after the training. It was interpreted that Figen was still concerned about the demands of the curriculum, and her adequacy to meet those demands. In her interview, she also stated: *"I need more formal training on the curriculum given by academicians."*

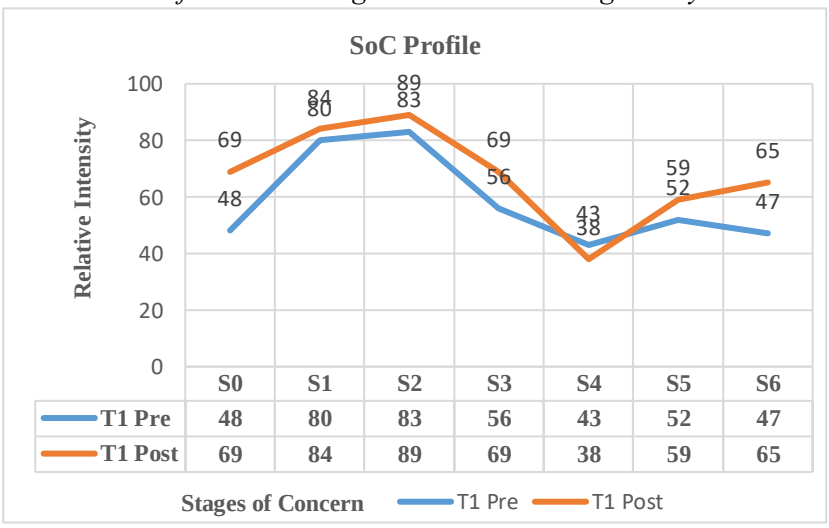

Figure 3. *Figen's (T1) pre- and post-study SoC profile*

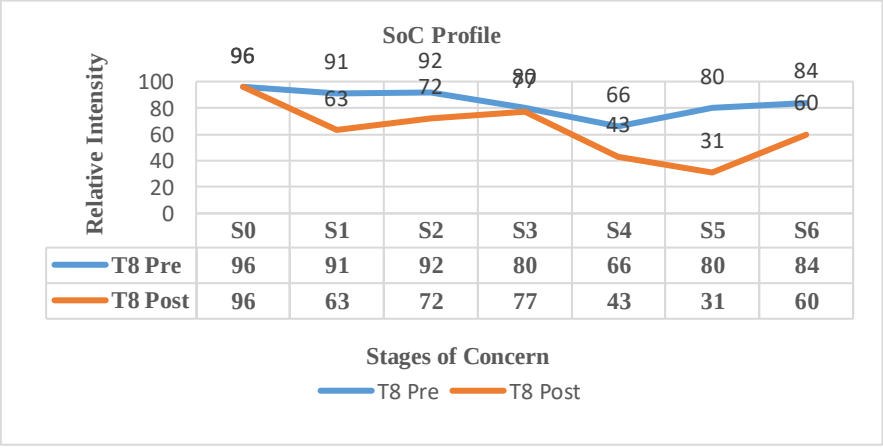

Figure 4. *Zehra's (T8) pre- and post-study SoC profile*

Finding IV. Change in the Participants' Implementations of the Curriculum

Analysis of the semi-structured individual interviews and samples of the exam papers revealed that the positive change in the participants' perceptions of the curriculum did not suffice to alter their implementations in accordance with the curriculum, except for the teachers Gül and Hülya:

Gül changed her practices in compliance with the English Curriculum for Grades 2-8. Authentic short videos, and technology integrated listening and speaking activities became an indispensable part of her classes. She also began to have her students video-record their speeches. Before the training, she had been giving the instructions in Turkish so that her students would understand the task better. After the training, English became the tool of instruction and interaction in the classroom for Gül; she decided to use body language and realia when the students did not understand the instruction in English. The high scores at Stage 3-Management and Stage 4-Consequence in Gül's post-study SoC profile provided converging evidence that her concerns about the current curriculum progressed to the impact level.

The analysis of Gül's exam papers revealed the misalignment between the English Curriculum for Grades 2-4 and the Regulation on Pre-school and Primary Education Institutions of MoNE (2014). The article 20(3) of the Regulation required only written exams for the assessment of the student learning; it did not take into consideration the targeted outcomes of the curriculum, which are the development of listening and speaking skills in the grades 2-4.

Thanks to the positive results of the action research Hülya conducted on her 3rd graders, the listening and speaking activities became Hülya's routine classroom activities. She also decided to assess her students' listening and speaking skills formatively by understanding the emphasis the current English Curriculum for Grades 2-4 puts on these skills. However, her SoC profile did not provide converging evidence that her concerns reached the impact level. Zehra did not make any changes in her practices, although the training helped her feel supported and motivated as indicated by the following quote:

"The training process and staying in contact with the other participants emotionally supported and motivated me. I did not change any of my classroom practices after the training. Yet, I believe the effectiveness of short authentic videos that are specific to the learning outcomes. I want to use them in my classes if they could be provided by MoNE in the resource pack." (Zehra)

Figen did not change anything in her instructional practices, nor did Serap, Canan, Elif, Merve, Işıl, Fatma, and Tülin, despite the positive attitudes they developed towards the curriculum as indicated by the following quotes:

"I had been feeling resentful towards the curriculum. The training broke it and motivated me. Teachers always complain. Yes, we talked about the problems too, but for the first time, thanks to this training, we came across the perception that we, as teachers, can overcome these problems." (Canan)

"In the training, we learned about what the curriculum expects us to do and the types of assessment the curriculum enables us to utilize (blog, vlog, and e-portfolio). I also realized that these technology-integrated assessment methods get away from the old methods. When I examined the book, I found its method very rational too. I thought that this method of teaching and learning would appeal to the students. However, as we, as a department, give more weight to teaching grammar, and our class sizes are large, we could not implement the curriculum effectively, but we attempted to." (Tülin)

The analysis of their exam papers also showed that their instructional practices were still focused on teaching and assessing the structural and linguistic elements of English explicitly, not on the functions that can be performed using these elements in four language skills, which is the objective of a skills-based, notional-functional syllabus (MoNE, 2018) (see Table 3). The lack of uniformity and alignment in assessment are also asserted by the study. The weight given to the grading of the skills showed variance among the schools, and the assessment was not aligned with the learning outcomes of the current curriculum.

Table 3. *Analysis of the participants' exam papers by skills/parts and grades*

Schools	Listening	Reading	Writing	Speaking	Grammar	Vocabulary
S1 (V&TAHS)	15	15	10	10	30	20
S2 (V&TAHS)	X	20	X	X	80	X
S3 (RAHS)	25	15	15	X	35	10
S4 (AHS)	10	10	10	10	50	10

X= No assessment of the skill

Finding V. Reasons for Not Changing the Implementation

The inquiry into the reason why the participants, except for Gül and Hülya, could not alter their instructional practices in compliance with the targeted outcomes of the curriculum after the training revealed that the issue was complex, multifaced and inextricably linked to the "tri-level of engagement" (Fullan, 2006, p.11). The following themes came out of the analysis of their responses: teachers' need for curriculum maps and mentors, the ineffectiveness of train-the-trainers, lack of school-level institutional support, lack of shared sense making out of the curriculum, comfort zone, and challenge zone.

Teachers' need for curriculum maps was indicated by the following quotes:

"Nobody knows anything about the curriculum. Teachers ask each other on social platforms. The one-day seminar in which the curriculum was introduced was insufficient, and not delivered well either. Why don't they tell us that you have to implement the curriculum like that? Why don't academicians give us training on how to implement the curriculum?" (Figen)

"They just informed us of the curriculum at the beginning through a meeting. But it wasn't very detailed; I think we need ideas about how to implement it instead of just introducing it." (Serap)

The following quotes indicated teachers' need for curriculum mentors:

"We need guidance and reinforcement on how we are doing." (Serap)

"I asked our principal for help to clarify some points regarding the assessment. He told me to ask another teacher." (Figen)

The ineffectiveness of train-the-trainers was indicated by the following quote:

"I attended two programs of train-the-trainers given by MoNE, one was in Kızılcahamam, and the other was in Antalya, I do not remember the exact dates now. You take the training, and come back to school, and naturally you want to share what you have learned with your colleagues in the department, but no one cares about what you have learned, and you cannot change anything." (Serap)

The following quotes indicated that school-level institutional support lacked in the context:

"School principals are not stakeholders in curriculum implementation. They are neutral." (Elif)

"E.g. I had a disagreement about how to assess the language skills and grade them in the department. I asked the principal to clarify the issue. I said that the curriculum says so, but the principal told me that you, as the teachers in the department, had to reach an agreement." (Serap)

"At times of conflict, the principals generally tell us to reach an agreement by majority vote." (Işıl)

The lack of shared sensemaking out of the curriculum in the context was indicated by the following quote:

"After the training, we, the three teachers, developed positive attitudes towards the coursebook and wanted to follow its method by getting away from the Grammar Translation Method we had seen in our previous departments. We wanted to teach and assess the grammatical structures in the text. However, the teachers who did not take the training and were more experienced than us did not agree with us; they wanted to teach and assess grammatical structures explicitly. That is why we had a little conflict." (Fatma)

"The three teachers from my school wanted to attend the training; yet the school administration allowed only me to attend since there were no substitute teachers for our classes. If we, as the three teachers, had been allowed to attend, we could have motivated each other and convinced the others in our department in order to do the skill-based activities in the book.". (Elif)

Explicit grammar instruction formed a comfort zone to the teachers in the context as indicated by the quotes below:

"Before this training, I would do the grammatical structures of the unit first and then have the students do some activities from the coursebook. My English teachers used to teach in this way too." (Merve)

"We see the learning outcomes in the syllabus, but we neglect them. It can be considered not getting out of the comfort zone. Teaching and assessing grammar is easy. Teaching skills is difficult, and students are unmotivated." (Elif)

"Teaching grammar is easier; when you teach grammar, the students take notes. Teaching skills is difficult." (Işıl)

Teaching and assessing skills, especially speaking and writing, comprised a challenge zone for the teachers in the context as indicated by the following quotes:

"I do not expect my students to speak; I expect them to comprehend what they read in English. That is sufficient for me. We, as the department do not assess the students' speaking skills; last year, we did not assess their listening either. If I suggested assessing speaking at the department, my colleagues would find it troublesome." (Merve)

"I did all the reading and listening activities in the book, but quite a number of the writings could not be done. I did not understand the importance of the learning outcomes in the syllabus, are there any teachers in the district who have understood them?" (Figen)

DISCUSSION, CONCLUSION, RECOMMENDATIONS

The multiple instrumental case study that aims at facilitating and enhancing Turkish EFL teachers' implementation fidelity provides in-depth insights into the issue in the Turkish state school EFL context. The findings of the study assert the critical role capacity building plays in raising teachers' awareness and acceptance of the proposed changes in a curriculum initiative (OECD, 2012).

In the first phase of the study, the results of the SoCQ showed that the Turkish EFL teachers were unconcerned about and resistant to the current curriculum. Their personal concerns outweighed their concerns about the impact of the curriculum on student learning. Besides, 84% of the respondents did not take any formal training concerning the current curriculum, and 72% of them perceived that they were not supported in its implementation. This finding accounts for the gap between the intended and implemented curriculum, as shown by the curriculum fidelity studies conducted in the context (Aksoy 2020; An, 2020; Arslan Çelik, 2020). As stressed by Hall and Hord (2015), "if there is limited training and support for the change, it is likely that it will not be fully or faithfully implemented" (p. 59). The insufficiency of formal training regarding the curriculum and the teachers' increasing need for it (Kara & Bümen, 2023; Kırkgöz, 2008) were shown by the present study, although an abundance of in-service training programs seems to exist in the context (Altun, 2011; Güngör, 2017; Önalan & Gürsoy, 2020; Öztürk & Aydın, 2019). The findings of the present study also support the assertion that the content of an in-service training program needs to be explicitly linked to the school curriculum and classroom lessons to enhance its effectiveness (Desimone & Garet, 2015).

In the second phase, the eleven participants' reflective writings throughout the theoretical part of the training suggested a positive change in their perceptions of the current curriculum by revealing the themes of positive attitudes towards the curriculum, increased motivation, raised awareness of teacher reflective

practice and inquiry, and sense-making out of the curriculum both individually and collectively, which was found to be lacking and seemed not to have been encouraged in the context (Arslan Çelik, 2020; Karsantık, 2021). As stated by Land et al. (2015), without effective reading of curriculum materials, it is unlikely that teachers will implement the curriculum with fidelity. The findings asserted the indispensable role of teacher reflective practice in building capacity for effective curriculum implementation (Carless, 1998; Fullan, 2007).

Concerning the change in the teachers' stages of concern, while all the participants were found unconcerned about and resistant to the curriculum before the training, five of them developed to be concerned about and not resistant to it. Whereas one participant progressed to not being resistant to but unconcerned about the curriculum, one participant remained resistant after the training. The findings revealed the participants' varying responses to the training (Desimone & Garet, 2015) and matched the CBAM's assertion that "change is a highly personal experience" (Hord et al., 2014, p. 6).

The positive change in the eleven participants' perceptions about the curriculum did not suffice to help them change their instructional practices accordingly; except for the two of them, as cited in the literature, teachers may not be able to alter their implementations even though they may seem to understand the requirements of changes (Ayas et al., 2007; Msamba et al., 2023; Johns & Tanner, 2002). The finding pointed out that teachers need many opportunities for formal training on the curriculum to enhance their implementation fidelity (Carless, 1998; Kırkgöz, 2008; Yenipalabıyık & Daloğlu, 2016).

The inquiry into the participants' reasons for not being able to alter their instructional practices in accordance with the curriculum after the training revealed the teachers' need for curriculum configuration maps. The teachers' high Stage 2 personal concerns pointed out that they were still uncertain about what differentiated the current curriculum from the previous one. What instructional practices align with the objectives of the curriculum and which ones are drastic mutations and do not serve its targeted outcomes need to be explicitly demonstrated by the curriculum developer, MoNE, through curriculum configuration maps (Hall & Hord, 2015).

The inquiry also asserted that the context lacks school-level institutional support, as indicated by the perception that school principals are not stakeholders in the implementation. A limited number of teachers who take formal training through train-the-trainers cannot find any school-level institutional support and serve as change agents, and even they face the risk of isolation in their departments (UNESCO-IBE, 2013). This finding contradicts the premise of "tri-level engagement," considered essential for enhancing implementation fidelity; as stated by Fullan (2006), the national, district, and school levels should mutually interact during the implementation. Moreover, train-the-trainers, which is mainly used to introduce the curricular revisions to the teachers, was shown not to be effective in catalyzing the change for effective curriculum implementation (Çimer et al., 2010; Dichaba & Mokhele, 2012; Öztürk & Aydın, 2019). Therefore, a well-tailored system of curriculum mentoring can provide the institutional support teachers need by ensuring interaction between the national, district, and school levels and providing ongoing capacity building (Güngör, 2017; Ndagi et al., 2023).

The assertion of the study that teaching and assessing grammar create a comfort zone, while teaching and assessing language skills—especially speaking and writing—present a challenge for the teachers is consistent with the research findings in the literature (Morgan & Xu, 2011; TEPAV, 2014). A well-tailored system of curriculum mentoring can assist the teachers in mastering these challenges through workshops that are continuous, school-based, and explicitly connected to the curriculum.

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The Relationship Between Bilsem Teachers' Teaching Motivations and Digital Material Design Competencies

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ABSTRACT

In this study, the relationship between teaching motivation and digital material design competencies of teachers working in Science and Art Centres (BİLSEM) was examined. Research data were obtained from teachers working in BİLSEMs in the 2022-2023 academic year. In the research, mixed method was used in which quantitative and qualitative data were handled together. In the quantitative dimension of the research, gender and professional seniority differences between digital material design competencies and teaching motivation were examined with the data obtained from 106 teachers working in BİLSEMs across Turkey. In the qualitative dimension of the study, data were collected from 12 teachers working in a BİLSEM in the Western Black Sea Region with a semi-structured interview form. According to the results of the analyses, it was seen that BİLSEM teachers' digital material design competencies were at a high level. Teachers' intrinsic and extrinsic motivation levels were found to be at medium level. No significant difference was found between teachers' digital material design competencies and teaching motivation and gender and professional seniority variables. It was determined that there was a moderate positive relationship between teachers' digital material design competences and their teaching motivation (intrinsic-extrinsic). As a result of the research, it was revealed that teachers need training on current issues such as artificial intelligence, augmented reality, virtual reality.

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INTRODUCTION

Discovering the talents of gifted students at an early stage and ensuring that they receive education in accordance with their talents will contribute to countries' skilled workforce. Many countries make special efforts to educate gifted students for the benefit of humanity and society, and carry out studies in this field (Kurtdaş, 2012). The concept of special talent is expressed as "gifted, gifted and gifted/talented children" in different sources. In the Ministry of National Education Special Education Services Regulation, the concept of gifted individual is used (Gürler, Şahin & Akdal, 2023). Individuals who perform at a higher level than their peers in intelligence, creativity, art, leadership capacity, motivation or special academic areas are defined as gifted (Bilgiç, 2013). In 1995, Science and Art Centres (BİLSEM) were established under the General Directorate of Special Education, Guidance and Counselling Services of the Ministry of National Education in order to support the talents of gifted students outside of school. Through these schools, it is aimed to meet the educational needs of gifted children and to prevent the neglect of their emotional and social needs (Özbay, 2013). In Turkey, 67,375 students receive education in 355 BİLSEMs in 81 provinces (Ministry of National Education [MoNE], 2022). While selecting students for BİLSEMs, firstly, students who are considered to be gifted by their primary school teachers are taken to individual examinations by the experts in Special Education Guidance and Research Services, and then those who are decided to be gifted are directed to BİLSEMs (Ulusoy et al., 2014). In these schools, which have the mission of developing projects for all kinds of production, design, technology, and services, students receive project-based education in addition to their formal education (Özbay, 2013). Teachers who will provide education to these special students should have teaching skills in different fields in order to prepare education and training environments. Among these skills, "differentiated education" and the evaluation of this education are areas that require expertise (Köksal, 2021). MoNE assigns teachers to work in these schools within the framework of certain criteria. These criteria are; being a graduate of gifted education, having a master's degree with thesis, having a doctorate, certificates of achievement, certificates of appreciation, taking part in projects and some competences such as knowledge of foreign languages. The evaluation commissions established within the Provincial Directorates of National Education score these competences and assignment points. Then teachers are intervewiewed to measure their communication skills, self-confidence and persuasiveness ability to comprehend and express a subject and reasoning power, openness to scientific and technological developments, merit and ability to represent in front of the public, up-to-date knowledge, creativity and willingness. Teachers are appointed to BİLSEMs at the end of the process according to the total points calculated by taking 60% of the score calculated by the Provincial Directorates of National Education and 40% of the oral exam score and the superiority of the score (MoNE, 2023).

In the digital age, countries expect teachers to equip their students with 21st century skills such as critical thinking, creativity and complex problem solving in order to prepare their citizens for the future. This expectation requires the development of new approaches in education systems in general and in the education of gifted students in particular, and requires teachers to create educational environments that can meet the individual needs of students (Kanlı, 2021a). It is vital that teachers have the belief and motivation that they can teach gifted students. The high motivation of the teacher will positively affect his/her motivation to teach the students. Motivation, which is defined as the source of desires, wishes, needs and impulses of individuals (Kurt, 2013), is the sum of motives that activate individuals (Genç, 2012). Motivation, which is an important factor that affects job satisfaction, is divided into two groups: intrinsic and extrinsic motivation. Some individuals are motivated by internal sources, while others are motivated by external factors (Aslantaş et al., 2018; Ünal & Bursalı, 2013). Teacher motivation has an important role in the success of schools (Ada et al., 2013). High teacher motivation is among the important elements of the realisation of educational reforms (Neves & Conboy, 2001). Teacher motivation is an important factor that positively affects the student-teacher relationship (Kılıç, 2019). Teachers' ability to increase student motivation is related to motivation and self-efficacy towards teaching (Candan, 2019).

It is known that the extrinsic motivation of gifted students is lower than their intrinsic motivation (Kanlı, 2021b). These students need extrinsic motivational support such as teacher support. If these students cannot be educated in accordance with their capacities, they may have difficulties in self-actualisation (Kaya, 2013). Gifted students also receive education in BİLSEMs in addition to school education with their other peers. This situation may sometimes cause students to experience time management problems and decrease their motivation (Şahin, 2014). In order to overcome students' lack of motivation, teachers should be experienced about gifted students and participate in professional development programmes from time to time (Yıldız, 2010). Methods such as programmed teaching, independent studies, multiple intelligence method, interactive material design, project-based learning and interdisciplinary enrichment techniques are used in the education of these students (Göksu, 2021; Özbay, 2013). In these institutions, various workshops are organised in accordance with the interests and abilities of the students. These programmes include digital-focused workshops such as digital design, games and animation, renewable energy, robotic coding, software and hardware, ardunio, mechatronics, 3D design, STEM and artificial intelligence (Göksu, 2021). Teachers working in these workshops provide guidance and consultancy to students in developing projects in addition to their usual lessons. The ability of gifted students to develop projects using digital materials is strongly related to teachers' competences in digital material design. New technologies force teachers to develop their skills in different areas and transform education from traditional to digital-based methods (Pettersson, 2018). The acquisition of these competences by teachers will help students to use new technologies and to already have the necessary skills for future professions (Elsayary, 2023). Increasing the digital competences of teachers will contribute to the development of students' digital literacy skills, access to information and analytical thinking skills (Olpak, 2023). In order for teachers to use their digital competences effectively in students' learning processes, they should also have the pedagogical dimension of technology. However, the pedagogical aspect of digital competence is quite complex (Pettersson, 2018) and teachers often neglect the pedagogical dimension of digital technologies (Gellerstedt, Babaheidari & Svensson, 2018; Lucas, 2021). Teachers generally focus on the use of technology and fail to develop a technological pedagogical perspective (Gellerstedt, Babaheidari & Svensson, 2018). In the European Competence framework published by DigCompEdu, in which the digital competences of educators are determined, it is stated that educators do not have difficulty in using technology, but they have difficulty in using digital technologies by integrating them into education and training processes (Lucas, 2021). Shulman (1986) emphasises the concept of "Pedagogical Content Knowledge" for the necessity of using teachers' content knowledge and pedagogical knowledge together in education. Mishra and Koehler (2006) developed the Technological, Pedagogical and Content Knowledge (TPACK) model by adding the technology dimension to the concept developed by Shulman. Teachers need to have technological and pedagogical knowledge, i.e. TPACK competences, together with their content knowledge in order to integrate ICT and advanced teaching methods (Gellerstedt, Babaheidari & Svensson, 2018). Teachers, who have a critical role in the education of gifted students, do not receive the necessary training to create special programmes for gifted students during their university education (Yılmaz & Yılmaz, 2017). For these students, educational environments where innovative technologies are used in accordance with the conditions of the age (Türksoy & Karabulut, 2020; Ulusoy, et al. 2014) can be realised with new pedagogical approaches. The fact that teachers working in BİLSEMs have high teaching motivation, can use digital technologies effectively, can develop materials suitable for the individual needs of students, can apply and evaluate these materials will make significant contributions to the development of talents of gifted students.

This study aims to contribute to the literature by determining the teaching motivations of BİLSEM teachers and their digital material design competences including various elements. In this direction, answers to the following questions were sought:

What are the digital material design and teaching motivation levels of teachers working in BİLSEMs?

- What are the levels of digital material design and teaching motivation?

- Do digital material design and teaching motivation levels differ according to gender and professional seniority?

- Is there a relationship between teaching motivation and digital material design competences?

- What is the relationship between digital material design and motivation levels in the school where they work?

METHOD

In this study, mixed research method was used in which qualitative and quantitative data were used together and which provided a better understanding of the research problems (Creswell, 2012). The embedded design, which is one of the mixed research models, in which quantitative data are supported by qualitative data, was preferred (Creswell & Plano-Clark, 2007). In the quantitative dimension of the study, the relational screening model was used. Survey models include studies conducted to determine the characteristics of a specific group (Büyüköztürk et al., 2012). In the qualitative dimension of the research, data were collected using a semi-structured interview form to support the quantitative data. In the qualitative part of the study, "Case Study", which is one of the qualitative research methods, was preferred to reveal the views of BİLSEM teachers on digital material design.

Case studies are in-depth researches in which individuals, events and processes are handled as a whole, using multiple data collection sources (interviews, observations, documents, reports) in a certain period of time (Creswell & Plano-Clark, 2007; Yıldırım & Şimsek, 2011; Yin, 1984).

Data Collection Tools

Quantitative data collection tools

The population of this study consists of 4329 teachers working in BİLSEMs in Turkey. The sample of the study consists of 106 primary and secondary school teachers working in BİLSEMs in various provinces of Turkey. Of the teachers participating in the study, 39.6% (n=42) were male while 60.4% (n=64) were female. Of these teachers, 18.9% (n=20) had 0-10 years of professional experience, 45.3% (48) had 11-20 years of professional experience and 35.8% (n=38) had 21 years or more of professional experience.

In the quantitative dimension of this study, the " Teachers' Motivation for Teaching Scale" was used to determine teachers' motivation to teach and the "Digital Material Design Competencies Scale" was used to reveal their digital material design competencies. Data were collected online via Google Forms.

First research instrument; Teachers' Motivation for Teaching Scale: This scale was developed by Kauffman, Yılmaz Soylu, and Duke (2011) and adapted into Turkish by Candan and Gencel (2015). The scale, which consists of two factors, intrinsic and extrinsic motivation, has a 6-point Likert type. The reliability coefficient for the intrinsic motivation factor in the original form of the scale is Cronbach's Alpha .86, while the reliability coefficient for the other factor extrinsic motivation is .76. In this study, the reliability coefficient for intrinsic motivation dimension is Cronbach's Alpha .87 and for extrinsic motivation factor is .77. According to the arithmetic mean scores obtained from the scale, teachers' motivation levels are evaluated as "Low" between 1.00-2.49, "Moderate" between 2.50-4.49 and "Advanced" between 4.50-6.00 (Candan & Gencel, 2015).

Second research instrument; Digital Material Design Competencies Scale: The scale developed by Karaban (2020) consists of 31 items and 4 sub-factors. The sub-factors of the scale are "Design and Development Competence", "Technical Competence", "Technopedagogical Competence" and "Implementation and Evaluation Competence" and have a 5-point Likert type. In the evaluation of the data obtained from the scale, the arithmetic mean value of 31 points is calculated as the lowest score and

155 points as the highest score. Among the sub-factors of the scale, "Design and Development Competence" is 9-20.99 Low, 21-32.99 Medium, 33-45 High, "Technical Competence" factor is 8-18.66 Low, 18.67-29.33 Medium, 29.34-40 High, "Technopedagogical" factor is 8-18.66 Low, 18. 67-29.33 Medium, 29.34-40 High in the "Technopedagogical" factor, 6-13.99 Low, 14-21.99 Medium, 22-30 High in the "Implementation and Evaluation" factor, and 31-72.33 Low, 72.34-113.66 Medium, 113.67-155 High in the scale in general. The overall reliability coefficient Cronbach's Alpha value is .98. The reliability coefficients of the sub-factors are .97 for "Design and Development Competence", .94 for "Technical Competence", .96 for "Technopedagogical Competence" and .95 for "Implementation and Evaluation Competence". In the study, Cronbach's Alpha value was obtained as .97 in the scale. The reliability coefficients of the sub-factors are .93 for "Design and Development Competence", .92 for "Technical Competence", .92 for "Technopedagogical Competence" and .92 for "Implementation and Evaluation Competence".

Qualitative data collection tools

In the qualitative dimension of the research, 12 teachers working in a BİLSEM in the Western Black Sea Region were interviewed, 7 of the participants were female and 5 were male. In the qualitative phase of the study, a semi-structured interview form was used. The themes used in the analysis phase of qualitative data were formed by taking into account the scales and sub-factors of the scales used in the quantitative dimension of the research.

The semi-structured interview questions were sent to two academics working in the field of educational sciences and two teachers working at BİLSEM to obtain expert opinions. The interview questions were rearranged with the suggestions from the experts. Attention was paid to open-ended questions in the preparation of the questions. The arranged questions are given below.

The following questions were asked to the participants in the semi-structured interview form.

1. What are your thoughts on designing and developing digital materials for gifted students?

2. Do you consider yourself technically competent in preparing digital materials? Why?

3. What can you say about your pedagogical competence for gifted students?

4. How do you perceive your ability to implement and evaluate digital materials for gifted students? Why?

5. Are you feel satisfied with working at BİLSEM? Why?

A pilot application was carried out with two teachers working at BİLSEM using the arranged questions. As a result of the pilot application, it was seen that the interview questions were understandable.

Analysis of Quantitative Data

In the analysis of the quantitative data, firstly, it was checked whether the data showed normal distribution or not. When the Kolmogorow-Smirnov test results of the data obtained from the Teachers' Digital Material Design Scale were analysed, it was seen that ($p>0.05$) and it was found that the data fit the normal distribution. When the Kolmogorow-Smirnov test results of the data obtained from the Teachers' Teaching Motivation Scale were analysed, it was seen that the Intrinsic Motivation Factor was ($p<0.048$) and did not fit the normal distribution, while the Extrinsic Motivation Factor was ($p>0.17$). When Skewness and Kurtosis values, another criterion used in deciding on normal distribution, were analysed, it was seen that Skewness=-0.624, Kurtosis=0.944 in the data of Teachers' Digital Material Design Scale, Skewness=-0.322, Kurtosis=-0.535 in the Intrinsic Motivation factor of Teachers' Teaching Motivation Scale, and Skewness=-0.197, Kurtosis=-0.500 in the Extrinsic Motivation factor. When Kurtosis and Skewness values take a value between -1.5 and +1.5, it can be accepted that the data are normally distributed (Tabachnick & Fidell, 2013). According to these results, the data were accepted to be normally distributed and analyses were made.

Analysis of Qualitative Data

The data obtained from the teachers working in BİLSEMs were analysed by descriptive analysis method. The main purpose of descriptive analysis is to reach the concepts and relationships to be used in explaining the data. A framework is created in the realisation of descriptive analysis. Data are processed, findings are defined and interpreted according to the created framework (Yıldırım & Şimşek, 2011). In the direct quotations included in the analysis, the institutions and personal information of the teachers participating in the study were kept anonymous, and the individuals were coded as P1 P2....P12.

In the study, the data obtained from the teachers through a semi-structured interview form was transferred to the Microsoft Word program and descriptive analysis was performed. The data was processed according to the thematic framework, meaningful and logical arrangements were made and the data found to be unimportant were removed from the study. In defining the data, care was taken to ensure that they were readable and understandable. Codes were created according to the determined themes and comments were made in accordance with the purpose of the study.

In order to ensure credibility in the validity phase of qualitative research, all the data obtained and the final version of the study were sent to an academic expert in the field of Educational Sciences and expert review was carried out. The data analysed in the credibility dimension were sent to the participants and participant confirmation was obtained. Credibility is one of the most important criteria of scientific research (Başkale, 2016). In the data analysis phase, direct quotations reflecting the views of the participants were used. In order to ensure maximum diversity in the teachers participating in the research, teachers from different branches were included and gender distribution was taken into consideration. In order to ensure maximum diversity in the teachers participating in the research, teachers from different fields were included and gender distribution was taken into consideration.

To ensure reliability, the interviews were recorded and then the statements in the recordings were transcribed as they were. Factors that contribute to increasing reliability are recording the data, transforming the data in a complete and error-free manner, using these data by more than one researcher (Büyüköztürk et al., 2012).

Ethic

Ethics committee permission for the study was received from Zonguldak Bülent Ecevit University Human Research Ethics Committee (Date: 28.04.2023/299828 Protocol No: 200).

FINDINGS

Findings Related to Quantitative Data

This section presents the findings obtained from quantitative data in the research

Descriptive statistics on the competency levels of academics and teachers in digital material design are given in Table 1.

Table 1. *Arithmetic means of competency levels in digital material design and teaching motivation of teachers*

Scales	Competency Category	N	X	Ss	Level
Digital Material Design Competency	Design and Development	106	32.83	7.21	Medium
	Technical Competency	106	31.59	5.81	High
	Technopedagogical	106	31.82	5.39	High
	Implementation and Evaluation	106	24.35	4.25	High
	Total (General)	106	120.60	20.51	High
Teaching Motivation	Intrinsic Motivation	106	27.87	7.92	Medium
	Extrinsic Motivation	106	16.25	5.30	Medium

When Table 1 is examined, it is seen that the competency level of teachers in digital material design across the scale ($\overline{X}$=120.60) is rated as "High" with the arithmetic mean, "Design and Development" sub-factor ($\overline{X}$=32.83) is rated as "Medium" with the mean, "Technical Competency" ($\overline{X}$=31.59) is rated as High, "Technopedagogical" ($\overline{X}$=31.82) is rated as High, and in the "Implementation and Evaluation" factor ($\overline{X}$=24.35) it is rated as High with the mean. It is observed that teachers have a medium level of motivation in the "Internal Motivation" factor ($\overline{X}$=27.87) and a medium level of motivation with the arithmetic mean in the "External Motivation" factor ($\overline{X}$=16.25).

The results of the t-test regarding whether there is a significant difference between the competency levels in digital material design and teaching motivation of teachers and the gender variable are given in Table 2.

Table 2. *t-Test results on the difference between gender variable and competency levels in digital material design and sub-factors as well as teaching motivation levels of teachers*

Scales	Factors	Gender	N	$\overline{X}$	Ss	Sd	t	p
Digital material Design	Design and Development	Male	42	33.45	6.86	104	0.71	.47
		Female	64	32.42	7.45			
	Technical Competence	Male	42	32.95	5.45	104	1.97	.04*
		Female	64	30.70	5.91			
	Technopedagogical Competency	Male	42	32.57	4.96	104	1.17	.24
		Female	64	31.32	5.55			
	Implementation and Evaluation	Male	42	24.50	4.13	104	.26	.78
		Female	64	24.26	4.36			
	Total	Male	42	124.47	19.17	104	1.17	.24
		Female	64	118.71	21.28			
Teaching Motivation	Intrinsic Motivation	Male	42	26.54	8.45	104	-1.06	.16
		Female	64	28.75	7.50			
	Extrinsic Motivation	Male	42	16.26	5.42	104	0.01	.99
		Female	64	16.25	5.26			

*p<.05

When Table 2 is analysed, it is seen that a significant difference between teachers' digital material design competency levels and gender variable is found only in the "Technical Competence" [t(104)=1.97, p<.05] factor, whereas in the overall scale [t(104)=1. 17, p>.05], sub-factors "Design and Development" [t(104)=0.71, p>.05], "Technopedagogical Competence" [t(104)=1.17, p>.05] and "Application and Evaluation" [t(104)=0.26, p>.05]. According to this result, it is seen that male teachers have higher levels of Technical Competence than female teachers.

The one-way analysis of variance (ANOVA) test results conducted to determine the difference between teachers' levels of digital material design competency and their professional seniority is presented in Table 3.

Table 3. *Variance analysis results on the difference between teachers' levels of digital material design competency and professional seniority*

Factor	Seniority	N	$\overline{X}$	Source of Variance	Sum of Squares	df	Mean Squares	F	p	Difference
Design	0-10 years	20	35.20	Between Groups	139.05	2	69.27	1.34	.26	---
	11-20 years	48	32.35	Within Groups	5327.89	03	51.72			
	21 and above	38	32.18	Total	5466.94	105				
Technical	0-10 years	20	31.40	Between Groups	1.27	2	.63	.01	.98	---
	11-20 years	48	31.58	Within Groups	3550.28	03	34.46			

	21 and above	38	31.71	Total	35551.55	105				
Technopedagogical	0-10 years	20	32.35	Between Groups	10.30	2	5.15	.17	.83	---
	11-20 years	48	31.52	Within Groups	2983.29	03	28.96			
	21 and above	38	31.92	Total	2993.54	105				
Implementation and	0-10 years	20	24.95	Between Groups	16.11	2	8.05	.44	.64	---
Evaluation	11-20 years	48	23.95	Within Groups	1888.26	03	18.33			
	21 and above	38	24.55	Total	1904.37	105				
Total	0-10 years	20	123.90	Between Groups	287.05	2	143.52	33	.71	---
	11-20 years	48	119.41	Within Groups	43912.30	03	426.33			
	21 and above	38	120.36	Total	44199.35	105				

When Table 3 is analysed, no significant difference [F(2,105) = .33, p>.05] was found between the professional seniority of the SAC teachers and their digital material design competency levels. Similarly, no significant difference was found in the sub-factors "Design and Development" [F(2,105) = .01, p>.05], "Technical Competence" [F(2,105) = .17, p>.05], "Technopedagogical Competence" [F(2,105) = .17, p>.05] and " Implementation Competence" [F(2,105) = .44, p>.05].

The results of the one-way analysis of variance (ANOVA) test conducted to determine the difference between BILSEM teachers' teaching motivation levels and professional seniority are presented in Table 4.

Table 4. *Variance analysis results on the difference between teachers' levels of ıntrinsic and extrinsic motivation and professional seniority*

Factor	Seniority	N	$\overline{X}$	Source of Variance	Sum of Squares	sd	Mean Squares	F	p	Difference
Intrinsic	0-10 years	20	29.65	Between Groups	187.57	2	93.75	1.50	.22	---
Motivation	11-20 years	48	26.45	Within Groups	6407.83	03	62.21			
	21 and above	38	28.73	Total	6595.40	105				
Extrinsic	0-10 years	20	17.60	Between Groups	49.13	2	24.56	.87	.42	---
Motivation	11-20 years	48	16.14	Within Groups	2906.99	03	28.23			
	21 and above	38	15.68	Total	2956.2	105				

When Table 4 is examined, no significant difference was found between the professional seniority of BİLSEM teachers and the factors of "Intrinsic Motivation" [F(2,105) = 1.50, p>.05] and "Extrinsic Motivation" [F(2,105) = 0.42, p>.05].

In order to determine the relationship between the digital material design competencies and sub-factors of BİLSEM teachers and their teaching motivation levels (intrinsic-extrinsic), Pearson Correlation Coefficients analysis results are provided in Table 4. When interpreting the correlation values between factors, it is considered high if the absolute value is between 0.70-1.00, moderate if between 0.70-0.30, and low if between 0.30-0.00 (Büyüköztürk et al., 2012).

Table 5. *Correlation coefficient results between teachers' digital material design competences and sub-factors and their motivation to teach (intrinsic-extrinsic) levels*

Scale/Scale Sub-Dimension	1	2	3	4	5	6	7
Design and Development	1.00						
Technical	.722**	1.00					
Technopedagogical	.804**	.844**	1.00				
Implementation and Evaluation	.647**	.723**	.795**	1.00			
Design (General)	.906**	.914**	.947**	.847**	1.00		
Intrinsic Motivation	.392**	.174	.316**	.341**	.340**	1.00	
Extrinsic Motivation	.408**	.193*	.326**	.286**	.342**	.727**	1.00

** p<.01

When Table 5 is analysed, it is seen that there is a "High" level positive relationship between the digital material design competencies of BILSEM teachers and their sub-factors "Design Competence" level (r=.906, p<.05), "Technical Competence" (r=.914, p<.05), "Technopedagogical Competence" (r=.947, p<.05) and "Application Competence" level. It is seen that there is a positive "High" level relationship between "Intrinsic Motivation" and "Extrinsic Motivation" levels of BILSEM teachers (r=.727, p<.05).

Furthermore, there is a positive "Moderate" level correlation between BILSEM teachers' external motivations and digital material design competencies (r=.342, p<.05), a "Moderate" level correlation between the sub-factor "Design Competency" level (r=.408, p<.05), a positive "Low" level correlation with "Technical Competency" (r=.193, p<.05), a "Moderate" level correlation with "Technopedagogical Competency" (r=.326, p<.05), and a positive "Moderate" level correlation with "Implementation and Evaluation" level (r=.286, p<.05).

Moreover, there is a positive "Moderate" level correlation between BILSEM teachers' intrinsic motivations and digital material design competencies (r=.340, p<.05), a "Moderate" level correlation with the sub-factor "Design Competency" level (r=.392, p<.05), a positive "Moderate" level correlation with "Technopedagogical Competency" (r=.316, p<.05), and a positive "Moderate" level correlation with "Implementation and Evaluation" level (r=.341, p<.05). No significant relationship was found between intrinsic motivation and "Technical" competency (r=.174, p>.05).

Lastly, a positive "High" level relationship is observed between BILSEM teachers' intrinsic motivations and extrinsic motivation levels (r=.727, p<.05).

Findings Related to Qualitative Data

In this section, findings related to each qualitative research question are presented.

What are your thoughts on designing and developing digital materials for gifted students?

The teachers who participated in the research stated that each gifted student has different learning styles, that it is difficult and time consuming to prepare materials for each student, and that they need professional development programmes for innovative implementations such as augmented reality, virtual reality and artificial intelligence.

The opinions of some teachers on this subject are as follows. *Each of the gifted students has different learning styles. Therefore, preparing personalised materials for these students is the most difficult issue for me (P4). New digital materials are constantly coming out, I have to follow them. I feel the need to constantly improve myself (P8). On the other hand, it takes a lot of time to prepare digital materials (P2).*

Do you consider yourself technically competent in preparing digital materials? Why?

Among the teachers who participated in the study, there were five teachers who considered themselves technically competent in preparing digital materials (P1, P3, P4, P9, P11), six teachers who considered themselves partially competent (P2, P6, P7, P8, P10, P12), and one teacher who considered herself/himself inadequate (P5).

The opinions of some teachers who consider themselves competent in preparing digital materials are as follows. ..... *I can create interactive materials, simulations, special applications and online content in accordance with the needs of students. In addition, I try to observe technical standards such as accessibility, usability and interactivity when designing digital materials (P4). ..... So far, I have had the opportunity to analyse a lot of materials and materials. Knowing what will be useful for students, I can make designs for them (P9) I can easily apply these designs in my classroom. But I still feel a great hunger for learning (P11).*

The opinions of the teachers who consider themselves partially technically competent in preparing digital materials are as follows

...I consider myself partially competent. Digital material development or design is a very wide field. New tools come out every day. I try to improve myself by feeding myself from various sources in line with my needs (P10) There are many ready-to-use educational digital materials on my subject. Therefore, I prefer ready-made and existing educational digital materials, especially augmented reality or artificial intelligence applications. Preparing these requires a separate software, it is very difficult to master all of them, but I prefer them because it is easy, practical and useful to prepare digital materials with Web2.0 tools (P8, P12). For example, I would like to make a mobile application related to my branch, but I do not have enough knowledge on this subject (P12). We need trainings for digital material design (P5), software, hardware and licensed programmes (P9).

What can you say about your pedagogical competence for gifted students?

While nine of the teachers who participated in the study stated that they were pedagogically adequate about gifted students (P1, P2, P3, P4, P5, P6, P8, P10, P11), two teachers (P7, P12) stated that they were partially adequate and one teacher stated that he/she was inadequate (P9). They stated that the reason why they considered themselves sufficient was that they had teaching experience, they had taught gifted students in their classes in the schools where they worked before BİLSEM, and they had participated in professional development programmes for these students. The opinions of some teachers on this subject are as follows.

..... I can use pedagogical methods (P3, P4) thanks to my experience of working with gifted students and my constantly updated knowledge in this field. I participate in seminars and trainings organised for these students (P2, P8, P10, P11). I can make my lessons more fun (P5). There were gifted students in the regular schools I have worked in until today, I think that I have gained experience in terms of working years and that we have done good pedagogical work with these students (P6).

The teachers who stated that they were partly competent explained the reason as follows

..... I was very anxious before I started working at BİLSEM. I still am. I think I need to add a lot to them (P7). In order to be sufficient for these students, I try to follow those who do different studies, follow relevant books and social media accounts (P12).

How do you perceive your ability to implement and evaluate digital materials for gifted students? Why?

While some of the BİLSEM teachers (P1, P2, P4, P7, P8, P10, P11) considered themselves sufficient, some of them (P3, P6) considered themselves partly sufficient, and some of them (P5, P9, P12) considered themselves insufficient in terms of having students practise and evaluate using digital materials. Eachers who applied and assessed students using digital materials stated that digital materials are useful in concretising abstract concepts, providing permanent learning and interaction. The opinions of some teachers on this subject are as follows.

..... I use the digital tools I have developed in process evaluation and identifying student needs. These tools guide me in communicating and collaborating with students (P4). We make students find the abstract mathematical rules by proving them with design geometry, in the same way, the proofs we make using the Geogebra programme enable students to learn the subjects more permanently (P8). The WEB 2.0 tools that I use as digital materials are tools that contribute to active, interactive and permanent learning (P10)

The comments of some teachers who felt themselves inadequate in the dimension of implementation and evaluation of digital materials are as follows.

....., the application and evaluation of digital materials is a very wide area and I do not feel myself sufficient in the field (P3). The practice and evaluation aspect is not for me. I stay away from it as much as possible except in compulsory situations (P9). I think that they should learn by doing and experiencing

rather than digital materials (P5).

Are you feel satisfied with working at BİLSEM? Why?

When the teachers who attended the study were asked the question "Do you feel satisfied working at BILSEM? Why?", some teachers stated that they were happy to work with gifted students and that there were factors that positively affected their motivation (P1, P3, P4, P5, P6, P7, P8, P9, P11), while others (P6, P7, P8, P9, P10) repoerted that their motivation decreased.

Some of the teachers who stated that they were happy to work at BİLSEM explained the reasons for this as follows.

.... I can say that working with gifted students is a passion and privilege for me. Their unique talents, creativity and curiosity are my biggest source of motivation. It is a great pleasure for me to work with them (P4, P7), it is very nice for them to put their dreams into practice by using their imagination (P5), it is an enjoyable job (P6). Working on different subjects and producing something without the rush of curriculum training (P7) prevents me from getting rusty, my mind is constantly busy to produce something new (P11). The perception, preparedness and reasoning levels of the students who come here are quite high. This situation relaxes us. It also gives us the opportunity to improve ourselves and enrich our activities (P12).

Some of the teachers participating in the research (P6, P7, P8, P9, P10) stated that working at BİLSEM causes loss of motivation, that students are sometimes reluctant to come to a second school when they leave their schools, and that their lack of attendance decreases their motivation. Teachers stated that BİLSEM's working schedule is out of normal working hours and some administrators' attitudes cause their motivation to decrease. Some teacher opinions on this matter are as follows.

..... students leave school and come to BİLSEM reluctantly and tiredly. Therefore, the reluctance of the student causes us to lose motivation (P6). Another reason for the loss of motivation is due to the BILSEM system (P10), working hours makes our family life difficult and conflicts with it (P12). Administrator attitudes also affect us negatively from time to time (P9).

DISCUSSION, CONCLUSION, RECOMMENDATIONS

In this study, it was tried to reveal the relationship between the digital material design and development competences of teachers working in BİLSEMs and their teaching motivation. The quantitative and qualitative data collected in the study were analysed and interpreted together.

What are the digital material design and teaching motivation levels of teachers working in BİLSEMs?

According to the quantitative data of the study, it was concluded that BİLSEM teachers considered themselves "Highly" competent in the overall Digital Material Design Scale and its sub-dimensions of Technical, Technopedagogical, Implementation and Evaluation dimensions, and "Moderately" competent in the Digital Material Design and Development sub-dimension. Gökbulut, Keserci and Akyüz (2021), in their study conducted for academicians, found that they had high level competencies in the overall digital material design scale and its sub-dimensions of Technical, Technopedagogical, Implementation and Evaluation dimensions. Kılıç and Özkan (2022) found that BİLSEM teachers consider themselves competent above average in designing and developing learning environments and evaluation activities suitable for the digital age. In the same study, it was concluded that educational technology standards and self-efficacy perceptions were at a high level, supporting the research finding. It is determined that BİLSEM teachers use WEB 2.0 tools intensively and their competences in this regard are high (Kıroğlu & Güven, 2024). Altındiş (2016) states that BİLSEM teachers have high technology integration self-efficacy. Türksoy and Karabulut (2020) stated that BİLSEM teachers are willing to use augmented reality and virtual reality applications in education, but they have prejudices against preparing

materials in this field, and Eker (2019) stated that they do not have information about how to perform technology integration. BİLSEM teachers need training on the integration of design, modelling, web content development, robotics and STEM education (Çalışkan, 2017).

In the qualitative interviews conducted with teachers in the study, they stated that each gifted student has different learning styles, that it is difficult and time-consuming to prepare materials for each student, and that they need professional development programmes in these areas in order to develop innovative applications such as augmented reality, virtual reality and artificial intelligence. Altun and Vural (2012) stated that in-service training activities for BİLSEM teachers were not sufficient, and that a limited number of teachers participated in the trainings organised so far and that they were inefficient. In their study, Öğülmüş and Sarı (2014) stated that BİLSEM teachers were inadequate in trainings due to lack of materials and they could not meet the educational needs of students.

It was concluded that BİLSEM teachers had "moderate" level of motivation in the Intrinsic Motivation and Extrinsic Motivation dimensions of the motivation scale for teaching. In the literature, in parallel with the research finding, it is frequently encountered in quantitative studies conducted with teachers working in schools other than BİLSEM that intrinsic and extrinsic motivation is at a moderate level (Çelik, 2022; Gökbulut, 2023; Gün & Turabik, 2019; Kütükcü, 2020; Oran, Güler & Bilir, 2016). In the qualitative interviews conducted in order to reveal the reasons why BİLSEM teachers defined their intrinsic-extrinsic motivation as medium level in the quantitative dimension of the research, teachers stated the issues that negatively affected their motivation as follows. The students come to BİLSEM from compulsory education and they are sometimes reluctant to come to a second school. Besides this, the problems of the absence of students, the working hours of BİLSEM, the attitudes of the administrators negatively affected their motivation. While students continue formal education (preparation for central exams, study centre, and private lessons), coming to BİLSEM puts students in an intense tempo and sometimes they are absent to do their homework and lessons. These factors negatively affect the extrinsic motivation of teachers (Eker, 2019; Kazu & Şenol, 2012; Öğülmüş & Sarı, 2014; Kurtdaş, 2012; Özkan, 2009). Another factor that negatively affects the motivation of BİLSEM teachers is the insufficiency of professional development opportunities offered by both the Ministry of National Education and the institution (Altun & Vural, 2012). BİLSEM teachers feel themselves inadequate in terms of appropriate pedagogical methods to know gifted students in mental, social and emotional dimensions and to provide education for their needs (Topcu, 2022). BİLSEM teachers need to increase their motivation and support their personal development (Altun & Vural, 2012).

When the quantitative and qualitative data of the study are analysed together, it is seen that BİLSEM teachers are willing to prepare and use digital materials in trainings and use WEB 2.0 tools in their trainings. Although they are willing to prepare and use materials, we can say that they feel inadequate about augmented reality, virtual reality, artificial intelligence applications and they need professional development programmes on these issues. We can say that teachers' intrinsic motivation to work in BİLSEM is at a good level, while extrinsic motivation sources cause motivation losses. On the basis of the loss of extrinsic motivation, it has been observed that students come to BİLSEMs tired, reluctant and absenteeism after formal education.

Do the digital material design and teaching motivation levels of teachers working in BİLSEMs differ according to their gender and professional seniority?

While there was no significant difference between the Digital Material Design (General) and the scale sub-factors Design and Development, Technopedagogical, Implementation and Evaluation dimensions of the teachers working in BİLSEMs and the gender variable, a significant difference was found in the Technical Competence sub-factor. According to these results, we can say that there is no difference between male and female teachers in Digital Material Design (General) and scale sub-factors, Design and Development, Technopedagogical, Application and Evaluation dimensions. In the technical

level of digital material design, we can conclude that male teachers have higher competences than female teachers. Kılıç and Özkan (2022) found no significant difference between BİLSEM teachers' self-efficacy towards educational technology standards and gender in their study. In the same study, similarly, no significant difference was found between the gender variable in designing and developing learning environments and assessment activities for the digital age. In their study, Gökbulut et al. (2021) obtained a result in favour of male academicians in the overall digital material design scale and its sub-dimensions, Technical, Technopedagogical dimensions, while no significant difference was found between male and female academicians in the Implementation and Evaluation dimension in support of the research finding. In the same study performe with teachers, no significant difference was found between male and female teachers in the overall digital material design scale and Implementation and Evaluation, Technopedagogical, Design and Development sub-factors, while a meaningful difference was found in favour of male teachers in the Technical Competence sub-factor. When the qualitative dimension of the research was analysed, more than half of the teachers stated that they were partly sufficient or insufficient in the technical dimension of preparing digital materials. They stated that they were inadequate especially in current issues such as augmented reality, virtual reality and artificial intelligence applications, and for this reason, they preferred WEB.2.0 tools which are easy to prepare digital materials. In-service trainings for BİLSEM teachers are not at an adequate level and teachers need to attend these trainings regularly for their professional development (Akhan & Altaş, 2021; Satmaz & Gencel, 2016; Semerci & Kaya, 2007; Sezginsoy, 2007; Özkan, 2009).

In the study, no significant difference was found between the sub-factors of the teaching motivation scale of BİLSEM teachers, Intrinsic Motivation and Extrinsic Motivation factors and gender variable. According to this result, it can be said that there is no difference between the intrinsic and extrinsic motivation of male and female teachers working in BİLSEM and that motivation sources do not create a difference on male and female teachers depending on gender. In the literature, there are no quantitative studies investigating the difference between the intrinsic-extrinsic motivation of BİLSEM teachers and the gender variable, however, studies on teachers working at other education institutions are frequently available. Among these studies, there is no significant difference between extrinsic motivation of teachers and gender variable (Ertürk, 2014; Gökbulut, 2023) in the direction of supporting the research finding, as well as studies in which intrinsic motivation of female teachers is high (Al-Salameh, 2014; Çiçek, 2009; Emiroğlu, 2017; Gökbulut, 2023; Kaya, Yıldız & Yıldız, 2013; Kılıç, 2019). The reason why different results were obtained between the motivation and gender variable in the studies conducted for teachers working in BİLSEMs and teachers working in other educational institutions may be due to the fact that BİLSEM teachers work in these schools after passing a several-stage examination and that it's their choice to work there.

No significant difference was found between digital material design (General) and scale sub-factors Design and Development, Technical, Technopedagogical, Technopedagogical, Implementation and Evaluation dimensions of teachers working in BİLSEMs and professional seniority variable. According to this result, we can say that teachers' working year is not effective in designing digital materials. Similarly, no significant difference was found between teachers' intrinsic and extrinsic motivation levels and professional seniority variable. According to this result, we can say that professional seniority has no effect on the intrinsic and extrinsic motivation levels of BİLSEM teachers. Since they are selected to these schools through written and oral exams, have the desire and motivation to work voluntarily in these schools, and are experienced in project-based learning, so professional seniority may not have an effect. As a result of the qualitative interviews with the teachers, they stated that the majority of them were happy to work in BİLSEM, that they did not have much difficulty after becoming a teacher in these schools, and that the reason for this was that they had teaching experience before starting to work in BİLSEM, that there were gifted students in their classes in the schools they worked before and that they had participated in professional development programmes for gifted students. Sezginsoy (2007) reported that although the working periods of the teachers in BİLSEM were different, their opinions about the education and training

situations were similar. In their study, Kazu and Şenol (2012) stated that teachers with less professional seniority enabled students to use technology more, while Özkan (2009) pointed out that as the professional seniority of BİLSEM teachers increased, their negative opinions about the institution also increased. Altındiş (2022), in his metaphor study on BİLSEM teachers' views on distance education, states that teachers with high professional seniority develop fewer metaphors and that these metaphors are negative ones. Gökbulut et al. (2021) found no significant difference between the overall scale and its sub-factors and the variable of professional seniority in support of the research finding in their study with academicians, while in their study with teachers, they found that the digital material design competencies of teachers with less professional seniority were higher than those of teachers with more professional seniority.

Is there a relationship between teaching motivation and digital material design competences of teachers working in BİLSEMs?

In the study, it was observed that there was a "High" level relationship between BİLSEM teachers' digital material design (General) and scale sub-factors Design and Development, Technical, Technopedagogical, Implementation and Evaluation aspects. According to this result, we can say that teachers should have the same level of competence in the dimensions of Design and Development, Technical, Technopedagogical, Implementation and Evaluation. The factor with the lowest correlation between the overall scale and its sub-factors is the "Technical" factor. In the qualitative interviews with the teachers, they stated that they had the most difficulties in the technical parts of preparing digital materials and that they needed to participate in professional development programmes on these issues. It is stated that the reason for the low self-efficacy of teachers working in BİLSEM is due to their concerns about technology (Kılıç & Özkan, 2022).

In the study, it was seen that there was a "High" level relationship between intrinsic motivation and extrinsic motivation of BİLSEM teachers. According to this result, we can say that extrinsic motivation sources can affect BİLSEM teachers' willingness to work in BİLSEM, which is an intrinsic motivation source. When the qualitative data obtained in the study were evaluated, it was concluded that the teachers were happy to work in BİLSEM and to be with gifted students in a way that supports the quantitative finding. The fact that teachers want to work in BİLSEM is an indication that their intrinsic motivation is high. Communication with colleagues, attitudes and behaviours of school administrators are among the factors affecting extrinsic motivation of teachers. Teachers and administrators working in BİLSEMs are also assigned to these schools according to certain criteria and in line with their wishes. Communication and collaboration between teachers who have the same intrinsic motivation to teach gifted students is likely to positively affect their extrinsic motivation. Similarly, high intrinsic motivation of school administrators appointed to BİLSEM will positively affect the extrinsic motivation of teachers. This may have been effective in the high correlation between teachers' intrinsic and extrinsic motivation. Kurtdaş (2012) states that students who come to BİLSEM are happy despite being in an intense schedule, and Eker (2019) reports that students' self-confidence and motivation increase with the education they receive at BİLSEM and that they have fun at the same time. Similarly, Akhan and Altaş (2021) stated that teachers are happy to work in BİLSEM, their professional satisfaction and job satisfaction are high, and they feel themselves autonomous (Topcu, 2022).

In the study, a "Moderate" level relationship was found between the intrinsic motivation of BİLSEM teachers and Digital Material Design (General) and scale sub-factors Design and Development, Technopedagogical, Implementation and Evaluation dimensions. No significant relationship was found between intrinsic motivation and technical competence. According to this result, we can say that as teachers' intrinsic motivation increases, their willingness to design digital materials will increase or vice versa, as their intrinsic motivation decreases, their willingness to prepare digital materials will decrease. We can state that the reason why there is no correlation between teachers' intrinsic motivation and technical competence levels is that teachers are eager to develop digital materials, and this does not affect

their technical skills in digital material development positively or negatively.

Another result obtained in the study is that there is a "Medium" level relationship between the extrinsic motivation of BİLSEM teachers and Digital Material Design (General) and the scale sub-factors Design and Development, Technical, Technopedagogical, Implementation and Evaluation dimensions. According to this finding, we can state that as the extrinsic motivation of teachers increases, their willingness to design digital materials will increase, and vice versa, when their extrinsic motivation decreases, their willingness to design digital materials will decrease. Directing and participating in professional development programmes on digital material design may be effective in increasing the extrinsic motivation of teachers. Teachers working in BİLSEM need in-service (Satmaz & Gencel, 2016) or pre-service training to meet the needs of students, to use technological equipment at a high level, and to improve their qualifications (Kayaalp et al., 2022; Kontaş & Yağcı, 2016).

Recommendations

When the researches on BİLSEMs are analysed, it is seen that there are mainly studies that include teachers' opinions. In this study, a mixed design with qualitative and quantitative data for BİLSEM teachers was used. Similar studies can also be done for BİLSEM students and parents.

Professional development programmes on digital material design for BİLSEM teachers can be organised, and experimental studies related to trainings can be carried out.

Students receiving education in BİLSEMs are gifted and the characteristics of each of them may differ from other students. In the study, teachers reported that they had difficulty in developing personalised materials. They also stated that they need professional development programmes especially on innovative applications such as augmented reality, virtual reality and artificial intelligence. In-service training courses can be organised in these areas.

In the research, the design competences of male teachers in the technical dimension of digital material design were higher than female teachers. In-service trainings can be given to female teachers in the technical level of digital material design.

Among the factors that negatively affect the motivation of BİLSEM teachers, it was stated that students are reluctant to come to BİLSEM after schools, because this can sometimes be extremely tiring for students. Bilsem working programmes (in terms of days and hours) can be rearranged in cooperation with formal education institutions.

In the quantitative dimension of the study, although the teachers stated that they had a high level of competence in the application and evaluation of digital materials, it was seen in the qualitative interviews that their knowledge about application and evaluation was limited. In-service training programmes can be organised for teachers, especially for the use of digital materials for application and evaluation purposes.

In the quantitative stage of the research, it was obtained that the technopedagogical competences of the teachers were high, and similarly, in the qualitative interviews, the majority of the participants in the research stated that their pedagogical competences were high in teaching gifted students. However, it was observed that they had limited knowledge about technopedagogical competences. In-service trainings on technopedagogical education can be organised for BİLSEM teachers.

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The Effect of the Mobile Application on Students' Achievement, Readiness and Technology Acceptance [1]

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ABSTRACT

The purpose of this study is to develop a mobile learning application for teaching vocabulary learning in order to support English as a foreign language education and to test its effectiveness. In this study, carried out in two phases, the multi-phase mixed method, which allows using qualitative and quantitative methods, was used. In the first phase (Phase 1), a Mobile-Assisted Language Learning (MALL) application was developed. At this phase, the study group consists of 14 students who have previously taken English courses in web-supported learning environments at a university. In accordance with the ADDIE model, a needs analysis was carried out first, the application was developed in the light of the results and in line with the opinions of the field experts, and the application was finalized with pilot studies. In the second phase of the study (Phase 2), the effectiveness of the mobile learning application was tested. For this purpose, the effects of MALL application on students' academic achievement, technology acceptance and technological readiness were examined. For this study, an experimental study lasting four weeks was conducted using a quasi-experimental design. In the experimental study, whose study group consisted of 61 students taking English courses at the same university; as pre-test and post-test, achievement tests and scales were administered to the experimental and control groups. According to the data obtained from the study, it was found that the mobile assisted language learning environment is more effective than the web supported learning environment in terms of students' academic achievement; however, no significant difference was observed on students' acceptance levels and readiness. As a result of the research, it is recommended that MALL applications should be used to support language learning. Additionally, it is thought that this study can be a guide for researchers who want to conduct studies for developing mobile-assisted language learning applications.

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INTRODUCTION

Technological developments have found its way in information and communication technologies as in almost every field of study. In this progress in information-communication technologies; in addition to the processing of information, accessing information from anywhere and anytime has taken an important place. This state of being mobile (Crompton, 2014), which was achieved with the production of the first mobile phone in the 1970s, accelerated with the production of smartphones in the 2000s. It has been moved even to a higher level with the mobile devices', which have already increased access opportunities, support of internet technologies. Today, users can stay mobile thanks to hardware such as tablets, smartphones and personal digital assistants.

According to the Digital in 2024 (We are Social, 2024) report published by We Are Social, a digital media agency, as of January 2024, 69.4% of the world's population (5.61 billion) uses mobile devices. According to the report, while the total population increased by 0.9% (74 million), the number of mobile device users increased more and reached 2.5% (138 million). Looking at the statistics, it is seen that the ownership rate of mobile technologies is high and mobile technologies are used frequently. This gives an idea of how effective it can be to integrate mobile technologies into education. Advances in mobile technology affect educational practices and provide new concepts in this field (Attewell, 2005). One of these is "mobile learning", which has been studied since the 2000s (Hameed, Qayyum & Khan, 2024).

Mobile Learning and Mobile Assisted Language Learning

Although the definition of the concept has been made many times in the relevant literature, there is still no agreed-upon definition of mobile learning (Kukulska-Hulme, 2009). One of the main reasons for this situation is the rapid advancements in mobile technologies. Another, perhaps most important one, is the ambiguity of the concept of "mobile". Some of the researchers argue that the "mobile" is technology, some of them are the learners, and some of them are the learning content (Kukulska-Hulme, 2009). According to Wagner (2008), the concept of mobile learning is the learner's realization of learning in line with their individual needs, by accessing information whenever and wherever they want.

Mobile learning not only provides the opportunity to learn anytime, anywhere, but also brings some other advantages. Some of these advantages are:

- It provides a learning environment in accordance with the pace of each learner
- As the mobile learning environment supports working in groups, it can realize collaborative learning.
- It also supports informal learning as learning activities continue outside the classroom environment.
- The learner can interact with the teacher and other learners.
- Learning becomes interesting (Naismith & Corlett, 2006; Cheon, Lee, Crooks & Song, 2012; Corbeil & Valdes-Corbeil, 2007)

Besides the advantages of mobile learning environments, there are also some limitations. Small screen sizes, low resolutions, internet bandwidth problems and high cost of qualified mobile devices are some of these problems (El-Hussein and Cronje, 2010; Hockly, 2012). In addition to those technical limitations, there are some psychological limitations as well. According to Park (2011), the use of social media and messaging applications on mobile devices and the use of these mobile devices for surfing the Internet hamper learning activities. Mobile learning tools, which have gained an indispensable place in education with many important opportunities compared to their limitations, are also preferred in language teaching, whose importance is increasing day by day.

The reflections of the developments and changes in mobile technologies in the field of education are also seen on the applications related to language learning and teaching. One of the most common uses of mobile technologies in educational environments has been in foreign language education (Wrigglesworth, 2020). Integration of mobile devices in language learning processes is explained by the concept of mobile-assisted language learning (Liu, Tao, & Cain, 2016; Wang & Hafferman, 2009). Kukulska-Hulme (2013) also defines this concept as taking advantage of the portability of mobile devices in language learning processes.

When the relevant literature is examined, it is seen that there are studies that explain the concept of mobile-assisted language learning by associating it with the concept of computer-assisted language learning (Zhang & Zou, 2020). According to Caudill (2007), mobile-assisted language learning is the successor and sub-dimension of computer-assisted language learning. Kukulska-Hulme and Shield (2008) underline that these two concepts are different from each other by stating that MALL emphasizes individuality and is more learner-centered compared to computer-assisted language learning, thus it is a more learner-related concept. Parkavi, Abdullah, Sujitha, and Karthikeyan (2018) defined MALL as a subset of both computer-assisted language learning and mobile learning. According to Stockwell and Hubbard (2013), the concept of mobile-assisted language learning should be examined together with mobile learning and second language acquisition theories.

When we look at the studies on MALL, it is seen that these studies deal with the issue from different perspectives (Cheng & Chen, 2019). Some studies have compared MALL with traditional methods or other learning environments. For example, Hayati, Jalilifar, and Mashhadi (2013) compared the effectiveness of three different teaching environments for teaching English idioms. According to the results of the pre-test and post-test administered in this research, conducted as an experimental study, it was understood that students who learned in the MALL environment learned better than the other students. It was concluded that thanks to the driving force of mobile technologies, students' regular exposure to foreign language elements enabled them succeed better.

Similarly, Wu (2014) designed a mobile application for teaching English vocabulary and investigated the effectiveness of this application. In order to test the application, he worked with a study group of 50 students, all of whom were Chinese students, who wanted to learn English. The researcher, who divided the study group into two as experimental and control groups, ensured that the control group continued their in-class learning with traditional methods and did not intervene. He enabled the experimental group students to use the MALL application he designed. According to results of the tests, administered before and after the experimental process, it was seen that the students in the experimental group who used the MALL environment outperformed the students in the control group in vocabulary learning.

Another study, examining different variables, was conducted by Kurt and Bensen (2017). The researchers formed a study group of 32 first-year undergraduate students and divided this group into two equal and homogeneous groups. While the first group, the experimental group, used a mobile environment for learning vocabulary, the control group didn't benefit from such an environment. According to the data obtained from the research, it was found that the students in the experimental group improved their vocabulary more than the students in the control group. In the same study, qualitative data was also collected and the analysis of the qualitative data showed that the students found the mobile learning application motivating and entertaining, and that stated that the mobile application provided them with a collaborative learning environment.

Foreign Language Teaching Methods and Approaches

a) Lexical Approach: This approach, put forward by Lewis, emerged against the distinction between grammar and vocabulary and argues that these two concepts are in continuity (Ördem, 2013). Acording to this approach, vocabulary teaching is important in foreign language education (Çetinkaya, 2005).

Words have an important function in understanding what is said and written, and in conveying feelings and thoughts to someone else (Çetinkaya, 2005). It is not possible to understand what is written, read or said without knowing the meaning of words. According to Nation (2001), who states that words are as important as grammar and language structures, vocabulary is a complementary part for foreign language learners' general proficiency and a prerequisite for an effective communication.

Vocabulary learning is an individualized process and individuals have different perceptions of words that connect their previous experiences and knowledge (Pearson, Hiebert, & Kamil, 2007). Therefore, in order to learn a word successfully, learners' individual needs and their vocabulary knowledge must be taken into account (Pressley, Disney, & Anderson, 2007). Vocabulary knowledge continues to develop based on each individual's experience, learning history and some other external factors. Therefore, the vocabulary of each individual differs. An individual's vocabulary knowledge affects his/her comprehension and expression skills in the target language (Özbay & Melanlıoğlu, 2008). The individual, who has a rich accumulation of words and concepts, has fluency and richness of thought in the thinking process. According to the studies, the vocabulary that directly affects the comprehension and expression skills of foreign language learners is open to development with different teaching methods and techniques (Hasbún 2005; Eden 2005; Acar & Yaman, 2011; Sarıgül, 2017). The Mobile Assisted Language Learning environment is one of these innovations.

b) Context-Based Vocabulary Teaching: In the teaching of the word, a meaningful learning will not take place by teaching only the knowledge of pronunciation and lexical meaning, and this does not ensure that the words can be used appropriately (Duran & Bitir, 2017). Glynn and Kobala (2006), who defined context-based learning as transferring the information to be taught by associating it with daily life, stated that this will facilitate the learners' comprehension and increase the chance of their recalling the information. Gür (2014), mentioning that for using context-based learning, associations have to be established by determining the word lists and contexts beforehand, stated that it is aimed to perceive, understand, use and remember words in contexts. According to Finkelstein (2001), one of the important advocates of this concept, context-based vocabulary learning is realized by inferring the meaning of a word from the context it is in, and this method is one of the most effective vocabulary learning methods. This method, which has attracted attention by many researchers, is used by adapting it to education systems (Acar & Yaman, 2011). In the current study, this approach was taken into consideration while developing the application.

Readiness for Mobile Learning

Readiness is a concept that is frequently researched and paid attention to in learning environments such as distance education, mobile learning and online learning (Demir-Kaymak & Horzum, 2013; Hukle, 2009; Leigh & Watkins, 2005; Watkins, Leigh & Triner, 2004). This concept refers to the learner's physical and mental readiness for a mobile learning organization. Although the learner has hardware and software opportunities in this learning environment where mobile technologies are used; psychological and technological skills should also be ready. Readiness is one of the most important variables that affect the effectiveness of mobile learning and its acceptance by individuals (Lin, Lin, Yeh, & Wang, 2016). According to Kalelioğlu and Baturay (2017), if individuals are not satisfied with the technologies they use and they do not feel ready to use them, they will avoid using these technologies. Abas, Chng, and Mansor (2009) suggested that readiness in mobile learning processes should be supported in research studies. This situation reveals the importance of measuring readiness in mobile learning environments.

In this respect, Suwantarathip and Orawiwatnakul (2015) conducted an experimental study that lasted seven weeks to examine the effect of MALL on learning English vocabulary and students' attitudes towards MALL. Based on the results of the research, the researchers, stating that the contents used in MALL should be carefully designed, highlighted that the students' readiness for MALL would affect their success.

Mobile Technology Acceptance

The acceptance of technology by users started to be researched frequently in the literature in the 1970s and continued to be researched in various fields in the following years (Legris, Ingham & Collerette, 2003). During these studies, theories such as planned behavior theory, diffusion of innovation theory and causal behavior theory emerged in order to explain the user's attitude and intention towards using technology (Menzi, Nezih, & Çalışkan, 2012). The Technology Acceptance Model, which investigates the acceptance of information technologies by users and makes important contributions in this direction, was developed by Davis in 1989 based on the theory of reasoned behavior (Davis, Bagozzi, & Warshaw, 1989; Omar, 2009). Studies in the field of education gained momentum in the 2000s regarding this concept, which points to the adoption and use of technology by individuals (Teo, 2010). In these studies, it has been observed that the technology acceptance model is effective on the habits, behaviors and intentions of users to use technology (Tarcan, Varol, Kantarcı, & Fırlar, 2012; Ma, Andersson and Streith, 2005; Menzi, Nezih and Caliskan, 2012). In their quasi-experimental study, Tsai, Wang, and Lu (2011) underlined the positive effects of designing the learning environment according to this model.

The evolution of the current model in order to explain mobile technologies in the educational environment has revealed the mobile technologies acceptance model. Paturisi, Chisaki, Usagawa, and Lumenta (2015) studied the acceptance of mobile learning technologies by students at the higher education level in a study they conducted. Researchers conducting an experimental study conluded that the lack of Students' Acceptance of Mobile Learning Tools would affect the success of mobile learning. A similar study was conducted by Zakaria, Hanapi, Zakaria, and Ahmad in Malaysia in 2016. In that study, which was conducted with 36 students aged between 19 and 22, the researchers aimed to question the effect of a MALL environment on students' English vocabulary acquisition and acceptance of mobile technologies. At the end of the study, the researchers drew attention to the linear relationship between students' mobile technology acceptance and academic achievement and suggested investigating this variable. Similarly, Chen, Seilhamer, Sugar, and Mao (2013) stated that there is a need for further studies on the acceptance of mobile technologies by learners, while Özer and Kılıç (2017) stated that there is a need for research on the acceptance of mobile technologies in foreign language teaching.

Although there are various studies on designing and developing a MALL environment, there is a need for further studies to find out the variables that affect the learning environment and to examine how these variables affect learning and the learning environment. At this point, this research aimed to develop an effective MALL environment and to test the effectiveness of this environment. In this respect, the research questions were as it follows:

1) What are the expectations of the learners from a MALL application?

2) Taking the experimental group using MALL application and control group using web-based distance education environment into consideration;

a) Is there a significant difference between the academic achievement test post-test scores?

b) Is there a significant difference between the readiness scale post-test scores for mobile learning?

c) Is there a significant difference between the mobile learning tools acceptance scale post-test scores?

METHOD

In this study, the multi-stage mixed method design, which is one of the 6 different mixed method research designs defined by Creswell and Clark (2011), was used. According to Creswell and Clark (2011), the multi-stage mixed method design is used in research that spans a certain period of time and includes the stages of design, development and evaluation. In this context, first of all (phase 1), a needs

analysis was carried out using qualitative research methods and a MALL application was designed and developed based on the findings obtained from the qualitative data. In this part of the research, the ADDIE research model, which was framed by the steps of analysis, design, development, implementation and evaluation, was used. Afterwards, experimental research was conducted to examine the outputs of the (phase 1) design process. In this part, the independent variable of the study is MALL, and the dependent variables are readiness for mobile-assisted language learning, acceptance of mobile technology, and academic success.

Study Group

In the design process of the mobile application, the study group, determined using the purposive sampling method, consisted of 14 students enrolled in six different programs at Amasya University. In the determination of these students, their academic success in Foreign Language courses and their mobile application usage habits were taken into consideration. Equal in number of students below and above the academic achievement average participated to the study. Additionally, students who use mobile applications frequently and those who use them less were brought together in order to create a heterogeneous group.

The study group of the experimental research carried out for testing the effectiveness of the mobile application, developed by the researchers, consisted of a total of 61 students taking Foreign Language Education courses at Amasya University. These students participated into the study voluntarily and were visited upon the recommendation of the field expert working in the distance education center. The gender distribution of the research group in the experimental and control groups was given in Table 1.

Table 1. ***Distribution of the Study Group by Gender***

Groups	Female	Male	Total
Experimental	27 (84%)	5 (16%)	32 (52%)
Control	24 (83%)	5 (17%)	29 (48%)

Data Collection Instruments

A semi-structured interview form was used in order to conduct a needs analysis during the development phase of the MALL application. In the experimental process of the research, academic achievement test, acceptance scale of mobile learning tools and readiness scale for mobile learning were administered.

Interview Form: This form, which was prepared in accordance with the semi-structured interview technique that provides in-depth information on a subject, is advantageous in asking further questions for some unclear answers and thus making the situation more explanatory (Çepni, 2007). A semi-structured interview form consisting of seven questions under two main headings was prepared in order to get the opinions of the learners about the MALL application by taking the opinions of the field experts. Examples of interview questions: What information would you like to learn from a mobile application developed for teaching vocabulary in the context of learning English as a foreign language? Why? How would you like to learn the content? Why? What motivates you in such an application? such questions were asked.

Academic Achievement Test: In order to measure the effect of MALL application on students' academic achievement, it was prepared as 33 items in line with the opinions of field experts and its validity and reliability were tested. For the reliability studies of the test, a pilot study was conducted with 358 students who were studying at Amasya University, were in the same units as the experimental and control groups of the study, and had taken Foreign Language courses before. In the pilot study, when the reliability analysis was performed after the items with low validity and reliability were removed, the KR-20 reliability coefficient was found to be 0.94 and the average difficulty index was 0.48. The finalized test was 100 full points and applied to the experimental and control groups as a pre-test and post-test.

Mobile Learning Tools Acceptance Scale (MLTAS): This scale consists of items targeting to determine the students' acceptance level of mobile learning tools. This scale, developed by Özer and Kılıç (2017), consists of 19 items in 4 factors. Cronbach's Alpha reliability coefficient for the whole scale was calculated as .83 and it was found to be reliable.

Mobile Learning Readiness Scale (MLRS): This scale, developed by Lin, Lin, Yeh, and Wang (2016), was adapted into Turkish by Gökçearslan, Solmaz, and Kukul (2017) who also conducted validity and reliability studies of the scale. The Cronbach's Alpha coefficient of this tool was calculated as .95 and was found to be highly reliable. The scale consisted of three factors and 17 items in total.

Designing and Developing MALL Application (PHASE I)

The data obtained as a result of the needs analysis research administered with the learners formed the basis for the development of the application. The data obtained from the needs analysis can be summarized as follows:

As a result of the needs analysis, it was found that the students wanted to learn words that could help them improve their speaking skills rather than English grammar. In this regard, they need the knowledge of the pronunciation and usage of the words, categorized according to themes and mainly encountered in daily life. They want this knowledge to be presented in a collaborative learning environment that allows interaction with other learners who will use the app. Another point underlined by the participants is the necessity of an environment that allows each individual to construct their own unique knowledge, that is, is adaptable to individual differences thanks to its using both visual and auditory elements. They also stated that it is important for this application to predict each learner's background knowledge and level of language proficiency and to present a content appropriate to each student's level of language proficiency. Students additionally mentioned that there should be some education games in the application. They stated that the competitive atmosphere in games was the most important factor that would increase their motivation towards language learning. In addition, they expect the application to send notifications at regular intervals, which would help them to reinforce their learning. However, the participants underlined that the high frequency of notifications would increase the cognitive load and negatively affect the use of the application. The learners expressed their needs for instant technical support within the application in order to cope with the technical problems they may encounter in the mobile learning environment.

The word pool, to be taught in the mobile application, was created after the interview, conducted with two field experts on Foreign Language Education. The words in the pool were categorized by themes. Appropriate sample sentence patterns were created for the words to be taught by paying attention to in-context learning. Questions were prepared in order to provide feedback to learners using the application and for the various in-app competitions. As a result of the preliminary study, 104 words were selected from 386 words in seven categories. After finding out the expectations and suggestions, the development process of the mobile application, which will be developed in accordance with these expectations and suggestions, has been started. Defining more broadly, an application was designed via which students can learn English words, assess their improvements, receive daily notifications for revising the newly-acquired vocabularies, interact with the other language learners in a competitive atmosphere.

First of all, it is aimed to develop a hybrid application so that the mobile application to be developed will work on all mobile devices. Thus, it was ensured that the application could be used on any mobile platform without being dependent on the operating systems of the mobile devices used by the students. In order for students to download and use the mobile application on their phones, the application was placed in the application markets with the name "Word Land".

As seen in Figure 1, the main menu of the "World Land" application, is as it follows: "I'm Learning Words", "Assessing Myself", "Word Challenge", "My Daily Tasks", "Tournament", "Clipboard", "Settings and Help" and "Learner of the Week".

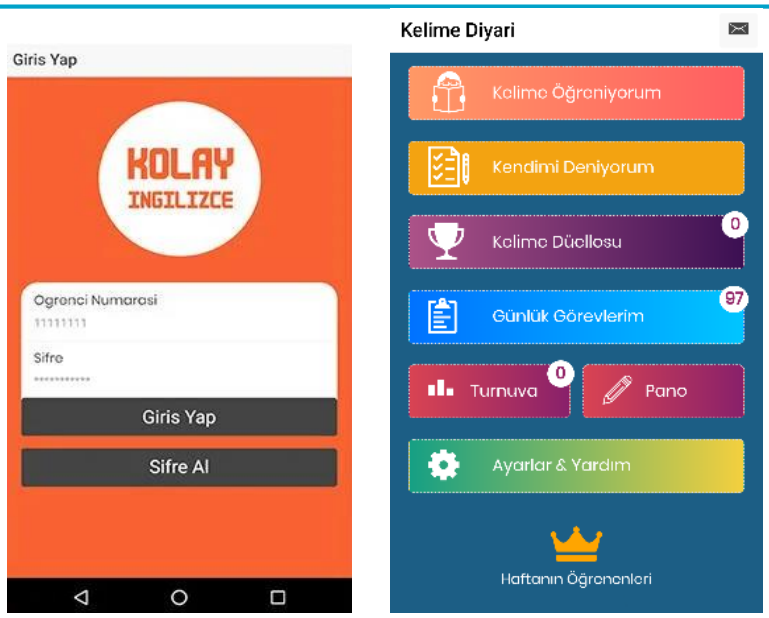

Figure 1. *An overview of "Kelime Diyarı" app menus*

"I'm Learning Words" menu: It is a menu that allows students to access and learn categorized words. When the students choose the category, they want to learn, the words grouped in that category are presented to the students in a random order. Each word, with its dictionary meaning, pronunciation and sample sentence informing about the usage, is placed in an ergonomically designed menu. In order to support contextualized learning, the sample sentences informing about the usage of the target word is placed just below the dictionary meaning. The following figure shows the general view of this menu.

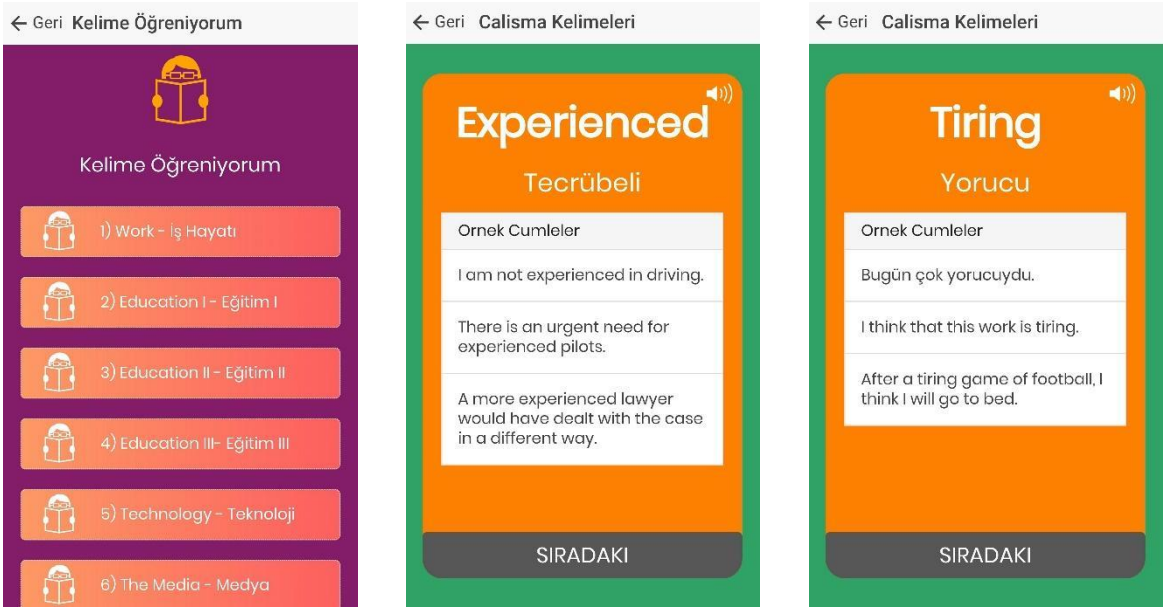

Figure 2. *"Kelime Diyarı" application, "I'm Learning Words" menu*

"Assessing Myself" menu: It is designed as a menu where students can test their knowledge or what they have learned. Exams that are open to access are highlighted with a check mark, and those that are not yet open to access are highlighted with a lock icon. At the end of the exam, a screen is displayed informing the student about how many correct and how many wrong answers they have. The questions asked in the exams are planned in the form of audio questions and multiple-choice questions. In multiple-choice questions, a selection animation is executed for the option chosen by the student and a check mark is placed next to the selected answer, making the answer option clearer. Voice questions, on the other

hand, have a play button and a text box where students can specify their answers. Students can listen to the audio question by pressing the play button as many times as they want. This menu is shown in Figure 3.

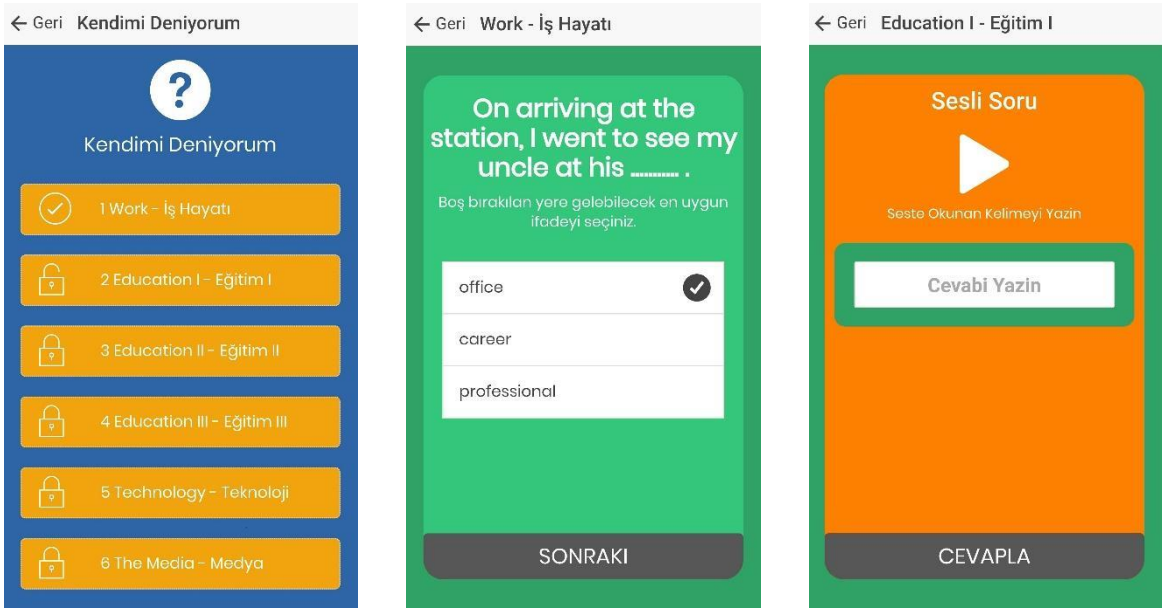

Figure 3. *"Kelime Diyarı" application "Assessing Myself" menu*

"Word Challenge" menu: It is designed as an educational game menu that allows students to interact with other students competitively. When the student presses the challenge button, the program randomly matches the student with another student who has started the learning activity, regardless of whether he is online at the moment. In order to ensure that students match up with different students, this random matching is planned in such a way that two students paired in the last 24 hours will not be paired again. When students decide to challenge and are matched with another student, a screen that shows who they are matched with pops up and then they see a quiz randomly generated by the program on their screens. The student who gives the most correct answers to the questions wins. Students can see the current score table and their own ranking in this table, together with the points they have earned, by clicking the "Score Status" button in the "Word Challenge" menu. The quiz consists of 5 questions randomly drawn from the question pool, from which both students started to learn using the "I'm Learning Words". Thus, it is ensured that the vocabulary items in the quiz are the intersection set of the words that both students have already started to learn. The questions are in the form of multiple choice and audio questions. Students must finish the exam within 6 hours to respond to the challenge started by the other learner. Otherwise, they lose the duel. The program reminds the students of the duels that are not answered within the 6-hour period by sending a notification "Hurry up, time is running out" when 10 minutes remain. After the students finish the exam, the winner is determined by the program and the scores are sent to both students.

"My daily Tasks" menu: This menu is used for reminding the students of the words they have learned at certain time intervals, in order to spread the learning over time and to increase the effectiveness in the learning. The program defines the words to be reminded the student and the frequency of reminders of these words with the help of the data obtained from the "I'm learning Words" menu and "Assessing Myself" menu. The number of the remaining words that students need to review on that day is displayed to students through a counter placed in the corner of the daily tasks button in the main menu.

"Tournament" menu: It is designed as a different tool in addition to "Word Challenge" menu in order to meet the expectations of the students for competition, interaction and educational game. In the "Word Challenge" menu, two students play with each other, while in the "Tournament" menu, the game is between all students. By using the management menu, the system administrator plans the name of the

tournament, its duration, the number of the questions to be included in the tournament, the type of the questions to be asked, and how long the tournament should remain open to students. Figure 4 below is an example of the "Tournament" menu.

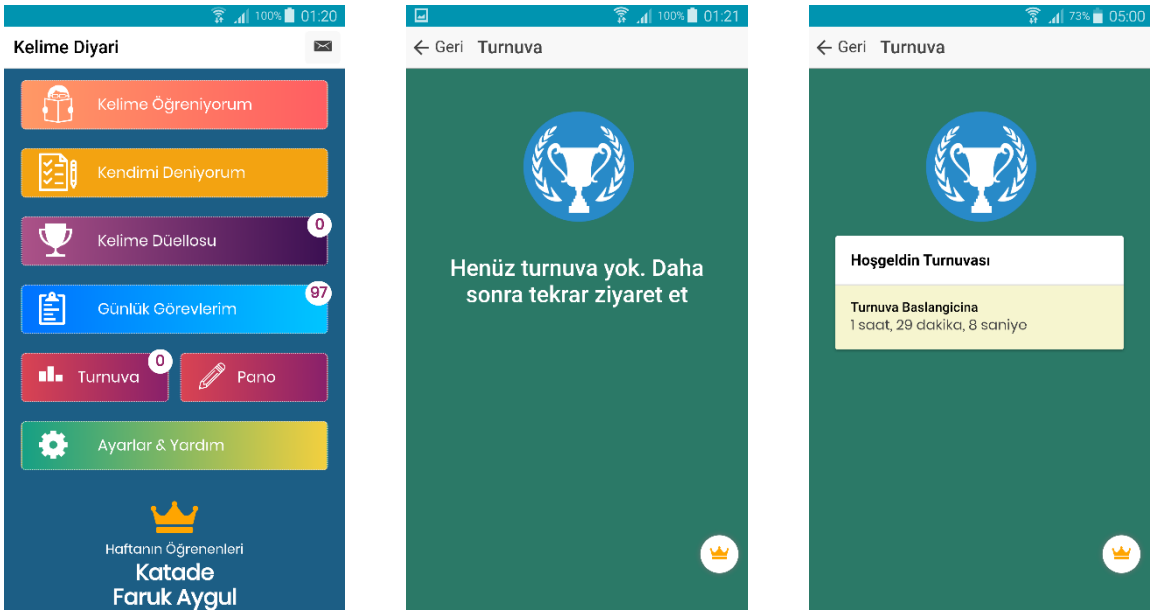

Figure 4. *"Kelime Diyarı" application "Tournament" menu*

"Clipboard" menu: It is designed as a menu that allows students to contribute to the program content themselves. In this menu, students can write sample sentences about the words they have learned and post those sentences via a board on the application. The most liked post by the students is determined as the sentence of the week. The post, which is the sentence of the week, is highlighted with a "Crown" icon and a different background color and pinned to the top of the board. The post, which is the sentence of the week, provides the owner with some additional points to become the learner of the week.

"Settings and Help" menu: It is designed as a menu that allows students to adjust some features of the program according to themselves and to request help in any problem they encounter in the program, thus enabling them to use the program in the most effective way.

After the program was made operational with all its features, it was published under the name "Kelime Diyarı" in the application markets in order to provide access to the students. Brochures were designed to introduce the program to students. The use of the menus and their functions are briefly mentioned in the brochure. Thus, it is aimed to prevent the demotivation of students as a result of the any confusion that may occur while learning to use a new program.

Web Based Distance Education Environment

A learning management system is used to provide a distance education environment. In this system, students can follow both their progress in the courses they are responsible for and the course curriculum. There is no restricted time for reaching the content of the course. The student can access the course content, available both as a video and written document, by selecting which week's content they want to view. In the lecture menu of the distance education environment, students can find the relevant courses videos, recorded in the studio environment, and the content in those videos was presented and taught by the responsible instructor of the course. The student can not only watch these records, but also have access to additional course resources prepared by the lecturer responsible for the course. The English vocabulary content presented to the students in this environment is in line with the content presented in the MALL environment. In the experimental part of the study, the students in the control group used this platform.

Figure 5. *Distance Education Environment Lecture Menu*

Experimental Research Process for the MALL Application (PHASE II)

Experimental research was carried out in order to teach English words in a mobile-assisted language teaching environment and in a distance education environment. Those words were in parallel with the English as Foreign Language lessons of the students. The implementation period of the experimental design was planned to be four weeks, and in this process, there were homogeneously formed two groups, the experimental and the control group. While the control group learned English words through the web-based distance education system, which they had to follow as a part of the foreign language course they were attending; the experimental group used the mobile application developed in addition to this system.

The experimental group students were introduced to the "Kelime Diyarı" application and they were motivated to use the application. The control group students were instructed to follow the distance education environment on a regular basis.

Academic achievement test, mobile learning technologies acceptance scale and mobile learning readiness scale pre-test and post-test were administered to the experimental and control groups.

RESULTS

Data analysis

In the study, content analysis method was used in the analysis of qualitative data collected via semi-structured interview forms. The data set formed by listening to the audio recordings and the notes taken during the interview were grouped according to the themes and content analysis was made with the NVivo program.

In addition, SPSS program was used in the analysis of the data obtained from the Academic Achievement Test, Mobile Learning Tools Acceptance Scale and Mobile Learning Readiness Scale. When the normal distribution characteristics of the data sets were examined, it was seen that they showed normal distribution according to the Shapiro-Wilk test. Accordingly, it was understood that the data showed normal distribution, and parametric tests were preferred for the analysis of the data (Büyüköztürk et al., 2017).

Paired Sample t-Test was used to examine the difference between the in-group pre-test and post-test scores of the experimental and control groups. Independent Sample t-Test was applied to examine the difference between the pretest and posttest scores of the experimental and control groups.

In order to determine whether the Experimental and Control groups were homogenous in terms of the variables (Academic success, Acceptance of Mobile Learning Tools and Readiness for Mobile Learning) measured before the experimental process, a pre-test was applied to the groups before the experimental process and the results were compared. According to the results of the independent sample

t-test, it was observed that the experimental and control groups were homogeneous in terms of the measured variables (p>0.05).

According to the analyses made after the experimental process

a) An independent sample t-test was conducted to find out if there is a significant difference between the groups in the academic achievement test post-test scores. Table 2 shows the analysis results.

Table 2. *The Effect of MALL environment on Academic Achievement*

Academic Achievement post-test	N	$\bar{X}$	SS	Sd	t	p
Experimental group	32	44,13	18,91	55,92	2,41	,019
Control group	29	34,07	13,42			

At the end of the experimental period, when the post-test results of the academic achievement test applied to the experimental and control groups were examined; there was a difference between the mean score of post-test of the experimental group (=44,13, ss=18,91) and the mean score of the post-test of the control group (=34,07, ss=13,42). According to the results of the independent sample t-test administered for the analysis of the data, this difference is statistically significant in favor of the experimental group (t(55.92) =2.41; p<0.05).

b) The results of the independent sample t-test, conducted to find out if there is a significant difference between post-test scores of the Readiness for Mobile Learning Scale are given in Table 3.

Table 3: *The Effect of MALL environment on Readiness for Mobile Learning*

Sub-dimensions of the Scale		N	$\bar{X}$	SS	Sd	t	p
Self-sufficiency	Experimental Group	32	4,04	0,62	59	,334	,740
	Control Group	29	3,99	0,47			
Optimism	Experimental Group	32	3,93	0,70	59	,725	,471
	Control Group	29	3,81	0,52			
Self-regulated learning	Experimental Group	32	3,85	0,59	59	,339	,691
	Control Group	29	3,78	0,72			
Scale Overall	Experimental Group	32	3,94	0,50	59	,644	,522
	Control Group	29	3,86	0,42			

The results of the Mobile Learning Readiness Scale post-test administered to both the control and the experimental groups at the end of the experimental process are shown in Table 3. When the table is examined, although the means of the experimental group are higher than the means of the control group both in the sub-dimensions and in the overall scale, there is no statistically significant difference according to the results of the independent sample t-test. According to the overall scale, the mean of the experimental group was =3.94, while the mean of the control group was 3.86. The difference between them is not statistically significant (t(59)=0.644; p>0.05)

c) The results showing if there is a significant difference between the post-test scores regarding Mobile Learning Tools Acceptance Scale are given in Table 4.

Table 4: *The Effect of MALL environment on Mobile Learning Tools Acceptance*

Sub-dimensions of the Scale		N	$\bar{X}$	SS	Sd	t	p
Mobile Willingness	Experimental Group	32	3,78	0,69	59	-,210	0,835
	Control Group	29	3,81	0,46			
Perceived usefulness	Experimental Group	32	3,93	0,63	59	0,976	0,333
	Control Group	29	3,78	0,52			
Contribution to Foreign Language Learning	Experimental Group	32	3,79	0,56	59	1,60	0,114
	Control Group	29	3,57	0,51			
Negative Perception	Experimental Group	32	2,69	0,61	59	-,058	0,954
	Control Group	29	2,70	0,70			
Scale Overall	Experimental Group	32	3,55	0,40	59	,650	0,392
	Control Group	29	3,47	0,33			

The results of the Mobile Learning Tools Acceptance Scale post-test, administered to control and experimental groups at the end of the experimental process are shown in Table 4. As can be seen from the data obtained from the independent sample t-test, there are no statistically significant differences between the groups. When the overall scale was examined, a difference was observed between the post-test scores in favor of the experimental group (Experimental=3,55; Control=3,47). As it is understood from the results of the independent sample t-test administered to find out if this difference is significant or not, this difference was not statistically significant ($t(59)=0.65$; $p>0.05$). When the sub-factors are examined, it is remarkable that only the experimental group's results in the mobile willingness sub-factor (Experimental=3,78) were lower than the control group results (Control=3,81). However, this difference was not statistically significant. ($t(59)=-.21$; $p>0.05$).

DISCUSSION

Students' Expectations for MALL

As a result of the interviews conducted during the development of MALL application, most of the students think that their English vocabulary knowledge affects their academic success in foreign language courses, which is one of the compulsory common subjects at the higher education level. In this respect, learners mostly wanted to improve their speaking skills in English and they wanted to learn words that they may encounter frequently in daily language. They found it important to learn words in context. That is, it is important for learners to know how words are used in sentences. According to the relevant literature, the use of educational games is a method preferred by most of the learners in in this regard. For example, Ishaq et al. (2021) analyzed 67 studies selected based on inclusion criteria from a pool of 53,467 works. They stated that gamification is used in language education to make learning more enjoyable and engaging and to achieve high learning outcomes.

In addition, the learning environment's capability to address individual differences and to support interaction and communication between users are among the expectations of the learners because learners think that these factors will make learning English vocabulary fun. As mentioned in the related literature, these expectations of the learners are inherently found in MALL environment. In that, MALL environment can address individual needs and enable social learning by providing multi-way interaction thanks to the communication opportunities it offers (Shadiev, Liu & Cheng, 2023; Assapari, & Hidayati, 2023). EFL speaking student readiness to use mobile-assisted language learning. These facts make MALL environment fun and interesting. The students believe that MALL environment will increase their

motivation towards learning, make learning more effective and permanent. In their study, Kurt and Bensen (2017) found that MDQ practice increased students' motivation. When the literature is examined, it is possible to come across studies stating that MALL environment affects the permanence of learning in a positive way (Kadri, 2024; Bakay, 2017; Wardak, 2020).

Moreover, according to the majority of the learners, it is seen that it is important to encourage competition in the learning environment. All of the participants expected that the MALL application, which they will use for learning vocabulary, will support collaborative learning by providing interaction between users. Hsieh and Tsai (2023), who emphasized the importance of collaboration in MALL environments, also stated that among the learning methods offered in MALL, collaborative learning methods are more preferred by students. Although smartphones have been integrated into our daily lives, the majority of learners need a platform where they can get technical support in a mobile application that they will use for learning English vocabulary. Because they think that the technical problems encountered during the use of the applications remain unresolved or the delay in the solution will adversely affect the continuity of the use of the application. Another justification for the need for a technical assistance menu is that the problems encountered in practice prevent learners' cognitive load from increasing. It is seen that most of the participants do not integrate smart phones in the language learning process of, and they use these devices mostly for connecting social media and accessing the Internet. This situation can be explained by the lack of mobile learning applications and the relevant content or the lack of awareness.

The Effect of MALL Environment on Students' Academic Achievement in English Vocabulary Learning

When the academic achievement test post-test scores of the experimental group and control group were compared; it is found out that the mean score of the experimental group was =44.13 and the control group =34.07. When these post-test scores, which show an increase according to the pre-test results, were examined, it was determined that the increase in the academic achievement of the experimental group was higher than that of the control group, and this increase was statistically significant ($t(55.92) = 2.41$; $p<0.05$). In this case, it can be said that MALL has a more positive effect on academic achievement than WBL. In an experimental study conducted in China, Chen, Jia and Li (2021) also concluded that MALL environment is more effective than other learning environments. In the current study, researchers who examined the effectiveness of traditional learning environment, MALL and WBL environments, measured the students' success in learning English vocabulary in these learning environments. Researchers who observed that WBL increased student achievement compared to the traditional learning environment (Liu, 2016) stated that the most successful learning took place in MALL. The researchers explained that MALL environment was more effective than WBL environment just because of the fact that MALL environment was more successful in engaging students in the learning environment. Researchers mentioned that by helping students to gain autonomy, MALL environment provides an easier way to access to the course content and a more comfortable learning atmosphere. They also emphasized the importance of design factors regarding the content and the learning activities in the success of a MALL environment (Chen, Jia & Li, 2021; Hayati, Jalilifar & Mashhadi, 2013; Wu, 2014)

According to the findings obtained as a result of the experimental process, it was observed that the academic success of the students in the experimental group increased more than the academic success of the students in the web-based learning environment. In this case, it can be concluded that the MALL application is more effective and efficient than the WBL environment in teaching English vocabulary. When the literature is examined, many studies supporting these findings have been found (Makoe & Shandu, 2018; Alemi, Sarab & Lari, 2012; Zakaria et al., 2016;)

The Effect of MALL Environment on Students' Acceptance of Mobile Learning Technologies and Readiness for Mobile Learning

At the end of the experimental process of the research, although the means of the students in the experimental group, that is, the students who took the course via MALL environment, were high, no statistically significant difference was observed between the experimental and control group students in terms of readiness for mobile learning. These results can be explained by the fact that the control group students were not exposed to mobile learning technologies in the experimental process. Obtaining these results from the experimental group students who used mobile learning technologies throughout the experimental process indicates that being familiar with mobile technologies and using mobile technologies for educational purposes do not affect readiness. Similarly, Habib et al. (2022), in a study examining the readiness of students in colleges and universities in India for Mobile Assisted Language Learning (MALL) technologies, collected data from 581 students through surveys. They found that while many university students extensively use mobile technologies in their daily lives and are familiar with them, there is no significant relationship between familiarity with mobile technologies and their readiness for online learning.

In this study, it is estimated that the high level of readiness has an effect on the academic success of the experimental group. Krasulia and Saks (2020), researchers working with EFLlearners among 1st-year students in the Germanic Philology Department at Sumy State University, Ukraine, highlighted readiness as a crucial element of MALL. Suwantarathip and Orawiwatnakul (2015) postulated similar findings. In the study, the researchers observed the effectiveness of MALL environment at the end of the 7-week experimental period and they also examined the readiness of the students. Researchers stated that students who feel ready to use mobile learning technologies are more successful in the MALL environment. They estimated that this readiness allows the student to focus on the course content rather than the technological tool, which increases success.

Assapari and Hidayati (2023) conducted a study investigating the relationship between MALL and students' readiness at the higher education level. The study, conducted over one academic term, revealed that students did not exhibit a negative attitude toward the use of mobile technologies in their foreign language learning processes. The researchers also highlighted that students tended to use mobile technologies even when such tools were not explicitly provided to them.

Another finding of the study is that no significant difference was observed in the acceptance of mobile learning tools by the experimental and control group students at the end of the experimental process. In this respect, there may be various reasons that affect students' acceptance of mobile learning (Kim, Rueckert, Kim, & Seo, 2013). In the same vein, Dolawattha, Salinda Premadasa, and Jayaweera (2018) mentioned that the factors affecting students' acceptance of mobile learning include usefulness, interactivity, motivation, perception, facilitating environmental factors, and ease of use, and the most important factor among them is interactivity. Similarly, in a study conducted by Hoi (2020) investigated the factors affecting university students' use of mobile technologies for educational purposes. Performance expectation, the effect of facilitating condition, social influence are among the determining factors, while effort expectancy is not determining factor.

CONCLUSION AND RECOMMENDATIONS

The results obtained as a result of the research are as follows:

• Students want MALL applications to offer educational games supporting competition.

• They want MALL applications to offer both collaborative and individualized learning and to foster interaction and communication.

• Although they want MALL applications to support their learning by sending notifications and reminders, they especially mention that the frequency of those notifications should not be exaggerated.

• They stated that a MALL application developed based on their needs would increase their motivation and willingness to learn English vocabulary.

• The MALL application developed based on students' expectations increased the learners' English vocabulary learning success more than the web-based learning environment.

• It has been found out that the developed MALL application does not have a significant effect on the students' readiness for mobile technologies.

• It has been found out that MALL application has no significant effect on students' acceptance of mobile technologies.

Suggestions

• "Kelime Diyarı", the application, can be used alone to enhance students' language skills and vocabulary learning processes, or it can also be used as a tool to support their WBL.

• The effect of MALL applications on different variables can be examined.

• This study was conducted with students at higher education level. Studies can be carried out on the effectiveness of MALL at different education levels and in adult education.

• There is a need for similar studies to be conducted by gathering both qualitative and quantitative data from more participants participated in a longer experiment.

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Evaluation of Faculty of Health Sciences Students, Perspectives on Art

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ABSTRACT

This research aimed to determine the perspectives of health sciences faculty students regarding art. In this context, data was collected through a survey from 393 students in different departments studying at Necmettin Erbakan University Nezahat Keleşoğlu Faculty of Health Sciences in the 2023-2024 academic year. Participants: It was observed that 86.8% were women, 34.6% were sophomores, 28.8% were students of the Department of Nutrition and Dietetics, and 46.8% were not interested in any branch of art. The two statements with which the participants agreed at the highest level were "I like going to the movies" (4.32±.74) and "I believe that works of art evoke good feelings in people" (4.24±.73), respectively. The two statements with the lowest arithmetic mean in the scale were determined as "I would love to see myself as a famous artist in the future" and "I dream of my artistic works being exhibited in a museum or gallery one day," respectively. It is seen that the arithmetic mean and standard deviation of the scale total score are 3.80±.55. No significant relationship was found between students' attitudes towards art and gender, age, department, and class. The overall average of the scale with the sub-dimensions "valuing art education," "necessity of art," and "personal artistic tendency" is higher for participants who are interested in art than those who are not interested. In line with the research results, it can be recommended to support students' participation in artistic activities and increase such activities in schools.

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INTRODUCTION

Artistic activities are important works that enable individuals to express their emotions in aesthetic ways. Expressing oneself in creative ways and engaging in artistic production by engaging in any field of art also has positive effects in terms of psychological well-being. As Maslow includes in his hierarchy of basic needs, making an aesthetic and original production in a field is an important need that supports one's development. Engaging in creativity and artistic activities can help improve adaptive flexibility, support psychological well-being, and protect mental and spiritual health while increasing the individual's ability to respond to the increasing complexities of society (Lawrence et. al., 2015). The American Art Therapy Association also argues that through art, the individual's level of awareness can increase and the ability to cope with stress and traumatic experiences can improve (Quoted in Dempsey, 2023). In this respect, providing educational content that supports individuals' perspectives on art in their educational lives can motivate individuals to participate in art-related activities. As a matter of fact, providing opportunities for students to reveal their creativity and supporting them to develop positive attitudes towards art during the higher education process, which is one of the educational periods that support the development of individuals, is important in terms of both their ability to spend their education process more efficiently and their personal development (Jackson, 2004). In this context, students' having a positive perspective on art and being interested in a branch of art that suits their interests and abilities and the advancements in their artistic perspectives can contribute to their academic studies throughout their educational process in higher education, as science and art are disciplines that support each other. Additionally, advances in their artistic perspectives may enable them to develop a more innovative understanding (Yılmaz-Gündüz & Gürlen, 2023) Research results showing that the implementation of art-based programs in businesses can improve the creative abilities of employees and encourage innovation also support this inference (An & Youn, 2018). In addition to all these, students' having a positive perspective towards art during higher education can enable them to use their free time productively and have the opportunity to develop themselves in an artistic field.

Higher education institutions offering programs in health sciences train professionals in a range of disciplines, including child development, nutrition and dietetics, occupational therapy, physiotherapy and rehabilitation, and audiometry. Students graduating from these faculties undertake important professional roles in protecting and improving the health of individuals. He constantly carries out vital work whose subject is human, both during his professional practices at the university and throughout his professional life. The health sector is a work area where employees may experience emotional exhaustion due to both intense working hours and the special disease-related condition of the group they serve. There are also study results in the literature showing that engaging in an artistic activity for individuals working in the field of health can positively affect their work performance and mental health (nurse: Karpavičiūtė & Macijauskienė, 2016; nurses and mental health professionals: Gilliam, 2018; health professionals: Depret et al., 2019; medical school students: Karagöz et al., 2020). Considering these findings, it was chosen as the subject of this study, considering that it is important to examine the perspectives of health sciences faculty students towards art, starting from the period of their higher education. In the literature, different professional groups (preschool teachers, lecturers, teacher physicians, and student groups) have examined the perspectives on art, but no study has been found that evaluates the perspectives of health sciences faculty students on art (Shapiro & Stein, 2005; Ayaydın et al., 2018; Ülger, 2018; Chen et al., 2022; Polat et al., 2022; Fahy, 2023; van Woezik et al., 2023). It is thought that this study will contribute to filling this gap in the literature. In the light of this information, answers to the following questions will be sought within the scope of the study.

1. How are the students of the Faculty of Health Sciences interested in art?

2. What is the perspective of Faculty of Health Sciences students towards art?

3. Do the attitudes of Faculty of Health Sciences students towards art differ significantly according to the variables of age, gender, class, department, and interest in art?

METHOD

Research design

The research is a descriptive type of quantitative cross-sectional study.

Research Sample

The research population consists of all 1547 students studying at Necmettin Erbakan University Nezahat Keleşoğlu Faculty of Health Sciences. The sample size to represent the universe was obtained by calculating with the formula n=Nt2pq/d2 (N-1)+t2pq. The values in the formula were taken as t= 1.96, p= 0.5, q= 0.5, d= 0.05 (Erkuş, 2021) and the sample size was calculated as 308. 393 students were reached by easy sampling method.

Research Instruments and Processes

In the study, a personal information form prepared by the researchers was used to collect personal information about the participating students. The personal information form includes four questions regarding the participants' age, gender, interest in art, class they attend, and department information.

Attitude Scale to Reveal Students' Perspectives on Art

In order to reveal the students' perspectives on art at the Faculty of Health Sciences, the Attitude Scale for Revealing Students' Perspectives on Art, developed by Dede (2016) and whose validity and reliability were determined on high school students, was used. After deciding to use the measurement tool in the study, permission was obtained from the scientist who developed it (Dede, 2016). The original version of the scale consists of 4 factors and 21 items. The first factor is called 'Necessity of Art', the second factor is 'Valuing Art Education', the third factor is 'Personal Artistic Tendency' and the fourth factor is 'Participating in Artistic Activities'. The scale includes a five-point Likert-type evaluation as "strongly disagree, disagree, undecided, agree, completely agree." Items 3, 8, and 9 on the scale are negative items. High scores from the scale indicate that the student's perspective towards art is positive. Cronbach's alpha coefficient of the measurement tool is stated as 0.894 (Dede, 2016). Since the validity and reliability study of the scale in the original study was conducted on a high school student sample, it was first evaluated whether the items in the measurement tool were suitable for the university student sample before use, and it was evaluated that the items in the scale were also suitable for university students. In this study, Cronbach's alpha coefficient was determined as 0.897.

Data Analysis

Data was collected between February 10-20, 2024. Necessary institutional permission was obtained from Nezahat Keleşoğlu Faculty of Health Sciences, where the data will be collected. The scales were applied to students who volunteered to participate in the research until the numbers determined in stratified sampling were reached. Arithmetic mean and standard deviation values were used to evaluate the data obtained. In determining the level of Health Sciences Faculty Students' Perspectives on Art, a criterion of low, medium and high was developed by dividing the four-point range into three, taking into account the fact that each item in the scale can be scored between 1 and 5 based on the scores they obtained from the Attitude Scale for Revealing Students' Perspectives on Art. Accordingly, items with mean scores between 1-2.33 were evaluated as low, items with mean scores between 2.34-3.67 were evaluated as medium, and items with mean scores between 3.68-5.00 were evaluated as high.

Ethic

This study received an Ethics Committee Approval Certificate from Necmettin Erbakan University Health Sciences Scientific Research Ethics Committee, dated 07/02/2024 and numbered 2024/678.

FINDINGS

The findings regarding the distribution of the students participating in the research according to age, gender, department and class variables are presented in Table 1.

Table 1. *Demographic information of participants (n=393)*

Variable		f	%
Gender	Female	341	86.8
	Male	52	13.2
Age	18	30	7.6
	19	81	20.6
	20	93	23.7
	21	89	22.6
	22	56	14.2
	23+	44	11.2
Department	Healthcare management	85	21.6
	Social work	99	25.2
	Nutrition and dietetics	113	28.8
	Physical therapy and rehabilitation	96	24.4
Class	1.class	79	20.1
	2. class	136	34.6
	3. class	106	27.0
	4. class	72	18.3

Examining Table 1, it is seen that the average age of the students participating in the research is 20.48±1.44. Participants: 86.8% (f = 341) are women, 34.6% are sophomores (f = 136), and 28.8% (f = 113) are students of the Department of Nutrition and Dietetics.

The first sub-problem of the research is "How are the students of the Faculty of Health Sciences interested in art?" Findings regarding revealing students' interest in art in answer to the question are presented in Table 2.

Table 2. *Participants' interest in art(n=393)*

Interests	f	%
I am not interested	184	46.8
Literature	45	11.5
Statue	1	0.3
Architectural	4	1.0
Music	79	20.1
Picture	54	13.7
Cinema	16	4.1
Theatre	10	2.5
Total	**393**	**100**

Examining Table 2, it is seen that 46.8% of the students participating in the research are not interested in any branch of art. The branches of art that students are most interested in are music (20.1%), painting (13.7%), and literature (11.5%), while the branch of art that they are least interested in is sculpture (0.3%).

The second sub-problem of the research is "What is the perspective of the students of the Faculty of Health Sciences towards art?" The findings obtained from the scale applied to reveal students' perspectives on art in answer to the question are presented in Table 3.

Table 3. *Arithmetic mean and standard deviation values for the participants' responses to the scale items*

Expression	Mean	Ss	Score rank	Level
1. I attend art education classes with great enthusiasm.	3.38	1.0	17	Middle
2. I would like the duration of art courses to be extended.	3.26	.92	19	Middle

3. I lose interest quickly in art classes.	3.63	.84	15	Middle
4. I enjoy being in environments where works of art are exhibited, such as galleries and museums.	3.98	.96	9	High
5. I like going to the cinema.	4.32	.74	1	High
6. I enjoy chatting about artistic topics.	3.71	.90	14	High
7. Art is something necessary for everyone.	3.88	.96	12	High
8. I prefer not to do artistic work because I feel incompetent.	3.30	1.15	19	Middle
9. Concerts are boring to me.	4.18	1.03	4	High
10. I think intelligent people have an artistic side.	3.61	1.02	16	Middle
11. I think that our creativity will develop through art.	4.17	.84	5	High
12. I believe that works of art evoke good emotions in people.	4.24	.73	2	High
13. I see art as an area where I can express myself freely.	3.94	.81	11	High
14. I think that art has a great contribution to the development of humanity.	4.11	.74	6	High
15. I think that an individual who is interested in art will gain sensitivity towards his environment.	4.02	.78	7	High
16. I think I can express myself better through artistic works.	3.71	.88	13	High
17. I think that art is not given the necessary importance in our society.	4.00	.88	8	High
18.Art is a part of our cultural values.	4.23	.65	3	High
19. I dream of one day exhibiting my artistic works in a museum or gallery.	3.09	1.06	20	Middle
20. I believe that the development levels of societies will increase in direct proportion to the value they attach to art.	3.96	.84	10	High
21. I would love to see myself as a famous artist in the future.	3.02	1.1	21	Middle
Total	**3.80**	**.55**		

Examining Table 3, it is seen that the arithmetic means of the items in the scale regarding students' attitudes towards art vary between 3.02 and 4.32. The two statements with which the participants agreed at the highest level were "I like going to the movies" (4.32±.74) and "I believe that works of art evoke good feelings in people" (4.24±.73), respectively. The two statements with the lowest arithmetic mean in the scale were determined as "I would love to see myself as a famous artist in the future" and "I dream of my artistic works being exhibited in a museum or gallery one day," respectively. It is seen that the arithmetic mean and standard deviation of the total score are 3.80±.55. The arithmetic mean values of seven items in the scale revealed that the perspective on art regarding the relevant items was at a medium level, and the arithmetic average values of 14 items revealed that the perspective on art regarding the relevant items was at a high level.

The third sub-problem of the research is "Do the attitudes of Faculty of Health Sciences students towards art differ significantly according to the variables of gender, age, class, department, and interest in art?" The findings obtained from the analysis results in answer to the question are presented in Table 4. (Findings for variables for which no significant difference was observed are presented as text).

Table 4. *T test results regarding art interest status*

Variable		Necessity of art	Valuing arts education	Personal artistic inclination	Participating in artistic events	Overall scale average
		$\bar{x}$±sd	$\bar{x}$±sd	$\bar{x}$±sd	$\bar{x}$±sd	$\bar{x}$±sd
Interest in Art	Yes	3.58±.76	3.68±.62	4.13±.45	4.27±.70	4.01±.42
	No	3.18±.74	3.14±.58	3.87±.53	4.26±.70	3.71±.44
	TS	t=4.924 p=.000	t=8.764 p=.000	t= 5.177 p=.000	t= .070 p=.944	t=6.852 p=.000
Gender	Male	3.48±.79	3.47±.68	3.96±.47	4.10±.77	3.84±.43
	Female	3.39±.77	3.43±.66	4.01±.50	4.28±.68	3.88±.46
	TS	t=.703 p=483	t=.399 p=.690	t=-.647 p=.518	t=-1.646 p=.101	t=-.510 p=.610
Department	Healthcare management	3.41±.78	3.44±.60	4.02±.58	4.20±.76	3.88±.48
	Social work	3.39±.80	3.48±.71	4.04±.52	4.24±.76	3.90±.49
	Nutrition and dietetics	3.34±.88	3.32±.74	3.86±.66	4.26±.61	3.75±.58

	Physical therapy and rehabilitation	3.31±.75	3.38±.64	3.95±.54	4.26±.72	3.82±.49
	TS	F=.343 p=.794	F=1.015 p=.386	F=1.956 p=.120	F=.131 p=941	F=1.756 p=.155
Class	1.class	3.35±.77	3.46±.59	3.99±.45	4.22±.75	3.85±.40
	2.class	3.32±.81	3.41±.60	3.96±.55	4.28±.72	3.83±.48
	3.class	3.39±.82	3.40±.77	3.93±.57	4.26±.64	3.81±.54
	4.class	3.43±.84	3.35±.80	3.99±.78	4.18±.72	3.84±.66
	TS	F=.366 p=.778	F=.332 p=.802	F=.222 p=.881	F=.381 p=.767	F=.086 p=.968
Age	18	3.45±.80	3.53±.55	3.86±.43	4.11±.88	3.79±.41
	19	3.27±.77	3.37±.60	3.95±.51	4.36±.69	3.82±.45
	20	3.31±.84	3.31±.66	3.93±.60	4.25±.65	3.79±.53
	21	3.52±.80	3.41±.82	4.02±.56	4.23±.71	3.89±.52
	22	3.28±.81	3.42±.58	4.10±.53	4.16±.74	3.90±.45
	23+	3.37±.86	3.54±.77	3.82±.83	4.24±.67	3.78±.72
	TS	F=1.139 p=.315	F=.681 p=.822	F=1.104 p=.348	F=.948 p=.517	F=.890 p=.587

TS=test statistic

No significant difference was detected between students' attitudes towards art and gender, age, department, and class (p >.05 for all four variables). The attitudes of students who are interested in art and those who are not interested in art differ significantly towards art. Accordingly, the overall average of the scale with the sub-dimensions of "necessity of art," "valuing art education," and "personal artistic tendency" of the participants who are interested in art is higher than the participants who are not interested.

DISCUSSION, CONCLUSION, RECOMMENDATIONS

In this study, which was conducted to determine the perspectives of health sciences faculty students on art, the findings regarding their interest in art revealed that approximately half of the students (46.8%) were not interested in any branch of art. There are different numerical rates in the literature regarding university students' interest in art. In a study conducted with students in the classroom teaching department, it was found that only 16.59% of the students were not interested in art (Baysal & Dıvrak, 2020). In another study conducted with tourism faculty students, it was determined that 68.3% of the students were not interested in art (Unur & Şeker, 2016). According to the results we obtained in our study, the rate of interest in art among health sciences faculty students is higher than that of tourism faculty students and lower than that of classroom teaching students. It may be suggested that students in health sciences faculties should be directed to art, taking into account the existing literature information on the contributions of art engagement in their professional lives.

Research findings have shown that the two branches of art that students interested in art are most interested in are music and painting, respectively. The least interested branches of art are sculpture and architecture. Similar to our study, in the 10 Art Branches Most Preferred by Young People in Turkey Research conducted by the Turkish Youth Foundation in 2018, music (42.6%) and painting (16.4%) were in the first two places among the most preferred branches of art. Sculpture and architecture are not included in the ranking (URL 1). When it comes to art, the first branches of art that come to mind in society are painting and music, but artistic production should not be restricted to only the visual and auditory fields (Törün Oruç, 2023), and students should be directed to fields such as literature, theater, architecture, and sculpture, and students should be provided with the opportunity to express themselves in these fields. It is thought to be useful.

The research results revealed that the positive attitudes of health sciences faculty students towards art as a whole were at a high level (3.80±.55). In the literature, there are conflicting results in the results of previous studies conducted with students from different departments of universities. Similar to this study, in addition to the study results in which students' attitudes towards art are high (preschool teaching department students: Güngör and Dalgar, 2023; art and music teaching department students: Kayabaş, 2021), the attitude towards art is at a medium level (classroom teaching students; Baysal & Dıvrak, 2020), and study results showing that the attitude towards art is low (university students from different departments: Denac, Čagran, Denac, & Kafol, 2013). When evaluated in this respect, considering that the

study participants have an intense workload and are students who will do their profession in the field of human health, the high attitude of health sciences faculty students towards art is considered a positive situation. Art is the behavior of creating a form that meets the spiritual needs of the individual (Tansuğ, 1988). Having high attitudes towards art for students who will study in the field of health sciences may also be beneficial in meeting their psychological needs. It is also thought that students will contribute to themselves professionally when they start their professional careers. As a matter of fact, Bentwich & Gilbey (2017) revealed in their studies that a positive attitude towards art contributes to the development of empathy skills and tolerance for uncertainty in students who will work in the field of health.

The two statements with which the participants agreed at the highest level were "I like going to the movies" (4.32±.74) and "I believe that works of art evoke good feelings in people" (4.24±.73), respectively. Going to the movies is a type of activity that all university students can access. As a matter of fact, in the Turkey's Youth 2020 research conducted by the Turkish Youth NGOs Platform, it was revealed that the art activity in which young people participate most intensively is cinema (URL 2). Going to the cinema is a type of activity in which the participant participates as a spectator, that is, is passive. The item "I believe that works of art evoke good feelings in people" is similarly a passive statement that shows that the person has beliefs that support a positive perspective towards art. It may be recommended that students be directed to artistic activities in which they can actively participate, engage in artistic production, and thus express themselves.

The two statements with which the participants agreed at the lowest level were determined as "I would love to see myself as a famous artist in the future" and "I dream of my artistic works being exhibited in a museum or gallery one day," respectively. Whether students want to be artists in the future or want their artistic works to be exhibited in a museum or gallery one day are situations that require them to engage in active artistic production. Approximately half of the participating students stated that they were not interested in art anyway. Considering the two low items, it was also suggested that the research participants who expressed an interest in art thought that their artistic works were hobby-level pursuits, that their perspective on their own artistic production was not at the level of producing works of art, and that they did not feel competent in this respect.

The last finding of the research is that the attitudes towards art of students who are interested in any branch of art are significantly higher than those who are not interested. People who are not actively interested in art by producing products and who only have theoretical knowledge about the artistic works are viewers. The person who deals with art directly, that is, by producing products for it, is the person who is aware of the aesthetic pleasure that this action gives (Chapman, 1994). It is thought that this pleasure created by being interested in art may have positively affected the person's attitude towards art.

Limitations

This research also has some limitations. These are: the individuals participating in the research are students of Nezahat Keleşoğlu Faculty of Health Sciences and the research is limited to the participants' answers to the questions in the measurement tools.

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Teaching Usul-i Cedit (the New Method) to Primary School Teachers in Ottoman Provinces

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ABSTRACT

This research aims to uncover the activities undertaken to teach the new "usul-i cedit" teaching methods to sibyan (primary) school teachers who continued providing traditional education during the modernization period. Modernization of education encompasses various practices, from curricula of usul-i cedit to school management, teachers' personal rights, and health regulations in schools. Usul-i cedit focuses on teaching Turkish literacy and new methods developed for this purpose. Due to the failure of primary school reforms during the Tanzimat Period, the competence of school teachers was questioned. There was a push to gradually remove teachers unable to teach using usul-i cedit. However, training enough qualified teachers at Darülmuallimin-i Sıbyan would take time. Therefore, rapid courses were introduced to quickly train current primary school teachers in the new methods. Sample schools like iptidai, rüştiye, and provincial teacher training schools served as course centers. These courses primarily taught new methods for teaching Turkish literacy and included modern pedagogical methods for basic education subjects. The "usul-i tedris" (teaching method) lesson, central to teaching the new reading and writing methods, was a key component of all courses. The research employed document analysis, with data from Ottoman Archive documents forming the study's backbone. Historical data were analyzed using content analysis.

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INTRODUCTION

Education modernization in the Ottoman Empire exhibits a characteristic that expanded from the center to the periphery. The pilot region where education reforms were first tested was the capital, Istanbul. Along with the positive results obtained here, the reforms were implemented as a state policy in the provinces. Indeed, the forming and institutionalization efforts of modern education bureaucracy began at the capital, and after long efforts, extensions of the central organization were established in the provinces. It is surprising to see that this process, which can be considered natural for modern centralized states, is valid for almost all education reforms. For instance, modern secondary education institutions, rüştiye schools (junior high school), started education in Istanbul from 1838, while the first rüştiyes in the provinces were opened in 1852. Similarly, the first examples of the new methods and practices called usul-i cedit (the new method) in basic education began to be tested in schools operating in Istanbul from 1847, and it was only decided to be generalized throughout the country towards the end of the Tanzimat Period by formulating a program. The policy of gradually expanding the reforms might be preferred because it allowed for gaining experience through trial and finding the appropriate one with the accumulated knowledge. However, the delay in implementing even the fundamental reforms, which are extremely important and urgent for education modernization, in the provinces can be explained by the existence of some impossibilities/constraints beyond this utilitarian understanding. Apart from the inability to institutionalize the provincial bureaucracy, the lack of financial and human capital must have played a decisive role in the preference for this policy. Indeed, the decision to implement the usul-i cedit approach, which centered on teaching literacy in the mother tongue, in the provinces more than twenty years after it began to be tested in Istanbul schools is related to the state's apparatus starting to strengthen in the provinces. At the same time, with the issuing of the General Education Regulation (Maarif-i Umumiye Nizamnamesi) in 1869, leaving the costs of basic education to the people provided some of the necessary funding for the usul-i cedit practices (For the text of the General Education Regulation (MUN), see BOA, Y.E.E, 112/6, Düstur, I/2, 184-219, article: 4). Therefore, no obstacle was seen in starting the reform process.

The first developments in the usul-i cedit in basic education began in Istanbul in 1847 with the preparation of an instruction that the sıbyan schoolteachers in Istanbul would be obliged to implement to reform the traditional primary education institutions, sıbyan schools. Along with the instruction, which envisaged a common curriculum based on teaching Turkish literacy, it was desired to introduce some modern practices that would be valid in school management (Berker, 1945). However, due to the reluctance of sıbyan schoolteachers and other practical difficulties, the reform initiative could not succeed except for a few issues. However, the theoretical framework determined by the instruction found an opportunity to be implemented in 1863 (Öztürk, 2005). When successful results were obtained from the project tested in 36 schools identified in Istanbul, it was decided to generalize it and include all Sıbyan schools in the country. Accordingly, in 1868, with a ten-article regulation, compulsory basic education was introduced, and a curriculum including the lessons of the Quran, Morality, Writing, Catechism, Spelling, Tajweed, Useful Knowledge, Geography, and Arithmetic was made compulsory in Sıbyan schools (BOA İ.MVL 584/26278 appendix 1). The fact that the regulation mentions that reading and writing will be taught in the usul-i cedid in a way that will cover all Sıbyan schools shows that there is a will in the government to spread the usul-i cedit. So much so that this situation was confirmed in the General Education Regulation, written a year after this regulation, and it was definitively decided that the alphabet would be taught according to the usul-i cedit in Sıbyan schools (MUN article: 6).

Of course, it was the teachers who would implement the usul-i cedit in the existing sıbyan schools. In this case, the teachers working in sıbyan schools were expected to have the competence to implement the program. However, the Darülmuallimin-i Sıbyan (teacher training school for sıbyan schools), established to train teachers capable of teaching according to the usul-i cedit, had only started education in 1868 (Takvîm-i Vekâyi no: 1025 4 Shaban 1285). The examinations conducted in the Education

Council to determine the qualifications of the existing school teachers revealed that none of the teachers had the competence to teach the subjects envisaged for Sıbyan school students. In this situation, a new decision was implemented as of 1869. Those sıbyan school teachers who met certain conditions would learn the usul-i cedit by taking courses at the Darülmuallimin-i Sıbyan for six months and then return to their duties (BOA ŞD 205/11). In this way, the sıbyan schools that provided education according to the old method would also be transformed into usul-i cedit schools. Various methods were used to establish the usul-i cedit approach in Istanbul. By 1872, intensive efforts would be made to spread the usul-i cedit in the provinces. The primary aim of this research is to reveal the quality of the training courses given to Sıbyan school teachers in the provinces within the context of the usul-i cedit practices. To fully understand the subject, the term usul-i cedit needs to be explained in all its aspects. While this term has been used to express many innovations in education modernization, it will be evaluated in this study in the sense of the skills intended to be imparted to sıbyan school teachers.

METHOD

In this research, which aims to uncover the activities undertaken to teach new teaching methods to sıbyan school teachers who continued to provide traditional education during the education modernization period, the document analysis method was used. This method is used to systematically analyze the content of written documents (Kıral, 2020). Although document analysis plays a complementary role for many research methods, it can also be used as an independent scientific research method (Bowen, 2009). On the other hand, the document analysis method, which involves examining documents to collect data, classify, and evaluate the data obtained, allows revealing a historical situation (Sak et al., 2021). This method was naturally preferred in this research due to the desire to reach a conclusion by analyzing the content of documents related to the subject in the Ottoman Archives.

The following method was followed in data collection: Firstly, the terms and concepts of usul-i cedit, sıbyan school, teacher, regulation, and instruction were identified as keywords. The related documents were identified by scanning these keywords in the Ottoman Archives. Similarly, collections of Düstur and Salname, the national thesis center, ISAM, the National Library, and Atatürk Library were scanned, and related data were reached. Published books and articles were also examined, and the data to be used in the research were collected. The time interval for data collection was limited to the years 1868-1919.

Content analysis method was used to analyze and interpret the obtained historical documents. This method was particularly used in the process of extracting information cards by reading the documents, dividing them into themes and categories. The abbreviations of the Ottoman documents used in the research were given in the bibliography section with detailed catalog information. Additionally, the date conversion processes related to the Hijri, Rumi, and Gregorian calendars were carried out with the help of the Date Conversion Guide on the website of the Turkish Historical Society.

FINDINGS

Since the research aims to determine how the modern teaching methods referred to as usul-i cedit were taught to sıbyan school teachers in the provinces, it is first necessary to clarify all aspects of the usul-i cedit. Determining the quality of the courses opened in the provinces, which constitute the problem of the research, will undoubtedly be beneficial to present similar practices. Therefore, it is necessary to also address the practices of integrating sıbyan teachers into the system, which started in Istanbul just before the provinces.

Usul-i Cedit (The New Method)

The usul-i cedit is described as the application of new and effective teaching methods by abandoning traditional teaching methods and using modern teaching materials (Akyüz, 2012). The term usul-i cedit, used to denote the contemporary approach substituted for traditional practices in the Ottomans, became a term

describing modern pedagogical practices that emerged in connection with the education reform during the Tanzimat Period. The educational modernization initiatives led to the broadening of the meaning attributed to the term usul-i cedit, and many innovations regarding the institutionalization of the education system, curricula, teachers, students, school buildings, and health rules in schools began to be expressed with this term.

The rüştiye schools, which are modern educational institutions, were the schools where the first applications of the usul-i cedit were experienced. Indeed, with the efforts of Ahmet Kemal Efendi, Director of Public Schools, new teaching methods were tried in the rüştiyes in 1847, and positive results were obtained. In 1848, the Darülmuallimin-i Rüştiye (teacher training school for rüştiye schools) started its educational life to train teachers who could teach the subjects taught to children in the rüştiyes with easy and effective teaching methods (Akyüz, 2012). This institution not only served to institutionalize the new understanding in the rüştiyes but also found an opportunity to spread the usul-i cedit in the country through many educators who graduated from the school. This issue will be explained with examples in the following parts of the research. It should be emphasized that the usul-i cedit had its main transformative effect in the field of basic education. The first step in creating an educated society is teaching literacy in the mother tongue. It is extremely important to impart this skill to children effectively in a short time. However, in traditional Sıbyan schools, the aim was to reach a level where one could read the Quran in its original Arabic. The usul-i cedit in basic education essentially referred to focusing on teaching Turkish literacy and the new methods developed to facilitate this. The usul-i cedit brought the "usul-i savtiye" method, which was based on reading Turkish words directly by sounding out the letters, instead of the traditional "usul-i tehecci" method, which meant reading Arabic words by spelling out the vowels of the letters.

How was Turkish literacy taught according to the usul-i cedit? Detailed information about alphabet teaching with the new method can be found in the famous work "Rehnümâ-yı Muallimîn," written by Selim Sabit Efendi, considered one of the most important representatives of the usul-i cedit, in the 1870s. Since the book was prepared to guide teachers, the alphabet teaching was explained in detail step by step. According to this, the teacher should start by teaching the letters. For ease, the teacher should write a group of letters on the teaching board, grouped in threes or fives, and have the students pronounce them one by one, pointing to each letter with a thin stick. The names of the letters should be read together, making the students accustomed to pronunciation, and in this way, all the letters should be shown, and their names should be taught. Then, the similarities and differences in the shapes, punctuation, and joining features of the letters should be explained in detail. After all these stages, the teacher should write the letters on the teaching board in a mixed and irregular manner in groups of five, ask practice questions to the students, and ensure the full understanding of the subject. After the letters, the vowel points should be taught in the same way. After teaching the names, shapes, and pronunciations of the letters and vowel points, reading syllables and words should be started, and writing exercises should be initiated at this stage. When teaching the reading of syllables and words, it was essential to read the letters' names and sounds directly, rather than pronouncing the names of the vowels as in the past. For example, the syllable of the letter "jim" (ج) should have been read as "je," "ji," and "jü" instead of "jim fatha: je", "jim kasrah: ji," and "jim dammah: jü." Similarly, "ba-nun (fatha)" (ب - ن) should have been read as "ben," and "kaf-waw-zay (dammah)" (ز- ¬ و - ك) should have been read directly as "güz." Teachers were advised to choose words from daily life, names of objects that children knew before, and to continue reading exercises until the students could read and understand a Turkish book (Selim Sabit Rehnümâ-yı Muallimîn, tarihsiz; Şanal, 2021). The book also covered how Turkish writing exercises should be done. After the students thoroughly memorized the shapes and names of the letters and vowels, reading and writing exercises would progress together. For the first writing exercises, children would use the stone tablets they had. On these stone tablets, suitable for writing and erasing, the writing of the letters would be practiced, and then the teacher would show the method of writing on paper with a pencil. When explaining the joining forms of the letters and the writing of one- and two-syllable words, students would be familiarized with writing by giving homework examples from the alphabet book prepared according to the usul-i cedit. Finally, it was aimed to bring the students to a level where they could write sentences dictated from memory with an ink pen (Selim Sabit Rehnümâ-yı Muallimîn, tarihsiz).

Selim Sabit Efendi outlined the general framework of the reading method introduced by the usul-i cedit in his work. Another famous representative of the new method, Mehmet Cevdet Efendi, who was a contemporary of Selim Sabit Efendi, believed it would be more beneficial to begin teaching reading by first teaching the letter-shaped vowel points used in Turkish. According to Mehmet Cevdet Efendi, the letter "alif" acted as the "fathah"," the letter "waw" as the "dammah", and the letter "ya" as the "kasrah," while the letter "ha" allowed for reading smoothly without elongating the letters, like "ba," "ta." Since many words in Turkish were written with spelling letters, teaching these first would facilitate reading. Indeed, when moving on to syllable reading, it would be possible to read all the letters by combining them with spelling letters, make meaningful words by combining the syllables, and construct meaningful sentences from these words (Ayar, 2022). Although there were some minor differences in the opinions put forward by educators on teaching reading, the main goal was to teach literacy in the mother tongue in a short time.

In the modernization of education, the usul-i cedit was not just about bringing new teaching methods for reading and writing in basic education. A program that included the use of modern pedagogical methods in teaching the subjects in the sıbyan school curriculum was also introduced. Detailed explanations on this subject were included in the Rehnümâ-yı Muallimîn. First, it was envisaged that the lessons would be taught in a classroom setting according to a common curriculum. The durations of the lessons and break times were determined. The contents of the subjects in the Sıbyan school program, such as History, Geography, Arithmetic, and the Ottoman Turkish Language, were clarified, and how they should be taught was explained. Information was provided about the duties and responsibilities of teachers and students, the functioning of schools, and the practices of reward, punishment, and examination in schools (Selim Sabit Rehnümâ-yı Muallimîn, tarihsiz). In addition to all these, the preparation of Turkish textbooks and the use of these books by teachers as a basis for teaching with modern educational materials were also included in the scope of the term usul-i cedit.

It should be noted that the aspects of the usul-i cedit outlined in the Rehnümâ-yı Muallimîn were not just Selim Sabit Efendi's views, but a program created by the Islah-ı Mekatib Commission (Commission on the Reform of Schools), an official committee formed to modernize schools, of which Selim Sabit Efendi was also a member. This program was adopted by the Ministry of Education and implemented first in numune schools (modern, exemplary primary education institutions established to implement the new Usul-i Cedid principles) and then in regular modern primary education institutions called iptidai schools.

The decision to generalize the usul-i cedit practices in basic education throughout the country as of 1868 was made after testing and refining them in Istanbul schools. This was a very ambitious initiative. It was planned to integrate thousands of schools, which had been providing education with the old method in a familiar order for years in Istanbul and the provinces, into the modern education system. The teachers at these schools would also abandon the old teaching methods and conduct education according to the usul-i cedit. However, many of the existing teachers were closed-minded and insufficient in terms of pedagogical qualifications. The success of the project depended on changing the perspectives of the teachers and enhancing their qualifications. Therefore, the government started by creating a legal regulation that would make it compulsory to conduct education according to the usul-i cedit in sıbyan schools. In 1869, with the General Education Regulation, it was stipulated that having a diploma from the Darülmuallimin-i Sıbyan or proving the ability to obtain this diploma through an examination was necessary to be a primary school teacher. From now on, those who did not know the usul-i cedit could not become sıbyan schoolteachers. Existing teachers were also required to meet the same conditions to continue their duties. Therefore, the existing teachers needed to gain the competence to conduct education according to the new methods to continue their duties.

Teaching Usul-i Cedit to Primary School Teachers in Istanbul

The Darülmuallimin-i Sıbyan, which started education in 1868 to train teachers capable of teaching according to the usul-i cedit in Istanbul, had not yet produced graduates. It was impossible to meet the needs of the existing Sıbyan schools in Istanbul with the teacher candidates who would graduate from this school in

a short period. Therefore, policies needed to be developed to integrate the teachers working in Sıbyan schools into the system. The Maarif Council hoped that the new methods could be taught to those teachers with a certain academic background through accelerated courses, and thus education could continue without interruption. Indeed, in 1869, it was decided that sıbyan school teachers who had received at least five years of madrasa education would be subjected to a certain period of education at the Darülmuallimin-i Sıbyan. The teachers who learned the usul-i cedit methods here would continue teaching in their old schools (BOA ŞD 205/11). In fact, the Darülmuallimin-i Sıbyan was not only an institution that trained teachers in the new style but also a place where the usul-i cedit was taught. Teachers who attended this school on designated days and showed success were able to continue their duties.

In addition to the Darülmuallimin-i Sıbyan, numune schools, designed as model modern basic education institutions, also became institutions where the usul-i cedit education was provided. After 1873, sıbyan schools located centrally in Istanbul neighborhoods and with suitable buildings began to be transformed into sample schools (Ergin, 1977). Qualified teachers who knew and could implement the new methods were assigned to the numune schools. The duty of these teachers was not only to conduct education according to the new method in the schools to which they were appointed but also to teach the usul-i cedit to the Sıbyan school teachers in their vicinity, turning their schools into a training center for these teachers (Mahmud Cevâd, 1338).

With the appointment of Mehmet Cevdet Efendi, the former principal of the Darülmuallimin-i Sıbyan, to the Directorate of Primary Education in 1881, the activities to teach the new method to sıbyan school teachers in Istanbul gained momentum (BOA İ. DH 833/67017). It was first decided to establish centers to teach the necessary usul-i cedit and other lessons to sıbyan school teachers in Istanbul and to offer courses at designated times (Salnâme-i Devlet-i Aliyye H. 1299). The director himself, Cevdet Efendi, started teaching the usul-i cedit by opening a course in the education department (Mahmud Cevâd, 1338). To make these initiatives stable, a school called Dârülameliyat (practice school) was opened on April 17, 1882. In this school, external students were accepted, as well as existing sıbyan school teachers who wanted to learn the new method. Those who received education at Dârülameliyat for two or three months started to be appointed to Sıbyan schools (Mahmud Cevâd, 1338).

The efforts to implement the usul-i cedit program in basic education were initiated in the provinces simultaneously with Istanbul. The existence of institutionalization and trained human resources to serve the purpose was a chance for Istanbul, being the state center. The implementation of the program in the provinces, which did not have these opportunities, witnessed a long and arduous struggle.

Teaching Usul-i Cedit to Primary School Teachers in Provinces

Following the publication of the General Education Regulation and with some delay, efforts were initiated as of 1872 to transform the sıbyan schools, which provided traditional education, into usul-i cedit schools in the provinces. A circular sent to all provinces on July 23, 1872, requested the determination of the current status of sıbyan school teachers. An examination committee consisting of senior teachers from rüştiye schools and selected individuals from the clerical and scholarly community was to be formed in provincial centers, sub-districts, and districts, and these committees were to determine whether the teachers could teach the subjects in the curriculum. The committees were to assess not only the teachers' competencies in teaching the subjects but also their ability to read Turkish fluently. Those who passed the examinations would be reinstated to their positions with a certificate of proficiency graded in three degrees, while those found inadequate would be removed from the profession. External candidates could also participate in these examinations, and those who proved their competence would be appointed to schools without teachers. The circular emphasized several times that the candidates' proficiency in Turkish would be of utmost importance. This indicates that a minimum level of competence was sought in teacher candidates who could teach Turkish literacy, the essence of the new curriculum. However, was being able to read Turkish fluently sufficient to teach literacy according to the usul-i cedit? The official letter continued, showing that the Education Council did not find this sufficient. The council recommended that teachers who passed the examinations be subjected

to a course under the supervision of the senior teacher of the rüştiye school and a writing teacher for an hour each in the morning and evening to learn the new method (BOA MF. MKT 2/176). Since Darülmuallimin had not yet been established in the provinces, this task was assigned to the teachers who graduated from the Darülmuallimin-i Rüştiye in Istanbul. Considering the significant role the Darülmuallimin-i Rüştiye played in developing the usul-i cedit, this is not surprising. The teachers who graduated from this school and were appointed as senior teachers in the provincial rüştiyes became the first representatives of the new methods in the provinces.

For the Ministry of Education, determining the general condition of the sıbyan schools in the provinces was as important as assessing the qualifications of the Sıbyan school teachers. Since the goal was to transform the traditional sıbyan schools into usul-i cedit schools and integrate them into the modern education system, all kinds of information were needed. However, during this period, the Ministry of Education's provincial units had not yet been established. The only representatives of modern education in the provinces were the teachers appointed as senior teachers to the rüştiye schools. Therefore, the teachers of the rüştiye schools were tasked with inspecting the Sıbyan schools on holidays and preparing reports on the schools. Examples of reports prepared by the rüştiye school teachers after inspecting the sıbyan schools in their regions can be found in the Ottoman Archives. These reports provided information on the condition of the school buildings, income, student numbers, and whether the teachers were familiar with the usul-i tedris. For example, in the reports of the teachers of the Eski Zağra and Sarajevo rüştiye schools, it was noted that most of the Sıbyan school teachers in their regions lived on the provisions given by the local population, many were quite inadequate in teaching, and the school buildings were in a dilapidated state (BOA MF. MKT 5/123). The Ministry of Education did not hesitate to take necessary actions regarding the teachers mentioned in the reports as inadequate. For instance, according to a document dated December 28, 1872, five sıbyan school teachers in the Taşlıca district of Yenipazar Sanjak in Bosnia, who were not capable of teaching, were removed from their duties and suitable individuals were appointed in their place. Of these teachers, three who proved their competence in the examination remained in their positions, while two unsuccessful ones were replaced by other teachers (BOA MF. İBT 2/57). Another document dated September 5, 1872, shows that the Ministry of Education requested the dismissal of incompetent teachers mentioned in the report of the Prizren rüştiye school teacher and the appointment of qualified individuals in their place (BOA MF. MKT 4/93).

In accordance with the General Education Regulation, which stipulated that teaching in sıbyan schools required the ability to teach according to the usul-i cedit, teachers who wanted to continue their profession had to acquire these skills. As mentioned above, those competent to teach the new method in the provinces were the senior teachers of the rüştiye schools. Since many district centers had rüştiye schools, it was thought that sıbyan schoolteachers could interact with them. However, it appears that this idea remained on paper and could not be implemented for a long time. The inability to establish an educational bureaucracy to assess the current situation and organize the course system in the provinces must have delayed the implementation of the project. Indeed, the regular appointment of education directors to the provinces began after 1882 (Kodaman, 1991). With the establishment of educational organization in the provinces, the opening of model modern basic education institutions called numune schools, and the spread of Darülmuallimin, the project of providing usul-i cedit education to sıbyan school teachers was brought back to the agenda. The numune schools and Darülmuallimin opened in the provinces began to function as course centers for teaching usul-i cedit to Sıbyan school teachers, while in the districts, the teachers of the rüştiye schools undertook this task.

Teaching Usul-i Cedit to Primary School Teachers in Sıbyan And Rüştiye Schools

Numune schools, which were model basic education institutions opened in Istanbul after 1873, began to be opened in the provinces as well. Since teachers who graduated from Darülmuallimin and knew the new teaching methods were appointed to these schools, it was thought that these schools would also be used as a course place for sıbyan school teachers to learn the usul-i cedit. Indeed, a document dated August 2, 1879, states that it would be appropriate to require Sıbyan school teachers with suitable ages and academic backgrounds to attend the sample schools in their vicinity on Thursdays and Fridays to learn the usul-i cedit

(BOA MF. MKT 64/36). It appears that some of the numune schools, later renamed iptidai schools and spread throughout the country, indeed fulfilled this function. For example, according to a document dated October 20, 1879, the Priştine sample school was opened to teach the new teaching methods to the teachers at the existing schools and to train new teachers, and Hüseyin Efendi, a teacher at the Fatih Iptidai School, was appointed to the school. In his work, Mahmud Cevâd (1338) mentioned the efforts to teach the new teaching methods to sıbyan school teachers in 1884. According to Mahmud Cevâd, in the iptidai school in the center of Skopje, seven teachers from Radovişte and Palanga districts were trained according to the usul-i cedit, and those who succeeded in the examination were awarded certificates of competence. Similarly, in Balıkesir, nine teachers working in the sıbyan schools of Kemer district received training in the new methods at the school in the central district (Mahmud Cevâd, 1338).

Although detailed information about the education given to sıbyan school teachers in the iptidai schools is not yet available, some conclusions can be drawn from a document dated November 26, 1894. The document mentions the practice in the Akhisar district of Geyve. Accordingly, the Akhisar education commission summoned five imams from the surrounding villages who held the positions of imam and sıbyan school teacher and subjected them to a course in the iptidai school under the supervision of Kazım Hüseyin Efendi, the school teacher. After completing their education, the imams from the villages of Şahmelik, Evranlı, Bacı, Çardak, and Göksun were examined by the commission. The appendix of the document clearly lists the subjects in which the teachers were examined and their scores. The teachers were responsible for the subjects of the Quran and Tajweed, Islamic Catechism, Ottoman Grammar and Reading and Writing, Arithmetic, Basic Ottoman History, New Teaching Method (Usul-I Cedit-I Tedris), Geography, and Ottoman Handwriting (Rika). All the teachers who took the examination were found successful and were given certificates of confidence (BOA MF. MKT 241/27). This document is extremely important in showing the content of the courses and the proficiency examinations. It reveals that the courses did not only teach the new Turkish literacy method, which is the essence of the usul-i cedit approach but also included the teaching of the subjects in the curriculum.

In this process, the provincial administrations did not only rely on the teachers of the iptidai schools but also benefited from the senior teachers of the rüştiye schools, as planned in 1872. As noted above, in 1872, it was planned that the rüştiye school teachers would provide the course for an hour each in the morning and evening. However, it was impossible for the sıbyan school teachers working in the villages to attend these courses. Therefore, the courses began to be held during the summer holidays. For example, in Edremit district, it was considered to open a course for two months in the summer of 1896 to teach the usul-i cedit to Sıbyan school teachers. The district administration deemed Muharrem Hasbi Efendi, a teacher at Bursa idadi school (first stage of secondary school), suitable for this task. However, the Ministry of Education did not favor this, stating that the summer holidays of high schools were one month, so Hasbi Efendi could not supervise the two-month course. Ultimately, the task was given to the teacher of the Edremit rüştiye school, considering his familiarity with the usul-i cedit (BOA MF. MKT 326/53). In the Keskin district, when the education inspector found that some sıbyan school teachers were still teaching with old methods during an inspection, it was decided to summon the teachers to the district center and have them trained and taught the usul-i cedit by the rüştiye school teacher (BOA MF. MKT 489/28).

Although it can be assumed that the senior teachers of the rüştiye schools knew the usul-i cedit due to their education, it should not be forgotten that rüştiye schools were secondary education institutions and their curricula did not include subjects like teaching the alphabet. In contrast, the teachers of the iptidai schools, who were familiar with the usul-i cedit, were educators who were constantly engaged in teaching literacy in practice. It is interesting to see that this distinction was considered in the instructions drawn up by the Adapazarı district education commission regarding measures to be taken for improving education in the region. The commission decided that the courses planned to be opened for teaching the usul-i cedit to sıbyan school teachers should be given by the rüştiye school teacher for subjects like Geography, History, and Arithmetic, while the teaching of the alphabet should be left to Hafız Ali Efendi, a teacher from the iptidai school, with a salary of 100 kuruş allocated from the commission's fund (BOA MF. MKT 242/50).

So far, the research has provided information about the courses organized in the rüştiye and iptidai schools in the provinces for teaching the usul-i cedit. As can be seen, the given examples mostly concern the activities conducted in district centers. However, such training was also provided in provincial and sanjak centers. The Darülmuallimin, which began to be opened in the provinces after 1875, served as the places where sıbyan school teachers received education according to the usul-i cedit.

Teaching Usul-i Cedit to Primary School Teachers In Provincial Teacher Training Schools (Darülmuallimin)

The initiatives aimed at reforming sıbyan schools to transform them into modern basic education institutions suitable for the requirements of the age revealed that this could not be achieved without qualified teachers who knew the new teaching methods. For this reason, the Darülmuallimin-i Sıbyan was established in Istanbul in 1868 to train qualified teachers for basic education and to serve as a center to teach the usul-i cedit to the existing Sıbyan schoolteachers. However, the school did not have the capacity to train the teachers needed throughout the country. Therefore, the necessity of spreading such schools became imperative, and in 1872, it was decided to open two-year teacher training schools (Darülmuallimin) in provincial centers (Öztürk, 2005). The first provincial teacher training schools started education in 1875 in Bosnia, Crete, and Konya (Berker, 1945). After the 1880s, they quickly spread throughout the country and were even opened in some sanjak centers.

It is understood that the provincial teacher training schools were expected not only to train qualified teachers but also to teach the new methods to the existing Sıbyan school teachers, just like the Darülmuallimin-i Sıbyan in Istanbul. Indeed, in an official letter sent by the Ministry of Education to Mamüretülaziz province on July 23, 1879, it was mentioned that the teacher training school was intended to be used not only to teach the new teaching methods to the teachers in the sıbyan schools but also to train new teachers (BOA MF. MKT 63/154). In an official announcement of the Ministry of Education in 1884, it was emphasized that a teacher training school would be opened in Amasya to teach the usul-i cedit to both the competent sıbyan school teachers and the existing students (Mahmud Cevâd, 1338). However, some provinces preferred to use the darülmuallimins primarily to teach the usul-i cedit to the existing sıbyan school teachers. Due to the urgent need, it was seen as a more practical solution to integrate the existing teachers into the system through rapid courses instead of waiting two years to train new teachers. Indeed, the Trabzon darülmuallimin serves as a striking example in this regard. After obtaining approval from the Ministry of Education for the opening of the darülmuallimin, the provincial administration decided to open the school without waiting for the allocation of funds from the treasury. Three classrooms of the Provincial Industrial School were allocated to the school, and a portion of the revenue from the provincial printing house was temporarily transferred to the school for expenses. After the appointment of Abdullah Vehbi Bey as a teacher, the school started education on August 1, 1891. The Darülmuallimin was not opened to students in the first year but was dedicated to the education of sıbyan school teachers. According to a document dated January 23, 1892, since those without a teacher training school diploma or those who did not know the new methods could not teach in schools, as stipulated in a regulation communicated to the sub-districts, the imams who held school teacher positions in the villages began to come to the Darülmuallimin one by one to learn the usul-i cedit. The number of those who learned the usul-i cedit and received a certificate of competence quickly reached 309. The school teachers received lessons in groups of 40 for three months in subjects such as the Quran, Religious Sciences, Teaching Methods, Turkish, Arithmetic, History, Geography, and Calligraphy. After students began to be admitted to the Darülmuallimin in the autumn of 1892, the usul-i cedit courses were given during the summer holidays when the school was closed. The teachers were given the opportunity to complete the three-month courses in one month. Those who succeeded in the examination at the end of the course were entitled to receive a certificate of competence (Tosun, 2020). The measures taken by the provincial administration in Trabzon to force sıbyan school teachers to learn the usul-i cedit were largely successful. However, in some provinces, it was not possible to bring teachers to the teacher training school courses for various reasons. For example, a document dated October 18, 1884, mentions the unsuccessful efforts of the teacher training school teacher in Amasya. Immediately after

the opening of the teacher training school in Amasya, the appointed teacher tried to provide usul-i cedit education to the sıbyan school teachers but could not even bring the teachers in Amasya center to the courses. The local authorities advised the teacher to go to the districts and offer courses there. The official letter shows that the teacher claimed that the teachers in the center were not interested in the usul-i cedit education, and the district teachers would not show any interest either, requesting the Ministry of Education to ensure the attendance of the teachers at the courses by encouraging or even threatening them through the government. It is seen that the ministry did not remain indifferent to the issue and requested the concerned authorities to take necessary actions (BOA MF. İBT 17/105).

It appears that the perspectives of local authorities on the importance of the usul-i cedit were decisive for the success of the program in the provinces. The Darülmuallimin opened in Erzurum in 1893 was closed two years later. The provincial administration appropriated the allocation of the teacher training school to cover the expenses of the Industrial School they planned to establish and dissolved the school. The task of teaching and training according to the usul-i cedit was assigned to the idâdi school. However, it was later seen that the idâdi school teachers could not allocate time for this task due to their primary duties. Although some sıbyan school teachers were assigned, there was no benefit since no fee was paid for the teaching task. Since no visible success could be achieved in basic education in the province, the governor of Erzurum applied to the Ministry of Education on March 1, 1902, requesting the re-establishment of a Darülmuallimin in the province (BOA MF. MKT 647/2). Fortunately, permission to establish a Darülmuallimin in Erzurum was granted by an imperial decree on April 16, 1903 (BOA İ. MF 9/1).

The Diyarbakır Director of Education, in an official letter dated January 9, 1894, argued that the teachers could be brought to the darülmuallimin courses by encouragement rather than compulsion. The director thought that if the village teachers were given a monthly salary of 30 kuruş to at least meet their food needs during the course, all the sıbyan school teachers in the region could be educated in the teacher training school in groups of 20, taking turns (BOA MF. MKT 195/77). However, financial constraints did not allow such an initiative to be realized.

Of course, there were teachers among the sıbyan school teachers who voluntarily attended the courses with a desire to learn the new methods. A news article in the Kastamonu newspaper described the eagerness of an 87-year-old sıbyan school teacher to learn the usul-i cedit in a striking way. In January 1893, Hatipoğlu Ahmet Efendi, who was an imam and sıbyan school teacher in the village of Etyemez in the Akkaya sub-district of Kastamonu, applied to the darülmuallimin because he did not feel sufficient in education and teaching. After completing his usul-i cedit education there, Ahmet Efendi was examined in front of the class board like the other candidates (Mahmud Cevâd, 1338).

The transformation of sıbyan schools into modern basic education institutions conducting education according to the usul-i cedit could only be possible by selecting teachers who knew the new teaching methods. The General Education Regulation made this a legal obligation. Based on the provisions of the regulation, an effort was made to establish a standard for the appointment of school teachers in the provinces, and the qualifications of the existing sıbyan school teachers were also enhanced. However, it appears that due to the need for teachers, especially in towns and villages, the employment of teachers with old methods continued into the 1890s. Indeed, a directive believed to have been written in 1893 indicated the presence of teachers appointed through foundations or selected by the local population and stated that these teachers were required to attend the darülmuallimins at a time deemed appropriate by the provincial administrative council. These teachers did not need to attend the darülmuallimin for two years like other students. It was sufficient for them to receive education until they acquired teaching skills. Those who refused to attend would be investigated by local authorities (Salnâme-i Nezaret-i Maarif H., 1317). Teachers who received education in the provincial darülmuallimins and passed the examination were given a document called a certificate of confidence or competence. This document allowed teachers to continue their duties in schools. Since the appointment of teachers from outside the graduates of the darülmuallimins continued during the Second Constitutional Era, the activities of granting certificates of competence continued without slowing down. With the enactment of

the Temporary Law on Primary Education on October 6, 1913, the system of teaching in basic education was reorganized (Düstur II/5 804-823). Those who graduated from the teacher training schools were called teachers, and those who held certificates of competence were called assistant teachers, with a validity period of three years for the certificates. Assistant teachers holding certificates were required to attend the darülmuallimin courses for three years and obtain a diploma. Those who failed to do so would have their certificates revoked and would be dismissed (Articles 42-44). Thus, the darülmuallimins had to intensify their course activities after 1913. For example, in 1915, a two-month course was organized during the summer months for village teachers at the Konya Darülmuallimin, and the Dârülameliyat affiliated with the school was kept open for these teachers to practice (Sarıçelik, 2010).

CONCLUSION AND DISCUSSION

The research has revealed the activities carried out to teach the modern teaching methods called usul-i cedit to sıbyan school teachers in the Ottoman provinces. In addition to the general meaning of the usul-i cedit in the history of Ottoman modernization, it has been emphasized that it referred to the new methods developed for teaching Turkish literacy in basic education.

It has been found that the failure to achieve the desired success in the efforts to reform sıbyan schools during the Tanzimat Period was associated with the indifference of the teachers working in these schools towards modern teaching methods. Although a curriculum based on modern pedagogy was prepared and some administrative arrangements were made, the competence of the school teachers, who would be the actual implementers of these innovations, began to be questioned. Thus, a will was formed to gradually remove teachers who did not have the ability to teach according to the usul-i cedit from the system. Considering that it would take time to train the desired number and quality of teachers at the Darülmuallimin-i Sıbyan, the idea emerged to quickly train the sıbyan school teachers in office according to the new teaching methods through rapid courses.

Following the legal regulations that made it compulsory to conduct education with the new methods in sıbyan schools, it was understood that some officials were assigned to determine whether the sıbyan school teachers in the provinces were familiar with the usul-i cedit. Initially, the senior teachers of the rüştiye schools in the region, and with the establishment of the bureaucratic organization in the provinces, education inspectors, and finally, education commissions formed from local people were tasked with this responsibility. It was concluded that these officials had significant functions not only in determining the situation but also in directing the incompetent teachers to the courses.

It was found that the education of the new teaching methods to sıbyan school teachers in the provinces was given in numune schools, later renamed iptidai schools, rüştiye schools, and provincial Darülmuallimins. In the early periods, the location of the courses did not matter; the main expectation was that the courses be given by individuals specialized in the usul-i cedit program. After the establishment of Darülmuallimins in the provinces, these institutions regularly and continuously provided usul-i cedit courses, serving as in-service training centers that enhanced the competence of the existing sıbyan school teachers while also training new teachers.

It was understood that the timing of the courses organized in the provinces changed over time. Although the Education Council decided in 1872 that the courses to be given in the rüştiye schools should be an hour each in the morning and evening, it was seen that this could not be implemented. Subsequently, after the opening of the numune schools in the provincial centers, these schools were turned into course centers, and it was decided to provide education to the sıbyan school teachers in the vicinity on Thursdays and Fridays. It was found that such courses, held during the periods when sıbyan schools were open, were not efficient, and especially after 1890, the courses began to be given in compressed programs during the summer holidays, as determined from many documents examined.

In the courses, new methods that facilitated teaching Turkish literacy were primarily taught. Additionally, it was understood that a program that included the use of modern pedagogical methods in

teaching the subjects in the sıbyan school curriculum was also taught. It can be easily said that the usul-i tedris (teaching method) lesson, which included the new style of reading and writing teaching, remained the central lesson of all courses without any changes. On the other hand, some changes were made to the course program based on the curriculum arrangements in the basic education institutions. For example, while information on how to teach subjects such as the Quran, Morality, Writing, Catechism, Spelling, Tajweed, Useful Knowledge, Geography, and Arithmetic was provided in the courses after 1868, Ottoman Turkish grammar and History were added to the course program following the curriculum arrangement in 1892.

The research also examined why the education courses that started in the provinces in the 1870s could not be completed, and it was determined that this was due to the limited capacity of the primary education institutions in the country and their inability to meet the teacher needs. So much so that the education commissions continued to appoint teachers from outside, especially in villages and towns, as they could not find candidates who graduated from the teacher training schools.

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A Critical Hermeneutics Approach to Courses in Geography and Geography Education Departments

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ABSTRACT

There are currently changes occurring in a number of domains on a theoretical, philosophical, and practical level. Universities, science, and the courses that are taught there all reflect this shift. This reflection is not always realized to the intended degree, though. Put differently, not every point in the world is affected by the planet's rapid changes at the same rate. Being at the epicenter of knowledge production, universities are expected to both lead development and change and keep up with these developments. It is imperative that comparable advances are included into university curricula in accordance with these changes. This study looks at the relationship between the changes and geography courses, as well as the applicability of the field knowledge courses in the departments of geography and geography teacher education. The data from postgraduate student focus group interviews were descriptively evaluated in the article utilizing interpretative and critical methods. The study's findings indicate that significant modifications to geography content understanding courses are required. Among the study's significant findings are the participants' opinions that the division between physical and human geography is meaningless, that the interdisciplinary approach used in geography classes is insufficient, and that more specialized courses are necessary. This is the reason the conclusion section includes a thorough examination of the topic.

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INTRODUCTION

The geographical field possesses a key trait of being very adaptable to the paradigm adjustments occurring in the contemporary world. In the past 70 years, the three components of geographical knowledge, namely ontology, epistemology, and methodology, have experienced significant modifications and alterations. These developments were primarily influenced by the quantitative revolution, as discussed by Li et al. (2022). Similar to other fields of study, the knowledge generated in the field of geography is applicable worldwide. The universality of geographical knowledge guarantees its relevance and validity in many contexts (Bird, 1993). Hence, the swift transformation of scientific outlook and the embrace of inventive methodologies are crucial in the progress of geographical understanding. Universities play a crucial role in advancing and preserving geographical knowledge by facilitating the use and analysis of current methods and approaches (Johnston, 2003). This viewpoint also influences the substance and approaches of the courses instructed in universities. Aligning the geographical courses offered at universities with modern geographical methodologies would lead to substantial advancements in both academic and applied geography (Johnston & Sidaway, 2015). The degree of this transition is indicative of the quality of the geographical knowledge that is generated.

While the functionality mentioned above is effective in universities in developed countries like the UK and the US, it has been noted that in other countries, there is a lack of alignment between the modern and innovative perspective and the courses taught in universities (Altbach, 2004; Kyvik, 2009). On the other hand, developing countries like Türkiye in the Geography and Geography Education departments, there have been some advancements in course selection in recent years to align with contemporary knowledge. However, it is observed that these changes have not reached the intended level. In addition, Tanrıkulu (2018) has highlighted that the distinct approach taken by Geography departments and Geography Education departments leads to notable issues. It is widely acknowledged that there is an inadequate quantity of academic staff in these departments, and the remaining academic staff's quality does not fully fulfill the expectations (Kayan, 2000). Due to these reasons, the majority of geography courses in higher education tend to favor a teaching technique that focuses on memorization rather than one that emphasizes research or projects (Yaşar & Şeremet, 2010).

Regrettably, many colleges persist in designing curricula and delivering courses using divergent methodologies that are not favored in the contemporary scientific realm for both professional opportunities and scholarly advancement, without sufficiently taking into account the present scientific outlook (Ata, 2010). Furthermore, these universities have the capability to obtain authorization to establish postgraduate programs. Due to the mismatch between supply and demand, there has been a significant rise in the establishment of new geography departments, which have now become a crucial component of academia. Over the past few years, there has been a significant increase in the number of geography departments at newly established universities. Consequently, it has become increasingly challenging to differentiate their quality from one another. It is important to have a comprehensive discussion on the detrimental impact that these colleges have on the field of geographical science. Furthermore, scholars at geography departments have voiced their apprehensions regarding the establishment of new departments, citing numerous structural issues (İlhan, Gülersoy & Gümüş, 2013; Kayan, 2000). The literature extensively discusses the shortcomings of geography courses in higher education from various viewpoints (Balcı, 2014; Özgen & Bindak, 2009; Sözen, 2019; Şahin, 2001; Şeremet, 2015; Tanrıkulu & Gümüşçü, 2021; Topal, 2011; Turoğlu, 2022; Uzunöz, 2011).

Table 1. *Geography courses in Türkiye*

Geomorphology	Climatology	Biogeography
Soil Geography	Hydrography	Cartography
GIS	Population Geography	Settlement Geography
Urban Geography	Industrial Geography	Economic Geography
Transportation Geography	Cultural Geography	Political Geography
Agricultural Geography	Environmental Problems	Ecosystem Geography
Natural Disasters	Globalization	World Regional Geography
Geopolitics	Tourism Geography	Environmental Issues

Source: Turkish Higher Education, YÖK Dersleri Platformu, 2024

The courses displayed in Table 1 above are still frequently taught. Without a doubt, several departments in universities offer a greater variety of courses compared to the ones they really supply. However, to present a broader overview, we concentrated on the geography courses that are most frequently taught. These courses may not be offered in all geography and geography teaching departments. However, in addition to the mentioned courses, almost all departments provide at least two courses on the geography of Türkiye. Turkiye's geography is mostly divided into two categories: the coastal regions and the inland regions. Certain departments provide individual courses for each region. Despite a decline in the availability of regional geography courses, they are nevertheless offered in numerous departments at present.

Upon analyzing the geography curriculum offered by various colleges in Europe and the US, it becomes evident that there is a greater abundance of distinct and diverse courses. Furthermore, expanding the quantity of these instances is easily achievable given the extensive selection of geography courses accessible to students.

Table 2. *Geography courses in University of Berkeley and Oxford University*

University of Berkeley | Department of Geography	
World and Cultural Environments	Global Environmental Change
Global Ecology and Development	Urban Experience: Race, Class, Gender and the American City
Waste Materials	Geographies of Energy: The Rise and Fall of the Fossil Fuel Economy
Art and Ecology	Peoples of the World and Cultural Environments
Critical Economic Geographies	Global Development: Theory, History, Geography
Thinking Globally	Acting Regionally: Geographies of Climate Change
Postcolonial Geographies	Urban Sites and City Life
Food and Environment	Geographic Film Production
Oxford University | Department of Geography and Environment	
Childhood and Youth in the Global South	Current Issues in Cultural Geography
Critical Geographies of Development	Environmental Governance in Central Asia
Finance and Sustainability	Geographies of the Anthropocene
Geographies of Finance	Geopolitics of the Periphery
Transport and Mobility	Chinese Politics, Society and Culture
New Approaches in Urban Geography	Desert Landscapes and Dynamics

Source: University of Berkeley, 2024; Oxford University, 2024

The objective of this study is to evaluate the current relevance of the subject knowledge courses offered by the Geography and Geography Education departments in Türkiye, based on the perspectives of the participants. In order to accomplish this objective, this study employs a critical hermeneutics methodology. Consequently, the participants were asked open-ended questions regarding potential solutions to the existing issues. The study seeks to obtain comprehensive responses to the subsequent inquiries:

Are the contents of geography courses up-to-date?

What courses should be incorporated within the geography undergraduate curriculum?

Do geography courses offer an interdisciplinary approach?

What is the density of Geography of Türkiye courses in the programs?

What should be the optimal allocation of physical and human geography courses?

METHODOLOGY

Research design

This study's theoretical framework employs the hermeneutical method. The study adopts critical hermeneutics, a more critical variation of this approach. Furthermore, critical hermeneutics incorporates the aspects of the philosophical hermeneutic approach while also emphasizing a more inquisitive characteristic. The primary emphasis is on determining whether the thing being examined accurately represents reality, identifying the many characteristics of the phenomenon, and devising strategies to address the issues under investigation (Riceour, 1981, 1991). Put simply, critical hermeneutics combines methods of interpretation and critical analysis. This synthesis not only enhances comprehension of the phenomena under investigation but also takes into account potential remedies.

Hermeneutics is the discipline that encompasses the systematic study and analysis of knowledge and interpretation. Comprehending and analyzing, which is a primary goal of the social sciences, necessarily entails interpretation. These two occurrences are inseparable. Comprehension is regarded as one of the fundamental and essential requirements for human beings (Gadamer, 2002). Gadamer, the progenitor of the philosophical hermeneutic approach, asserts that theory and practice are intricately interconnected, and that every novel comprehension is a manifestation or implementation. Critical hermeneutics, however, focuses on the interpretation and application of knowledge, as well as the less apparent elements of occurrences.

According to the hermeneutic approach, dialogue is regarded as the primary aspect, and it is highlighted that meaning is derived through dialogue (Davey, 2006). Dialogue encompasses not just the act of speaking, but also the cognitive process of comprehending the other person(s) and discovering aspects of oneself through this process of comprehension (Gadamer, 2002; 2007). Dialogue should elicit a transformation in both parties involved, since a new significance necessitates alterations in the attitudes of the persons engaged in dialogues. When one party in a debate attempts to forcefully assert their own perspective, the dialogue loses its essence and significance because it deviates from the principles of hermeneutics, as stated by Dostal (2002).

The concept of the part-whole relationship holds significant importance in hermeneutic philosophy. Two distinct methods of interpretation are utilized: the first involves analyzing individual components and then forming a comprehensive understanding, while the second involves examining the entire context and then breaking it down into its constituent parts. These strategies are employed to enhance comprehension of written texts or spoken communication. The objective is to achieve a more comprehensive interpretation. The technique relies heavily on context, as the entire text must be considered to comprehend its meaning. Examining the entirety of the text offers a more comprehensive understanding of the context (Caputo, 2018). Hermeneutics asserts that meaning does not originate spontaneously. Put simply, meaning lacks a distinct start and finish; comprehension and interpretation are ongoing and procedural. According to Gadamer (2002), tradition and language are the primary sources of hermeneutical thought that enable a more comprehensive understanding of the current situation. These two sources allow us to ascribe significance to events and phenomena. Undoubtedly, meaning extends beyond the realm of historical perspective and language. However, it is crucial to acknowledge that these two phenomena are integral components of the processes involved in creating meaning (Ricoeur, 1991).

The study's sub-questions seek to thoroughly assess the extent to which geography education aligns with current scientific knowledge and the modernization of curricula. The study encompassed not only the perspectives of the participants but also included their evaluations in both the findings and conclusion sections. The perspectives of the participants were valuable and enhanced by the exchange of remarks and criticisms. The study adopts a critical hermeneutic approach as its theoretical framework, which highlights that meaning is enhanced by the combination and interplay of many perspectives. Understanding and comprehension are fostered when we are compelled to adapt our perspectives in response to differing viewpoints. Nevertheless, a solitary origin cannot serve as the focal point of significance; our ability to derive meaning expands as viewpoints and sources become more varied. Thus, the study's issue is approached from a more comprehensive standpoint.

Participants

The study included a cohort of 6 graduate students, consisting of 5 doctoral students and 1 master's student, who are now pursuing their graduate studies in the geography education department of a state university in Istanbul. The participants' ages spanned from 26 to 45. The study employed convenience sampling, which is a type of purposive sampling, to pick participants. The purpose of this technique is to optimize efficiency and cost-effectiveness by choosing a readily available sample (Baltacı, 2018). Three of the participants are pursuing higher education at various universities, while the remaining three are employed as educators, with a minimum of 2 years of practical experience, and are also engaged in furthering their postgraduate education. Throughout the process of collecting data, every participant was assigned a pseudonym, and their actual names were not utilized. Participants were administered the questions from the prearranged semi-structured interview form.

Data Collection

The data for this study was obtained through the use of a focus group study. Focus group studies are a research technique that facilitates participant contact in order to gather information through these interactions (Creswell, 2013; Morgan, 1996). The objective of focus group work is to achieve a broader and more communal viewpoint, rather than focusing primarily on individual perspectives. Interactions during the focus group can influence the perspectives of participants (Cohen, Manion & Morrison, 2010). The focus group is extensively utilized in qualitative research owing to its numerous benefits. The interviews were performed online to facilitate access to the participants. The interviews were carried out in two sessions, with each session lasting 40 minutes. During this procedure, precautions were taken to guarantee that the communication lines between the parties remained accessible. The queries presented to the participants in the focus group were utilized to tackle the study inquiries and were further supported with probing questions. Data was gathered on May 2024.

Participants contributed by offering an abundance of comprehensive information to the extent they desired. Every participant actively engaged in the same session and attentively listened to one another's statements during a seamless chat. The interviewer posed additional inquiries in order to discern disparities in the participants' encounters or anticipations. Examples of such queries may include: 1. Could you provide any illustrations? 2. What were the circumstances that led to this situation? 3. What was your source of information? 4. Which elements proved to be less valuable or completely useless? and/or: 5. What measures can be taken to enhance this situation? The audio recordings, along with the accompanying written notes, were transcribed word for word into a transcript spanning 43 pages. The transcripts were meticulously generated, using a methodical and logical approach, to guarantee accurate documentation of both spoken and non-verbal expressions.

Data Analysis

Reflection and critical questioning in focus groups aim to rationalize the participants' lifeworld, encompassing the context of meaning, patterns of interpretation, the establishment of norms, and social interaction. This serves as a counterbalance to the rationalization enforced by the system. Every

communication process is influenced by a pre-existing understanding that has been created by culture. Hence, it is crucial to take into account the lifeworlds and preunderstandings of the author and participants, and how these factors influenced their comprehension of complexity (Habermas, Smith & Smith, 1999). The author of the study possessed a preexisting comprehension of complexity, which originated from her professional involvement in both the Ministry of National Education (MEB) and the Council of Higher Education (YÖK). This prior awareness encompasses both the encounters of demanding instructional conditions and the knowledge of how these situations could be enhanced.

The data collected from the interviews were analyzed using thematic analysis. Thematic analysis serves the objective of identifying themes and addressing research questions or drawing significant conclusions about a specific subject. This method involves not only summarizing the data but also interpreting and comprehending them (Çarıkcı et al., 2024). Following the interviews, the participants' statements were transcribed, and a duplicate was sent to them. This stage was conducted to verify the congruence between the acquired data and the participants' subjective perspectives, hence striving for enhanced data accuracy. The analysis and interpretation of the issues posed in the focus group study did not just center on the perspectives of the participants, as is typically done in phenomenologically oriented studies. The data resulting from the participants' interactions were analyzed using a critical hermeneutic method. In this interpretation, the perspectives of both the participants and the researcher converged to yield a more comprehensive viewpoint.

The interpretation was primarily based on the text obtained from the focus group interview. The interviews were thoroughly scrutinized multiple times in order to comprehend the entirety of their content. The objective of analysis is to enhance understanding and lay the foundation for proactive measures (Kincheloe & McLaren, 2005). During the study, the author examined the hidden meaning of the text in accordance with critical hermeneutical concepts. Latent content pertains to the aspect of relationship and encompasses the analysis of underlying and more significant meanings that go beyond the superficial meaning of the text (Lee & Kim, 2001). The transcribed text was condensed into meaning units, where the fundamental meaning was kept and compacted (see to Table 3). The condensed meaning units were further extracted and categorized into sub-themes and themes, following the study's objectives and using high-level titles. All participants confirmed the outcomes of the analysis and were encouraged to question assertions if they disagreed with them. The dependability of the results was established, hence no revisions were required.

Table 3. *Themes and sub-themes obtained from focus group data*

Themes	Sub-themes	Quotations
Geography undergraduate courses are outdated	Lack of philosophical and theoretical background of the courses	"...the philosophy and theory of the lessons are not sufficiently covered. Why a subject is learned and its understandings are not sufficiently presented"
	Lack of interdisciplinary approach	"...if we are talking about identity, identity concerns both sociology, psychology and geography. It is not possible for it not to be interdisciplinary. I need to know psychology, and sociology when studying migration."
	Excess of the courses on Geography of Türkiye	"...I took courses like climatology 1-2-3 or geomorphology 1-2-3. Those courses could have been more specific"
Changes in undergraduate geography courses	Providing more specialized courses	"Courses can be in modules. Specific courses can be planned in one semester and we can take more courses via modules. So we can focus on more specific topics."
	Implementation of modular course system	"...it doesn't work to describe space, water, and place independently of people. I need to see people too. When describing wetlands, human activities should also be included. It should be in a way that encompasses physical and human activities."
	Making physical and human geography lessons more interactive	

FINDINGS

The Currency of Undergraduate Courses

The initial inquiry posed to the participants was, "Do the courses in geography and geography teaching undergraduate programs remain current and relevant?" None of the participants found the courses in these programs to be current. They provided justifications for their lack of up-to-date knowledge in various ways. Burak, a participant, expressed that the courses in Geography and Geography Teaching Undergraduate Programs are unable to keep up with technological advancements. In many academic departments, students are still required to manually create maps using their own hands. The proper utilization of GIS is hindered by overcrowding in certain departments. There exists a disparity in both the course material and geographical comprehension between MEB and YÖK. Merve highlights the insufficient technological advancements, expressing that "the university is unable to keep pace with the current era." Recalling knowledge from memory lacks significance. Population numbers are readily available, yet establishing relationships is crucial. Ahmet, however, expressed that the philosophy of geography courses is inadequately addressed, stating that "the courses lack sufficient coverage of their philosophy and theory." Why a subject is acquired but its understandings are inadequately conveyed. I believe that the study of anthropogenic geomorphology should receive greater emphasis in the curriculum of the geomorphology course. Güneş, who shares similar views with Ahmet, asserts that undergraduate courses lack enough coverage of the philosophy of geography and paradigm teaching. Celal argues that the course titles lack specificity and suggests the inclusion of more specialized courses. On the other hand, Emre contends that undergraduate courses are antiquated, as they predominantly adhere to classical geography principles. We must align our principles with the globalized world values and educational philosophy. For instance, it is seen that they use overarching narratives in their teachings without critically examining them and disregard information from many cultures and locations.

Ideal Curriculum Design for Geography Undergraduate Programs

The second inquiry of the focus group investigation pertained to the inclusion or exclusion of specific courses in geography and geography teaching curricula. The individuals were requested to provide a rationale for their responses. All participants advocate for the elimination of regional geography education. They argue that the current comprehension of geography is not consistent with the understanding of regional geography, and that an excessive amount of time is dedicated to regional geography courses. It is emphasized that these classes primarily focus on memorization, with little emphasis on synthesis. Merve expresses her dislike for the Introduction to Geography course. It would be more rational if there were courses specifically focused on the historical development of the philosophy of geography. Simultaneously, we consider both population and geomorphology. I fail to comprehend the purpose of the existence of this introductory course. Perhaps it would be better suitable to offer this course in a discipline that has a strong correlation with geography.

Participants emphasized the need to incorporate diverse courses within undergraduate geography curricula. Ahmet expressed the need for the inclusion of elective courses, as well as the opportunity to enroll in courses offered by other departments. Additional elective courses facilitate specialization. There ought to be an abundance of laboratory courses available in the field of physical geography. Modules may be used to structure courses. Individual lessons can be strategically designed and accomplished within a single semester, meaning that various modules can be integrated into a single course. Therefore, we can direct our attention towards more precise matters. Ahmet's proposal for modularity is really innovative. It would be feasible to enroll in 2-3 distinct courses, each comprising various modules, within a single semester. These lessons might be far more precise. The participants stress the need for geography courses to have more specialized content, since they find the current courses and their names to be too vague. According to Ahmet's assertion, it is possible to take three distinct courses by developing three separate modules inside a single semester. For instance, many courses like "Tourism in the Polar Regions" (as exemplified by Ahmet), "Environmental Problems in Central Asia," and "Latin American Crime Geography" can be delivered over a period of 14

weeks, divided into 3 modules within a single semester. Naturally, the quantity and characteristics of these modules can be adjusted based on the course material. Ahmet's concept is significant and can be readily executed. Celal expressed that he considers the courses and course names too vague. He suggested that instead of courses like climatology 1-2-3 or geomorphology 1-2-3, the courses may be rearranged to have a more eye-catching name. Emre believes that it is important to provide courses that cover contemporary intellectual movements such as Feminist Geography, Postcolonial Geography, Non-representational Theory, and Marxist Geography. Emre, Merve, and Güneş emphasize that the artificial intelligence course should be moved to the geography department. Conversely, Ahmet and Burak argue that identical concepts are reiterated using several course titles. According to Ahmet, tourism, agricultural, and industrial geography should be included as sub-branches within the economic geography course. Burak, on the other hand, argues that the general themes covered in human and physical geography courses are redundant and decrease overall effectiveness. According to the participants' opinions, the majority of the subjects discussed in the Human Geography of Türkiye course can be revisited in subsequent courses such as Türkiye's Tourism Geography, Türkiye's Population, and Türkiye's Transportation Geography. Consequently, lessons may be needlessly repeated, resulting in inefficient use of time.

Undergraduate Geography Courses and Interdisciplinarity

Two interrelated inquiries were posed to the participants in this section. Are undergraduate courses designed with an interdisciplinary approach? Is this strategy necessary? "What are the justifications for your position?" Every speaker emphasized the absence of an integrative approach in undergraduate courses. Participants substantiated the pertinent issue by providing illustrations. Merve stated that while discussing identity, it encompasses the fields of sociology, psychology, and geography. This is undeniably multidisciplinary. When studying migration, it is necessary to have knowledge in both psychology and sociology. Burak emphasizes that a comprehensive understanding of the subject can only be achieved by incorporating these disciplines, as they are not typically included in undergraduate courses. Biogeography is a field of study that is also part of biology, although we are unable to establish any connection with that discipline. In addition to this, as Merve mentioned, the matter of migration encompasses economic and social aspects, however, our attention is solely directed onto the geographical component. Our primary attention is limited to the distribution of objects in geography. We do not have the capacity to explore other aspects or go into philosophical matters. Similarly, Ahmet stated that geography has connections with other disciplines and incorporates them as well. However, this scenario is never employed. "Interdisciplinarity is of utmost importance," Emre stated, emphasizing the need to incorporate sociology, city planning, and architecture into humanities courses, as well as biology and geology into physical courses. Knowledge is derived from our collective human experiences. He supports his argument by explaining that when we acquire information, we select options from a complex system of concepts and apply them to real-life situations. The network of ideas originates from multiple sources. It comprises numerous sources. Hence, the notions in the field of geography have their origins in various other scientific disciplines.

Courses on Geography of Türkiye

During this portion, the participants were queried with the question, "What are your thoughts regarding the Geography of Türkiye courses?" Participants expressed that the quantity and duration of Turkiye Geography courses exceeded their requirements. Burak suggested the implementation of a single course dedicated to the geography of Türkiye. However, there should not be a large number of classes." When discussing geographical concerns, it is unnecessary to specifically address the geography of Türkiye, as examples from Türkiye already encompass the subject," Merve suggests. Therefore, Türkiye should be examined in terms of its human and physical geography." On the contrary, Güneş asserts that the courses on Physical Geography and Human Geography offered in the departments are satisfactory for Türkiye. Celal, who holds a unique perspective, expressed the necessity of including courses on the Geography of Türkiye. He argued that it is insufficient to merely provide a few instances of our own country, as this fails to address broader human and physical difficulties. "By learning superficially, we are unable to gain a comprehensive

understanding of our country," he asserts, expressing dissatisfaction with the limited availability of Geography of Türkiye courses.

Proportion of Physical and Human Geography Courses

The final inquiry of the focus group investigation was "What should be the ratio of weightage between physical and human geography courses, and what are your rationales?" Participants commonly assert that human geography courses should receive greater priority. Güneş stated, "...The focus should be on individuals, specifically human geography. Greater emphasis should be made on human geography. People are central to geography. Physical geography lessons inevitably intersect with human populations at some juncture. Merve suggested that physical geography education should involve more interpersonal contact. According to Merve, these lectures primarily cover the spatial distribution of various phenomena and provide introductory-level knowledge. Nowadays, this information may be readily accessed with great speed, even from mobile devices. Describing a landscape or place without considering the presence and impact of people is futile. I also require social interaction. When discussing wetlands, it is important to incorporate human activity into the description. The physical and human aspects should be mutually inclusive. Similarly, Emre stated that in the context of globalization, human geography has gained significant prominence. Physical geography encompasses our current understanding of the Earth's natural features and processes. Given the continuous updates and diversification of elements in human geography, it is necessary for the significance of human geography to be increased. Some other individuals have concerns about the clear difference between physical and human geography. Celal asserts that physical and human geography are interrelated disciplines that have a constant mutual influence and interaction. This factor should also be given due consideration during the process of teaching the course. I would argue that one should not be considered more important than the other. Incomplete learning may occur on one side if there is an imbalance in emphasis. "Therefore, both should be approximately equal to 50%," Ahmet stated, emphasizing that human and physical geography are inseparable. The connection between flesh and nail is indissoluble. These two fields are interdependent. It is connected. "According to him, it is essential to teach all lessons by considering both their human and physical dimensions," he states. Similarly, Burak emphasized the necessity for writing to encompass both physical geography and human geography. The visibility of human impact in physical geography should be increased. He considers the divide between physical and human to be insignificant, stating that they should be closely connected.

DISCUSSION, CONCLUSION, RECOMMENDATIONS

Based on the findings of the focus group study, it was concluded that the geography undergraduate courses lack sufficient timeliness. The proposed method to address this issue is to broaden the range of elective courses and streamline the process of selecting courses from different departments. This suggestion is seen as highly viable. Specifically, the assistance provided by the relevant departments in allowing students to enroll in courses from other disciplines enables them to customize their education by offering a diverse range of course options. This model, commonly used by institutions in Europe and the US, provides students with a diverse selection of elective courses based on their own interests. Permitting students to select these courses, regardless of their direct relevance to the discipline of geography, enhances their educational experience and facilitates their acquisition of multidisciplinary viewpoints. To address contemporary educational needs, it would be suitable and efficient to expand the range of courses offered in geography and geography education programs.

The participants particularly emphasized the absence of technology and philosophy instruction in geography sessions, highlighting its relevance and importance. While providing distinct illustrations, the prevailing consensus is that these two domains are subject to greater neglect. Specifically, the participants express that they inquire about the purpose for their enrollment in these courses. The answer to this issue can only be determined by considering the underlying philosophy of the course in question. Thus, it is imperative to present a compelling rationale for why the pertinent courses are being pursued. Furthermore, education that relies heavily on rote learning is specifically subject to criticism. Amidst an era of abundant information

accessibility, there is a growing inquiry as to why rote-based education continues to be widely embraced. While the constructivist method is considered more beneficial in contemporary geography education, it is believed that this approach is not adequately represented in course titles and content.

Participants assert that regional geography courses in Türkiye are not aligned with the contemporary geographical perspective. Balcı (2018), Bilgili (2016), and Özey (2016) provide a critical analysis of this perspective in the existing literature. The statement highlights that classical regional geography is no longer a contemporary paradigm and does not align with the current notion of space (Bilgili, 2016). Nevertheless, numerous colleges continue to offer courses on regional geography. Despite a declining trend, these courses continue to be offered in several disciplines. Participants not only question the presence of these courses but also express dissatisfaction with their content. As per the participants' feedback, regional geography courses mostly focus on rote memory and descriptive methods, resulting in a constrained learning experience for students that revolves around remembering regional boundaries. This circumstance hinders the development of advanced cognitive abilities like analysis and synthesis, as described in Bloom's taxonomy. Within this particular framework, there is a strong emphasis on the necessity to reconfigure and modernize regional geography courses. It is recommended that the course content be structured to foster the development of students' critical thinking abilities, with a particular focus on conducting thorough analyses of geographical concerns.

The survey findings indicate that the participants commonly highlighted the absence of an interdisciplinary approach in geography courses. Nevertheless, it is crucial to comprehend that the multidisciplinary approach extends beyond merely enrolling in courses from other departments. Geography encompasses various sub-disciplines and courses, such as geomorphology, climatology, biogeography, economic geography, population geography, and political geography. These fields allow for an interdisciplinary approach to be taken. These courses have the potential to be restructured in order to provide a more complete geographical outlook. In order to rectify the deficiencies identified by the participants, it is advisable to promote greater interdisciplinary integration in geography education. This integration would provide students with the chance to synthesize viewpoints from many disciplines and comprehend geographical phenomena within a wider framework. An interdisciplinary approach is necessary to comprehend the interaction between climate change, geomorphological processes, and economic elements in global issues.

One outcome of the focus group talks is that the participants generally perceived the quantity of Geography of Türkiye courses to be excessively high. The validity of this approach by the participants should be acknowledged, as numerous prestigious geography departments worldwide, including Oxford, Cambridge, and Berkeley, provide limited courses on the nation of residence. Furthermore, a significant number of these courses consist of redundant subjects. This issue results in substantial depletion of energy and time in the field of geography education. Specifically, modifying the subdivisions of geography to align with the needs of Türkiye and incorporating them into the curriculum greatly diminishes scientific output.

Another finding of the study suggests that students should be provided with a wider range of course options that align with their individual interests. In addition, Bilgili and Kocalar (2020) highlight the imperative of adopting an interdisciplinary approach in today's scientific understanding. This is because the phenomena we encounter are not limited to a single dimension, but encompass various dimensions such as geography, history, society, culture, economy, and politics. Hence, when taking into account the geographical aspect, it is imperative not to exclude other dimensions, as doing so may result in an inadequate geographical perspective. The significance of spatial skills and spatial competence in geography education is often emphasized (Akgün & Yıldırım, 2023; Artvinli, et al., 2022; Gönülaçar & Öztürk, 2020; Kocalar & Demirkaya, 2015; Sezer, Üztemur & Sağlam, 2021; Şanlı, 2019; 2021; Ünlü & Yıldırım, 2017). Nevertheless, the lack of complete attainment of the spatial perspective that would merge physical and human geography remains a significant issue.

Participants perceive the dichotomy between physical and human geography as excessively inflexible and contend that these two subdisciplines can be readily amalgamated. They emphasize that human impacts are often disregarded, particularly in physical geography courses. Assessing physical events in isolation from human impacts is subject to criticism. They stress that physical events such as global warming, climate changes, ecological disruptions, and earthquakes have human dimensions and impacts. Consequently, proponents assert that greater emphasis should be placed on the human aspect when examining physical phenomena, and conversely, on the physical aspect when examining human phenomena. Environmental education is a significant field of education that encompasses both the physical and human aspects. This condition is highlighted by Alım (2006), Dere and Çinikaya (2023a; 2023b), Kocalar (2012), Kocalar and Balcı (2013), and Ünlü, Sever, and Akpınar (2011). An understanding of the interplay between physical and human aspects is crucial in geography education focused on environmental challenges. According to the critical hermeneutic approach, the many elements within the studied phenomena interact with each other, allowing for a more comprehensive analysis of diverse aspects of the phenomenon. Hence, it would be fitting to embrace a methodology that takes into account both the physical and human geography components collectively. Participants highlight that both physical and human geography lack an interdisciplinary aspect, and suggest that the courses should be reevaluated with this in mind. Indeed, upon reviewing undergraduate geography courses, it becomes evident that there is a narrow selection of courses available, and geography is taught in a very separate manner from other academic subjects. Interaction and information exchange with different disciplines are necessary, depending on the course's name and content. Participants frequently emphasize the need of engaging with many academic fields. Without a doubt, this suggestion holds significant importance. However, it is much more crucial to acknowledge that geography already encompasses the data from several other disciplines. The crucial aspect is to portray these statistics in a manner that incorporates a spatial dimension. Within the discipline of economic geography, concepts such as globalization, uneven development, and neoliberal policies are covered. However, the spatial aspect is not given much emphasis and the related issues are usually discussed in a descriptive manner. Economic geography encompasses information derived from disciplines such as economics, political science, and sociology. It is crucial to interpret these facts from a geographical standpoint.

The overall findings of the study indicate that the currency of the courses in geography and geography teaching programs in Türkiye is inadequate. The course titles are somewhat broad, and there is a limited selection of courses on specific subjects. Given the circumstances, it is advisable to augment the quantity of specialized courses and provide them as distinct modules. Furthermore, the curriculum is burdened by a large number of courses and lengthy durations specifically focused on Regional Geography and Geography Türkiye, thus diminishing its overall effectiveness. Geography courses have not adequately developed the interdisciplinary approach and have had limited interaction with other disciplines. The current situation necessitates a reassessment in order to offer a more all-encompassing viewpoint in the field of geography education. The study's conclusions indicate a necessity to reassess and reorganize geography curricula. During this revision process, it is crucial to consider the viewpoints of teachers, students, and other stakeholders in order to produce a more streamlined educational environment.

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From Awareness to Attitude and Behavior? Relationships among Pre-Service Science Teachers' Awareness of Sustainable Development, Attitudes and Behaviors towards Environmental Issues[1]

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ABSTRACT

This research aims to explore relationships among science teacher candidates' awareness of sustainable development, attitudes and behaviors towards environmental problems. For this purpose, initially, pre-service science teachers' (PSTs) awareness of sustainable development, attitudes and behaviors towards environmental problems were determined. Then, the relationships among PSTs' awareness about sustainable development, attitudes and behaviors towards environmental problems were explored. In the present study, correlational research method was conducted. The sample of research were 712 pre-service science teachers from four different public universities in Istanbul, Türkiye. The data were collected with 3 different data collection tools which are 'Sustainable Development Awareness Scale', 'Environmental Problems Attitude Scale' and 'Environmental Problems Behavior Scale'. Descriptive statistics and Pearson correlation analysis were conducted in the data analysis. Findings showed that PSTs' awareness about sustainable development and attitudes towards environmental issues are high level while their behaviors towards environmental problems are medium level. Furthermore, both the relationship between PSTs' awareness of sustainable development and PSTs' attitudes against environmental problems and the relationship between PSTs' attitudes towards environmental issues and their behaviors towards environmental issues are positively directed medium level. In addition, the relationship between PSTs' awareness of sustainable development and PSTs' behaviors against environmental problems is positively directed low level. The results of current study can contribute significantly to generate new ideas about that which courses and practices about sustainable development and environmental issues can be placed in higher education or how sustainable development and environmental issues can be integrated with courses, and how educators can plan their lessons effectively.

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INTRODUCTION

Today, our world has been suffering from critical environmental challenges like global warming, climate change, different types of pollution (air, water, soil etc.), water shortages, loss of biodiversity etc. These challenges threaten the continuity of our world and mankind by causing harmful effects on not only some regions and countries but also whole world. One of the most crucial reasons why our world has faced these environmental challenges is mainly the human actions (DuNann-Winter & Koger, 2004; Gardner & Stern, 2008; Klaniecki et al., 2019; Shafiei & Maleksaeidi, 2020; Steg & Vlek, 2009; Vlek & Steg, 2007; Williams & Cary, 2002). Therefore, the change of human actions is vital for managing and solving environmental problems. The important points in the transformation of human actions are to understand underlying factors of human attitudes and behaviors toward environmental problems and how those can be changed or improved. Surely, answering these questions is extremely complex. Research done so far showed that human actions toward environmental problems are affected by many different factors like demographic, internal (e.g. pro-environmental knowledge, awareness, motivation, values, emotion, attitudes, and responsibilities) and external factors (e.g. economic, social, institutional and cultural) (Blok et al., 2015; Hines et al., 1987; Kollmuss & Agyeman, 2002; Li et al., 2019; Mainieri et al. 1997; Vicente-Molina et al., 2013). All this research helps us to understand many factors affecting human actions toward environmental issues. There can be many other factors which affect environmental attitudes and behaviors. Therefore, we tried to explore the effect of another variable which can be a factor for the change of human attitudes and behaviors towards environmental problems in the current research. Awareness of sustainable development can be another factor which affects human attitudes and behaviors towards environmental problems because some research emphasized that high awareness about sustainable development (based on 3 dimensions: environmental, economic and social) can encourage environmentally friendly attitudes and actions (Rajapaksa et al., 2018; Yusliza et al., 2020). Fien (2006) emphasized that individuals who have high awareness about sustainable development are more conscious about environmental problems, more sensitive toward environmental protection and effectively involved in achieving sustainable development at local, national and international level. Moreover, Çobanoğlu & Türer (2015) emphasized that if teachers have high sensitivity to the environment, they can help students gain knowledge and skills toward environmental and sustainability issues. Pre-service science teachers are future-trainers and role-models to cope with environmental problems and achieve sustainable development (Keleş, 2017). Pre-service teachers can play a key role in the way they teach and prepare their students for the future (García-González et al.,2020). They can train students about environmental issues and sustainable development through science courses and elective environmental education courses (Çobanoğlu & Türer, 2015). Therefore, in order to cope with environmental challenges in today's world and develop practical solutions for a sustainable world, pre-service science teachers, who are the shapers of future generations, should be well equipped. In this manner, it is aimed to explore the relationships among pre-service science teachers' (PSTs') awareness of sustainable development and their attitudes and behaviors towards environmental issues in the current research.

Research Background

Sustainable Development and Education

From past to present time, the different kinds of problems like environmental, economical and social have gradually been increasing in the world because of many reasons such as rapid population growth, urbanization, industrialization and toxic wastes etc. In our present time, in order to cope with these problems, achieving sustainable development with all aspects together is a common important goal of many countries all over the world. Sustainable development refers to "the development that meets the need of the present without compromising the ability of future generations to meet their own needs" (World Commission on Environment and Development [WCED], 1987, p.43) and includes 3 different aspects (environmental, economical, social) (Strange & Bayley, 2008). Sustainable development involves the pursuit of a harmonious balance between these aspects that is, economic, environmental and societal imperatives (Ferguson et al., 2021). One of the most crucial steps for achieving sustainable development with all aspects both locally and globally is education

(Montebon, 2018; Nasibulina, 2015; UNESCO, 2013). However, sustainable development issues are not integrated enough into education systems (Bell, 2016; Biçer & Bulut, 2023; Dere & Demirci-Dölek, 2024; Tejedor et al., 2018). Developing a sustainable world requires not only the work of sustainable development experts but also the work of teachers and students whose efforts contribute to a more sustainable world (Moghadam et al., 2022).

Awareness of Sustainable Development

Teachers are critical agents in delivering the content and facilitating skills and action competencies to achieve sustainable development (Ferguson, Roofe & Cook, 2021). One of the policy action for the achievement of the sustainable development is to raise awareness of the sustainable development in higher education (Manolis & Manoli, 2021; Michael et al., 2020). Especially science and social studies teachers have key role to teach sustainable development issues at both science and social studies courses and elective courses like environmental education and climate change (Dere & Çinikaya, 2023; Fidan-Yazgan & Benzer, 2023). Therefore, pre-service teachers should have high awareness about sustainable development before they teach in classrooms as future professionals who can teach theoretical and practical knowledge necessary for achieving sustainable development. In the current literature, there are some researches about pre- and in-service teachers' awareness about sustainable development (Borg et al., 2014; Karpudewan et al., 2013; Khalid Malik et al., 2022; Labog, 2017; Nikel, 2007; Omisore et al.,2017; Omowunmi Sola & Michael, 2016; Öztürk-Demirbaş, 2011; Sunthonkanokpong & Murphy, 2019). All these studies showed that pre- or in-service teachers' awareness of sustainable development is high or adequate level.

Attitudes and Behaviors towards Environmental Issues

Environmental problems have been one of the major challenges facing humanity in today's world. Environmental problems can be defined as the processes that have negative effects on organisms and key elements needed for well-being of all livings such as air, water, soil as a result of human actions or mistreatments to environment (National Research Council [NRC], 1997; Pant et al., 2020). As understood from the definition, the most important reasons of environmental problems are people' attitudes and behaviors to environment. Environmental attitude refers to a set of feelings and values for the environment and the motivation for participating in environmental protection actively (United Nations Educational, Scientific and Cultural Organization [UNESCO], 1978). On the other hand, environmental behavior can be defined as consciously minimizing the negative impacts of actions on the environment like minimizing the usage of resources and reducing waste (Kollmuss & Agyeman, 2002). There is a need to increase positively environmental attitudes and behavior because environmental degradation is a general problem of humanity (Karpudewan & Ismail, 2012). Dobson (2007) emphasized that individuals, institutions and organizations should change their attitudes and behaviours to achieve sustainable development globally. As future educators of humanity, teacher candidates' level of attitudes and behaviors towards environmental problems are crucial because they have responsibility to raise individuals to deal with environmental problems and find solutions for them. Teachers' attitudes and actions can influence and shape learners' attitudes and actions. In the related literature, there are several studies about pre- and in-service teachers' attitudes toward environmental problems (Alpak-Tunç & Yenice, 2017; Arık & Yılmaz, 2017; Balcı, 2012; Kahyaoğlu & Özgen, 2012; Koç & Kuvaç, 2016; Major et al., 2017; Mansaray et al., 1998; Özerkeskin et al., 2012; Polat & Kırpık, 2013; Sadık & Sadık, 2014; Sarıkaya & Saraç, 2018; Tuncer et al., 2017; Uyanık, 2017). Most of these research demonstrated that science teacher candidates' attitudes toward environmental problems are generally medium or high level. On the other hand, many studies addressing pre-and in-service teachers' behaviors toward environmental issues revealed pre-service science teachers' behaviors toward environmental problems are medium or low level (Alper, 2014; Hsu & Roth, 2006; Khalid Malik et al., 2022; Pe'er et al., 2007; Tan, 2014; Timur et al., 2014).

Relationships among Awareness-Attitude-Behavior

In the literature, there are a lot of researches about preconditions for environmental behaviors since the basic goal of environmental education is to enhance behavior and to improve active citizenship

(Heimlich & Ardoin, 2008; Hungerford & Volk, 1990; Short, 2009). Therefore, many studies addressing various aspects of environmental behavior were conducted (Amoah & Addoah, 2020; Carmi et al., 2015; Eilam & Trop, 2012; Grob, 1995; Hansla et al., 2008; Kil et al., 2014; Kollmuss & Agyeman, 2002; Levy et al., 2018; Liu et al., 2020; Vicente-Molina et al., 2013). All this research showed that there are many different factors like demographic, internal (e.g., pro-environmental knowledge, awareness, attitudes, emotion, responsibilities) and external factors (e.g, social, economic, and cultural) as preconditions for environmental behavior (Ajzen, 1991; Kollmuss & Agyeman, 2002; Mainieri et al., 1997; Redondo & Puelles, 2016; Stern, 2000; Schultz, 2002; Vicente-Molina et al., 2013). According to research in related literature, it is obvious that there is a correlation among environmental awareness, environmental attitudes and environmental behaviours (Horvat & Smrekar, 2017; Kollmuss & Agyeman, 2002). However, the important points are the degree and direction of these correlations in terms of developing environmental behavior. Research showed that awareness can be an important determinant for environmental attitudes and environmental attitudes can be crucial determinant for environmental behavior (Gifford & Sussman, 2012; Marcinkowski & Reid, 2019; Newhouse, 1991). On the other hand, awareness may not be a direct condition for environmental behavior although there are relationships between each other. That is, even if individuals' awareness or knowledge is high level, they can remain rather indifferent to environmental behavior (Eom, 2019; Kaiser & Fuhrer, 2003; Moody-Marshall, 2022; Wi & Chang, 2018; Yılmaz & Can, 2020). In other words, enhanced environmental or sustainable development awareness generally can lead to positive environmental attitudes but it may not be enough to create environmental behavior. Therefore, the current research aims to explore whether pre-service science teachers' (PSTs') awareness about sustainable development is related with their attitudes and behaviors towards environmental issues. The research questions of this study are as follows:

- What are the levels of PSTs' awareness about sustainable development, attitudes and behaviors towards environmental issues?
- Are there significant relationships among PSTs' awareness about sustainable development, attitudes and behaviors towards environmental issues?

METHOD

Research design

This research was conducted with the design of correlational research. The correlational model is the quantitative research method revealing the relationships between two or more variables without manipulation of an independent variable (Büyüköztürk et al., 2016; Cohen et al., 2007). According to Fraenkel and Wallen (2006), correlational research can be seen one kind of descriptive research because it reveals existing relationships between variables. Correlational research also provides the direction and degree of relationships among variables (Fraenkel & Wallen, 2006). Therefore, the relationships among PSTs' awareness of sustainable development and attitudes and behaviors towards environmental problems were explored in the current study.

Research Sample

The sample of study is 712 (625 female and 87 male) pre-service teachers who were all grade level students (1., 2., 3. and 4.) from the department of science education at four different public universities in Istanbul, Türkiye. In this study, the sample was chosen as pre-service science teachers because they are future-trainers and role-models to cope with environmental problems and achieve sustainable development. All PSTs participated in this study voluntarily.

Data Collection

The data were collected with 3 different data collection tools. 'Sustainable Development Awareness Scale' developed by Öztürk-Demirbaş (2011), 'Environmental Problems Attitude Scale' developed by Güven (2013) and 'Environmental Problems Behaviour Scale' developed by Güven & Aydoğdu (2012)

were conducted to science teacher candidates in this research. Before the data collection process, the aim of the research was explained to PSTs, and they participated in the study voluntarily. There is detailed information about data collection tools below.

Sustainable Development Awareness Scale

'Sustainable Development Awareness Scale' developed by Öztürk-Demirbaş (2011) consists of 3 sub-dimensions (environmental-moral, communal-social and environmental-economic) and 30 items. In this scale, there are 14 items about environmental-moral subdimension, 9 items about communal-social subdimension and 7 items about environmental-economic subdimension. This scale is 5-point likert-type, and it was scaled like '1- disagree at all', '2-disagree', '3-undecided', '4-agree', '5-totally agree' for each item by developer. The Cronbach's-alpha coefficient was found 0,849 by developer. In the current research, the Cronbach's-alpha coefficient was calculated as 0,862. Because items' number in sub-dimensions are different from each other, scores obtained from items are not standard. Therefore, developer and researchers used the formula below for the purpose of standardization of obtained scores at scale.

$$X_{standard\ score}=\frac{X_{raw\ score}}{Items\ number\ at\ scale}\text{x}20$$

In this way, pre-service science teachers can get 20 points at least while they can get 100 points at most from this scale. According to obtained scores, if obtained scores between 20 and 46, awareness level is low, if obtained scores between 47 and 72, awareness level is medium and if obtained scores between 72 and 100, awareness level is high.

Environmental Problems Attitude Scale

'Environmental Problems Attitude Scale' was developed by Güven (2013) by following affective domain steps of Bloom's taxonomy (i.e. receiving, responding, valuing, organizing and characterizing). The scale consists of 45 items and 5 factors and is based on the reasons of environmental problems, local and global environmental problems, and preventing environmental problems. In addition, the scale is 3-point likert-type, and it was scaled like '2-agree', '1-undecided', '0-disagree' for each item by developer. The aim of developing this scale was to examine pre-service teachers' fears, uneasiness, anxiousness and sadness arising from environmental problems, and their value judgments and readiness level about environmental problems (Güven, 2013). The Cronbach's-alpha coefficient was found 0,88 by developer. In the current research, the Cronbach's-alpha was calculated as 0,832. Pre-service teachers can get 0 point at least while they can get 90 points at most from this scale. According to obtained scores, if obtained scores between 0 and 45, awareness level is low, if obtained scores between 45 and 72, awareness level is medium and if obtained scores between 72 and 90, awareness level is high.

Environmental Problems Behaviour Scale

'Environmental Problems Behaviour Scale' was developed by Güven & Aydoğdu (2012) by considering psychomotor domain steps of Bloom's taxonomy (i.e. perception, set, guided response, mechanism, complex overt response, adaptation and origination). The scale consists of 40 items and 6 factors and is based on reasons of environmental problems, local and global environmental problems, and preventing environmental problems. Moreover, the scale is 3-point likert-type, and it was scaled like '2-agree', '1-undecided', '0-disagree' for each item by developers. The aim of developing this scale was to determine pre-service teachers' behaviors and efforts to prevent environmental problems and their readiness level about environmental problems (Güven & Aydoğdu, 2012). The Cronbach's-alpha coefficient was found 0,85 by developers. In the current research, the Cronbach's-alpha reliability coefficient was calculated and found as 0,829. Pre-service teachers can get 0 point at least while they get can 80 points at most from this scale. According to obtained scores, if obtained scores between 0 and 40, behavior level is low, if obtained scores between 40 and 60, behavior level is medium and if obtained scores between 60 and 80, behavior level is high.

Data Analysis

In the data analysis, SPSS was used to assess PSTs' awareness of sustainable development, attitudes and behaviors towards environmental issues and the relationships among awareness about sustainable development, attitudes and behaviors against environmental issues. Firstly, PSTs' total awareness scores about sustainable development and scores for each subdimension (environmental-moral, communal-social and environmental-economic) calculated with descriptive statistics. Similarly, PSTs' scores about attitudes and behaviors toward environmental problems were calculated with descriptive statistics. Then, by using descriptive statistics, the mean, minimum and maximum scores of 712 PSTs' awareness about sustainable development and its subdimensions (environmental-moral, communal-social and environ-mental-economic), and their attitudes and behaviors toward environmental problems were calculated. In this way, PSTs' general awareness about sustainable development, attitudes and behaviors levels towards environmental problems were revealed. In order to investigate the relationships among PSTs' awareness of sustainable development and PSTs' attitudes and behaviors towards environmental problems, Pearson correlation analysis from parametric statistical methods were conducted since the data were distributed normally (Büyüköztürk, 2016; Pallant, 2007).

Ethic

The current study was conducted in accordance with the approval by the ethics committee of Akdeniz University (protocol code 55578142).

FINDINGS

In this study, PSTs' awareness about sustainable development, attitudes and behaviors towards environmental problems were determined. In addition, the relationships among PSTs' awareness about sustainable development, attitudes and behaviors towards environmental problems were explored. The results are presented under separate headings at below.

PSTs' Awareness of Sustainable Development

According to the findings, PSTs have high awareness of sustainable development (M=85,58) (Table 1). When PSTs' awareness about sustainable development was examined in terms of subdimensions of sustainable development, it was seen that their awareness about environmental-moral (M=91,16) and communal-social (M=88,00) subdimensions were high level, but their awareness about environmental-economic (M =71,31) subdimension was medium level. Moreover, findings demonstrated that PSTs have the highest awareness about environmental-moral dimension of sustainable development.

Table 1. *Descriptive statistics results related to PSTs' awareness of sustainable development*

	N	Mean	SD	Min.	Max.
Awareness of Sustainable Development	712	85,58	7,33	68,00	100,00
Environmental-Moral	712	91,16	7,03	68,57	100,00
Communal- Social	712	88,00	8,90	57,78	100,00
Environmental-Economic	712	71,31	17,59	20,00	100,00

PSTs' Attitudes and Behaviors toward Environmental Problems

Findings showed that pre-service science teachers' scores about attitudes towards environmental problems were high level (M =73,47) while their scores about behaviours towards environmental problems were medium level (M =56,67) (Table 2).

Table 2. *Descriptive statistics results related to PSTs' attitudes and behaviors toward environmental problems*

	N	Mean	SD	Min.	Max.
Attitudes toward Environmental Problems	712	73,47	8,72	45,00	89,00
Behaviors toward Environmental Problems	712	56,67	9,48	30,00	78,00

Relationships among PSTs' Awareness of Sustainable Development, and Attitudes and Behaviors toward Environmental Problems

Table 3 demonstrates the pearson correlation results about relationships among PSTs' awareness of sustainable development, and their attitudes and behaviors toward environmental problems. According to the findings, there is a positive relationship between PSTs' awareness about sustainable development and attitudes toward environmental problems in medium level (r=0,458, p<.01). Similarly, results indicated that there is a positive relationship between PSTs' attitudes and behaviours towards environmental problems in medium level (r=0,626, p<.01). On the other side, the results demonstrated that there is a positive relationship between PSTs' awareness about sustainable development and behaviours towards environmental problems in low level (r=0,294, p<.01).

Table 3. *Pearson correlation test results related to relationships between PSTs' awareness of sustainable development, and attitudes and behaviors toward environmental problems*

		Awareness of Sustainable Development	Attitude towards Environmental Problems	Behaviors towards Environmental Problems
Awareness of Sustainable Development	Pearson Correlation	1	,458**	,294**
	p (2-tailed)		,000	,000
	N	712	712	712
Attitudes towards Environmental Problems	Pearson Correlation	,458**	1	,626**
	p (2-tailed)	,000		,000
	N	712	712	712
Behaviors towards Environmental Problems	Pearson Correlation	,294**	,626**	1
	p (2-tailed)	,000	,000	
	N	712	712	712

DISCUSSION & CONCLUSION

Discussion

In the current research, PSTs' awareness of sustainable development, attitudes and behaviors against environmental issues were determined. Then, the relationships among PSTs' awareness of sustainable development, attitudes and behaviors towards environmental issues were explored. Results showed that PSTs' awareness of sustainable development is high level. Omowunmi Sola and Michael (2016) also revealed that university students have high awareness about sustainable development in their study. In addition, PSTs' awareness was examined in each sub-dimension of sustainable development which are environmental-moral, communal-social and environmental-economic. Their awareness about environmental-moral and communal-social subdimensions are high level but their awareness about environmental-economic is medium level. Research conducted with science teacher candidates in different fields supports the current research. Although pre-service teachers have high awareness about environmental and social sub-dimensions of sustainable development, their awareness about economic sub-dimension of sustainable development was not sufficient

level (Borg et al., 2014; Öztürk-Demirbaş, 2011; Türer, 2010). This result revealed that it should be taken in consideration and emphasized to the objectives about economic subdimension in education for sustainable development (ESD). Furthermore, in education programs for sustainable development, each subdimension of sustainable development should be equally emphasized in order that science teacher candidates can have a holistic approach about sustainable development.

The current study also showed that scores of science teachers candidates' attitudes toward environmental problems are high level. Many studies conducted previously revealed similar conclusions (Alpak-Tunç & Yenice, 2017; Balcı, 2012; Borhan & Ismail, 2011; Öz-Aydın et al., 2013; Sarıkaya & Saraç, 2018). On the other hand, scores of science teacher candidates' behaviors towards environmental problems are medium level. Alper (2014) and Güven & Aydoğdu (2012) also revealed in their study that PSTs' environmentally friendly behaviors are medium level. In another study, Sadık and Sadık (2014) found that PSTs' behaviors toward environmental problems were low level.

The most important finding of the current research is that the relationships among PSTs' awareness of sustainable development, attitudes and behaviors towards environmental problems. According to the results, the relationship between PSTs' awareness of sustainable development and their attitudes toward environmental problems is positively directed medium level. Similarly, there is a positive medium level relationship between PSTs' attitudes and behaviors toward environmental problems. However, the relationship between PSTs' awareness of sustainable development and their behaviors towards environmental problems is low level in positive direction. Pe'er, Goldman & Yavetz (2007) also revealed in their research that there is a low relationship between pre-service teachers' environmental knowledge (awareness) and environmental behaviors. Shafiei and Maleksaeidi (2020) and Zeng, Zhong, and Naz (2023) demonstrated in their research that environmental attitude is the direct determinant of environmental behavior and impacts it positively. Similarly, Liu, Teng & Han (2020) showed that environmental knowledge (awareness) has an important positive effect on environmental attitudes and environmental attitudes have a considerable positive effect on environmental behavioral intentions and environmental behaviors. On the other hand, awareness may not be a direct condition for environmental behavior although there are relationships between each other. That is, even if individuals' awareness or knowledge is high level, they can remain rather indifferent to environmental behavior (Eom, 2019; Kaiser & Fuhrer, 2003; Liu et al., 2020; Moody-Marshall, 2022; Wi & Chang, 2018; Yılmaz & Can, 2020). From these results, it can be inferred that although pre-service teachers have high awareness about sustainable development and positive attitudes towards environmental problems, they may not take an action as an environmentally friendly. This means that high awareness and positive attitude are not only determinants to create and develop positive behaviors towards the environment. There can be many other factors affecting environmental behaviors like demographic factors, external factors and internal factors (Hwang et al., 2000; Kollmuss & Agyeman, 2002; Vicente-Molina et al., 2013). Therefore, developing environmental behavior is a complex process and cannot be explained with a one framework or diagram (Hwang et al., 2000; Kollmuss & Agyeman, 2002; Liu et al., 2020).

Conclusions

The current research presented significant data about that PSTs' awareness of sustainable development and attitudes towards environmental problems are high level while their behaviors towards environmental issues are medium level. Moreover, the research revealed that both the relationship between PSTs' awareness of sustainable development and their attitudes towards environmental problems and the relationship between PSTs' attitudes towards environmental issues and their behaviors towards environmental issues are positively directed in medium level. On the other hand, the relationship between PSTs' awareness of sustainable development and their behaviors toward environmental problems is positively directed low level. This research is crucial in terms of giving feedback about PSTs' awareness of sustainable development, attitudes and behaviors towards environmental issues and the relationships among these variables to researchers, educators, curriculum designers for teachership programs, academicians and educational policy makers. The current study can contribute significantly to generate new ideas about that which courses and practices about sustainable

development and environmental issues can be placed in higher education or how sustainable development and environmental issues can be integrated with courses, and how academicians can plan their lessons effectively. Education has the key role for achieving sustainable development. Teachers especially science teachers have considerable responsibility to raise awareness about sustainable development of individuals. If science teachers' awareness of sustainable development should be adequate level before graduation of university, they can help students gain awareness about sustainable development. Therefore, they can guide their students' environmentally friendly attitudes and behaviors. Quality education aiming to improve pre-service science teachers' awareness, attitude and behavior levels can make an important contribution to the society's awareness of sustainable development, the society's awareness of local and international environmental problems, and most importantly, the positive change in attitudes and behaviors towards environmental problems.

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A Bibliometric Analysis of Studies on Sustainability in Mathematics Education Based on Web of Science Database

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ABSTRACT

This research aims to conduct a bibliometric analysis of studies on sustainability in mathematics education found in the Web of Science database. It is believed that this study will make a significant contribution to the literature on sustainability in mathematics education, serving as a valuable resource for researchers considering work in this field. To analyze the obtained data, the bibliometric analysis method, a quantitative research model, has been utilized. Through this method, targeted research has been conducted by scanning the Web of Science database using relevant keywords, resulting in the examination of 296 works published from 1997 to the present. The distribution of selected studies has been detailed according to publication years, categories, authors, institutions, countries, types, subject areas, and the most cited works. Additionally, network maps illustrating co-authorship relationships among authors, co-authorship relationships among countries, common keywords, citation matching by institutions, co-citation networks based on cited works, co-citation networks of cited journals, and co-citation networks of cited authors have been provided in the findings section. The results indicate that various aspects of sustainability in mathematics education have been addressed through numerous studies conducted from 1997 to the present.

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INTRODUCTION

In recent years, the concept of sustainability has gained significant importance as a means of addressing issues such as climate change, environmental degradation, and societal challenges. Sustainability refers to meeting present needs without compromising the ability of future generations to meet their own needs. Achieving and maintaining sustainability requires a broad transformation in consumption patterns, production perspectives, and social structures (Maniatis, 2023). Since the recognition of the necessity of these changes, the concept of sustainable development has come to the forefront (Aghion & Howitt, 1997).

Education for Sustainable Development (ESD) is essential for fostering the social transformation required to build a peaceful, prosperous, and sustainable world, as well as for nurturing individuals who can take active roles and act responsibly toward both themselves and society (United Nations Educational, Scientific and Cultural Organization, 2020). Education plays a crucial role in raising awareness and fostering a new perspective on sustainable development in all aspects of individuals' and communities' lives (Bulut & Polat, 2019). At this point, there is a significant relationship between sustainability and education, as educational activities aim to create a more sustainable future for society by following a sustainable path (Öztürk, 2017; Çoruk & Turhan, 2024).

The presence of sustainability and sustainable development in mathematics education has been evident in various parts of the mathematics curriculum (Vásquez et al., 2021). Issues arising from social, economic, and environmental challenges, as well as their solutions, can be better understood through mathematics (National Council of Teachers of Mathematics, 2000). Integrating the concept of sustainability into mathematics education not only deepens students' mathematical understanding but also strengthens their ability to transfer and apply these skills across different disciplines. Additionally, fostering sustainability awareness among students equips them with the necessary tools to face future environmental, economic, and social challenges. In this context, addressing mathematics education through a sustainability perspective contributes to the development of students as more conscious and responsible individuals (Serow, 2015). It plays a critical role in helping students connect real-life problems with their own environments, thereby highlighting the importance and role of sustainability in mathematics education (Renert, 2011).

Numerous studies have explored the relationship between sustainability and mathematics education, highlighting its importance (Li & Tsai, 2021; Petocz & Reid, 2003; Renert, 2011; Wals & Corcoran, 2004). In their research, Petocz and Reid (2003) examined how the concept of sustainability can be understood and applied within mathematics education. The researchers emphasized that mathematical thinking is a crucial tool for understanding and addressing sustainability issues. Their study demonstrates how integrating the concept of sustainability into mathematics education can enhance students' mathematical skills while also fostering greater awareness of sustainability. The research offers recommendations for sustainability-based mathematics education, arguing that the integration of these two disciplines can raise both academic and societal awareness among students.

In his research, Renert (2011) argues that mathematics education should be reconsidered through a sustainable approach. The researcher emphasizes the need to relate mathematics more meaningfully to daily life, as this could help students develop more positive attitudes toward the subject. Renert also highlights that sustainable mathematics education should not solely focus on technical knowledge but should enable students to develop critical thinking, problem-solving skills, and social responsibility. The study suggests new pedagogical approaches to make mathematics education more relevant and integrated into students' lives.

Li and Tsai (2021), in their study, examined how Education for Sustainable Development (ESD) can be integrated into the context of mathematics education. The researchers stressed the crucial role of mathematical thinking and problem-solving skills in achieving sustainable development goals. Their

research provided a theoretical framework for integrating ESD into mathematics education, focusing on pedagogical strategies and practical applications. Additionally, they addressed the challenges encountered during this integration process and proposed solutions to overcome these obstacles. The study offers a roadmap that can help students gain a deeper understanding of both mathematical and sustainability-related concepts.

Research provides an in-depth overview of the general state of the literature, revealing current trends and developments. These studies not only help us track the latest innovations in the field but also build upon the knowledge accumulated from previous research. As such, they serve as a guide for researchers in determining the direction of future studies. Additionally, these studies help identify gaps in the field and determine which topics should be prioritized. Scientific reviews conducted on specific topics play a critical role in establishing a solid foundation for future research, helping to define trends and priorities (Falkingham & Reeves, 1997). Yıldırım and Şimşek (2021) also emphasized in their research that synthesizing studies is important, offering a reliable and practical resource for future work. In the literature, various studies that analyze and synthesize research on different topics are observed (Çelik et al., 2018; Kaya & Dinçer, 2023; Sandelowski & Barroso, 2003; Saraçoğlu & Aşılıoğlu, 2022; Techentin et al., 2014). However, upon reviewing the literature, it is evident that a bibliometric analysis of studies on sustainability in mathematics education within the Web of Science database has not yet been conducted.

Therefore, this study aims to conduct a bibliometric analysis of research on sustainability in mathematics education, based on the Web of Science database. It is anticipated that this study will make a significant contribution to the literature on sustainability in mathematics education and offer a comprehensive literature review by compiling existing research in the field. Through this approach, researchers interested in focusing on sustainability in mathematics education will be able to assess the current state of the field and shape their own studies accordingly. The sub-problems identified within this framework are presented below. These problems will guide researchers and provide support in determining the direction of their work.

In the Web of Science database, studies on sustainability in mathematics education:

What is the distribution of studies on sustainability in mathematics education, in the Web of Science database, based on the following: year, category, author, institution, country, type, subject area, journal, and most-cited works?

What does the network map look like for the following aspects of studies on sustainability in mathematics education in the Web of Science database: co-authorship relationships by authors, co-authorship relationships by countries, common keywords, bibliographic coupling by institutions, co-citations by cited works, co-citations by cited journals, and co-citations by cited authors?

METHOD

Research design

This study aims to conduct a bibliometric analysis of research on sustainability in mathematics education based on the Web of Science database. Advances in information technology have facilitated faster, easier, and more economical access to information, leading to a substantial increase in the volume of accessible data. In this context, evaluating the obtained information, ensuring the reliability and currency of sources, and preventing the formation of useless data piles are critical. Therefore, analyzing data by classifying it, rather than handling it in bulk, makes it possible to obtain accurate, reliable, and sufficient information. Bibliometric analysis is one method that can be used for this purpose. Bibliometric studies are important works that examine the existing literature in a specific scientific field to reveal the current state, trends, and development processes of the field (Üsdiken & Pasadeos, 1993). Similarly, bibliometric analysis is a method widely used across various disciplines today, applied to examine the

structure and dynamics of academic and scientific work within a particular field. This technique has become an indispensable tool for understanding the development of a discipline and evaluating emerging research trends in that area. Additionally, this analytical method provides insights into the general state of the field and helps determine future research directions (Borgman & Furner, 2002). Based on this information, data will be analyzed through the creation of tables and scientific field maps, focusing on publication years, sources, authors, connections, countries, types, subject areas, co-authorship, common keywords, bibliographic coupling, and co-citation.

Data Collection

In accordance with the objective of the study, the scope of research on sustainability in mathematics education in the literature has been determined through a bibliometric analysis of studies published in the Web of Science database.

Web of Science is a multidisciplinary database that serves as an indispensable information resource for researchers, academics, and scientists worldwide. Initially launched in the 1960s by the Institute for Scientific Information (ISI) and currently operated by Clarivate Analytics, Web of Science allows for the systematic indexing of academic works published across a broad range of fields, including science, technology, social sciences, arts, and humanities. The platform offers a rich database containing millions of journal articles, conference papers, books, patents, and other academic resources. One of Web of Science's most powerful features is its citation analysis and research performance metrics. These tools enable the examination of a work's impact within the scientific community, its relationship with other studies, and citation counts. As a result, researchers can track the most current and influential works in their fields, monitor scientific trends, and better position their own research. Web of Science also provides capabilities for broader analyses, such as research funding, institutional performance, and scientific collaborations. Researchers can gain in-depth information on specific topics, authors, institutions, or journals, using this information to enhance literature reviews, identify future research topics, and shape academic publishing strategies. The comprehensive data and analytical tools offered by Web of Science make it a reference point within the global academic community (Clarivate, 2024).

To identify studies for the bibliometric analysis research method, a comprehensive literature review was conducted at the beginning of the research process based on the defined research questions. As a result of this review, relevant studies from the Web of Science database were selected. During the data collection phase, content analysis was performed to determine which studies to include, and consultations were held with experts in the field regarding the selection of keywords. Based on the feedback from these experts, keywords were established, and the research was refined using these keywords. In reviewing the literature, searches were conducted using the keywords "Sustainability in Mathematics Education," "Sustainability and Mathematics Education," "Sustainable Development in Mathematics Education," and "Sustainable Development and Mathematics Education." Studies that contained these keywords in their titles, keywords, or abstracts were identified and examined. As a result, all studies from the past to the present, across all indices, document types, publishers, institutions, authors, languages, and Web of Science categories were included in the research, leading to a total of 296 studies. The selected studies were then exported for the analysis phase.

Data Analysis

VOSviewer is a software tool designed for constructing and visualizing bibliometric networks (Eck & Waltman, 2017). This software is developed to analyze relationships between scientific publications and citations, presenting these relationships in visual maps. VOSviewer excels in visualizing concept networks, co-citation analyses, author collaborations, and the evolution of terms over time, particularly when working with large datasets. Its user-friendly interface allows researchers to easily examine the overall structure and dynamics of literature across different disciplines, identify research trends and gaps. Additionally, the maps created with VOSviewer contribute to a better understanding of academic work

and reveal significant connections and interactions in the literature. Consequently, VOSviewer has become a widely preferred tool in bibliometric analyses (Eck & Waltman, 2010).

In this study, the Web of Science database, which provides extensive global academic content, was utilized as a key resource. During the research process, the bibliometric mapping feature of VOSviewer software was employed to conduct the required analyses, enabling the creation of detailed maps for in-depth examination. Findings related to the questions posed were directly obtained from the database in tabular form and analyzed. This process integrated both the tabular analyses conducted through the Web of Science database and the bibliometric maps generated using VOSviewer, with results being carefully interpreted. All these findings are presented comprehensively and in detail in the results section. This approach has expanded the scope of the research and allowed for a more profound analysis of the findings.

Validity and Reliability of the Study

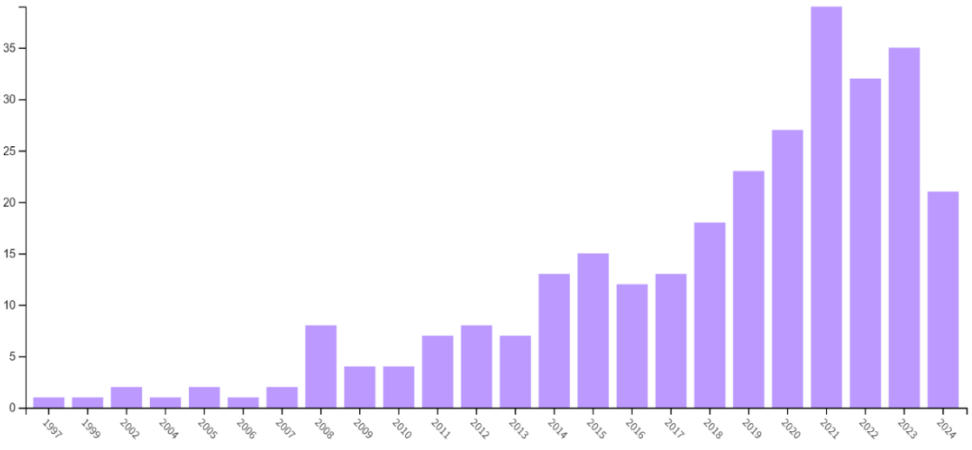
In this bibliometric analysis study, the literature review process was conducted meticulously. The objectives included identifying relevant studies on the topic, clarifying research questions, examining these studies under specific categories in detail, compiling them, and presenting a comprehensive report. The study's aims and research questions were clearly articulated, thereby defining the focus of the work.

Ensuring the reliability of the research is crucial not only in the selection of studies but also in verifying their accuracy and validity. In this context, extensive reviews were carried out over a prolonged period to process the studies without errors, and continuous communication was maintained with experts in the field. The selection of studies and the determination of keywords, based on expert opinions, enhanced the depth and accuracy of the research. Additionally, the processes of data export and cleaning were executed with great care, minimizing error margins during the analysis phase and maximizing the reliability of the findings. This process plays a critical role in enhancing the scientific contribution of the research and the value it adds to the literature.

FINDINGS

In alignment with the research focus, the distribution of studies in the Web of Science database was analyzed according to their publication years, sources, authors, connections, countries, types, and subject areas. Subsequently, network analyses were conducted for co-authorship (authors, countries), co-occurrence of keywords, bibliographic coupling (authors, journals, countries), and co-citation (authors, studies, journals).

The distribution of published studies on sustainability in mathematics education by year is presented below.



Graph 1. *Distribution of articles by year*

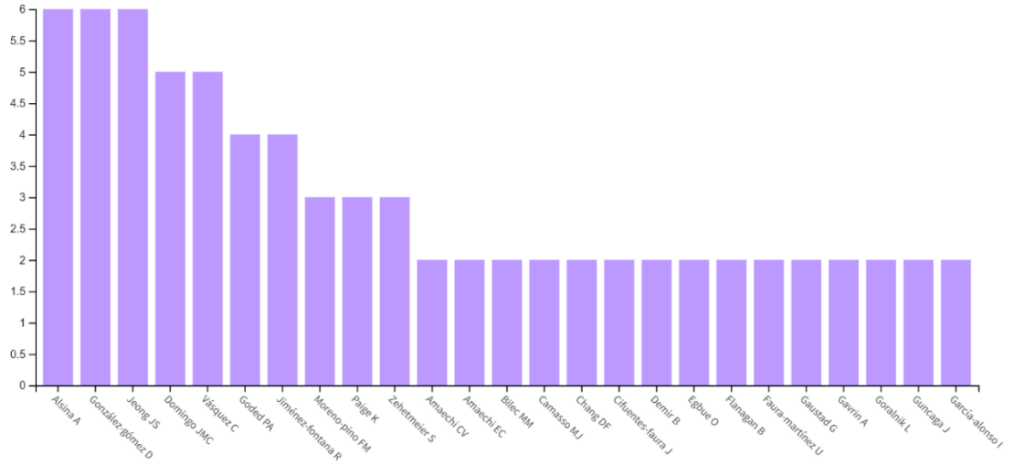
Upon examining Graph 1, it can be observed that studies on sustainability in mathematics education began in 1997 and generally increased up until 2021. The highest number of studies was conducted in 2021 (n=39). Following this, although the number of studies published remained higher than in previous years, it was lower compared to 2021. Interest in this topic has evidently increased since 1997. While a decline is observed in 2024, the number of studies in the graph only reflects the first seven months of the year.

The distribution of published studies on sustainability in mathematics education according to the top 25 categories in the Web of Science is presented below.

Figure 1. *Tree map of studies by the top 20 wos categories*

Upon examining Figure 1, it can be observed that in the Web of Science categories related to sustainability in mathematics education, Education & Educational Research ranks first (n=145). It is followed by Green & Sustainable Science & Technology (n=61), Environmental Sciences (n=58), Education & Scientific Disciplines (n=52), Environmental Studies (n=51), Engineering Multidisciplinary (n=18), Engineering Electrical & Electronic (n=9), Mathematics (n=9), Computer Science Interdisciplinary Applications (n=7), Psychology Educational (n=7), and Engineering Environmental (n=5).

The distribution of published studies on sustainability in mathematics education by the top 25 authors with the highest number of publications is presented below.



Graph 2. *Distribution by the top 25 authors with the most publications*

Upon examining Graph 2, it can be observed that the authors with the highest number of studies on sustainability in mathematics education are Angel Alsina (n=6), David Gonzalez Gomez (n=6), and Jin Su Jeong (n=6). They are followed by José María JMCD Cardeñoso Domingo (n=5), Claudia Vásquez (n=5), Pilar PAG Azcárate Goded (n=4), Rocío RJF Jiménez-fontana (n=4), Francisco Manuel Moreno-Pino (n=3), Kathryn Paige (n=3), and Stefan Zehetmeier (n=3).

The distribution of published studies on sustainability in mathematics education by the top 25 institutions is presented below.

Figure 2. *Distribution of studies according to the top 25 institutions*

Upon examining Figure 2, it can be observed that the institution with the highest number of publications on sustainability in mathematics education is Universitat De Girona (n=8). It is followed by Pontificia Universidad Catolica De Chile (n=7), Universidad De Cadiz (n=7), Universidad De Extremadura (n=7), University Of California System (n=5), University System Of Georgia (n=5), Oregon State University (n=4), Pennsylvania Commonwealth System Of Higher Education (PCSHE) (n=4), State University System Of Florida (n=4), Sungkyunkwan University (SKKU) (n=4), Universidad De La Laguna (n=4), Universiti Kebangsaan Malaysia (n=4), University Of California, Berkeley (n=4), and University Of Pittsburgh (n=4).

The distribution of published studies on sustainability in mathematics education by the top 25 countries is presented below.

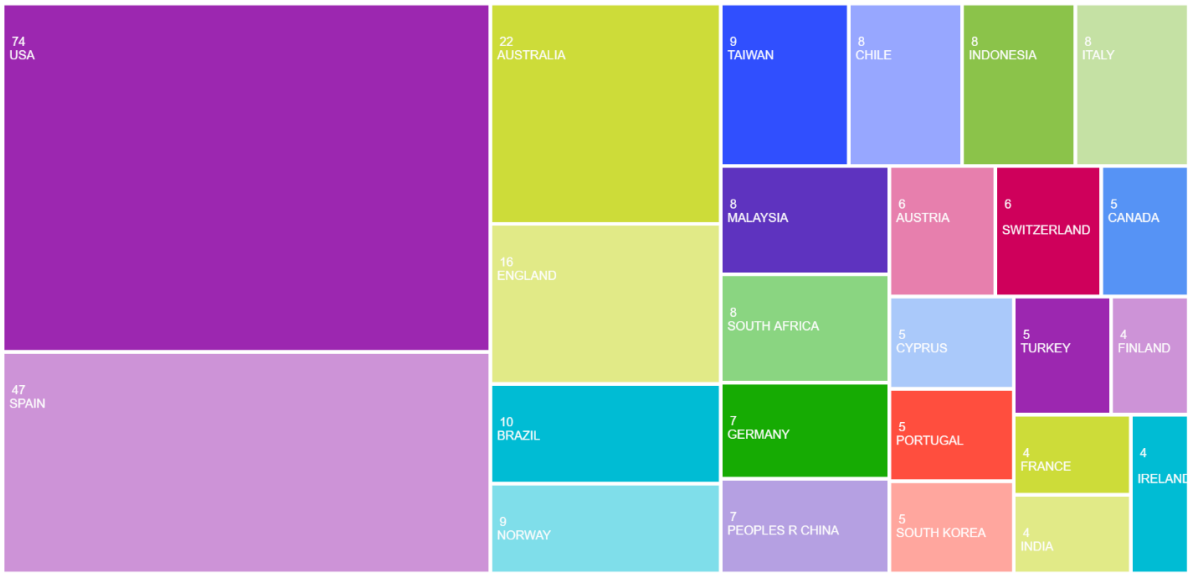


Figure 3. *Distribution by the top 25 countries*

Upon examining Figure 3, it can be observed that the country with the highest number of studies on sustainability in mathematics education is the United States (n=74). This is followed by Spain (n=47), Australia (n=22), United Kingdom (n=16), Brazil (n=10), Norway (n=9), Taiwan (n=9), Chile (n=8), Indonesia (n=8), Italy (n=8), Malaysia (n=8), South Africa (n=8), Germany (n=7), China (n=7), Austria (n=6), Switzerland (n=6), Canada (n=5), and Turkey (n=5).

The distribution of published studies on sustainability in mathematics education by type is presented below.

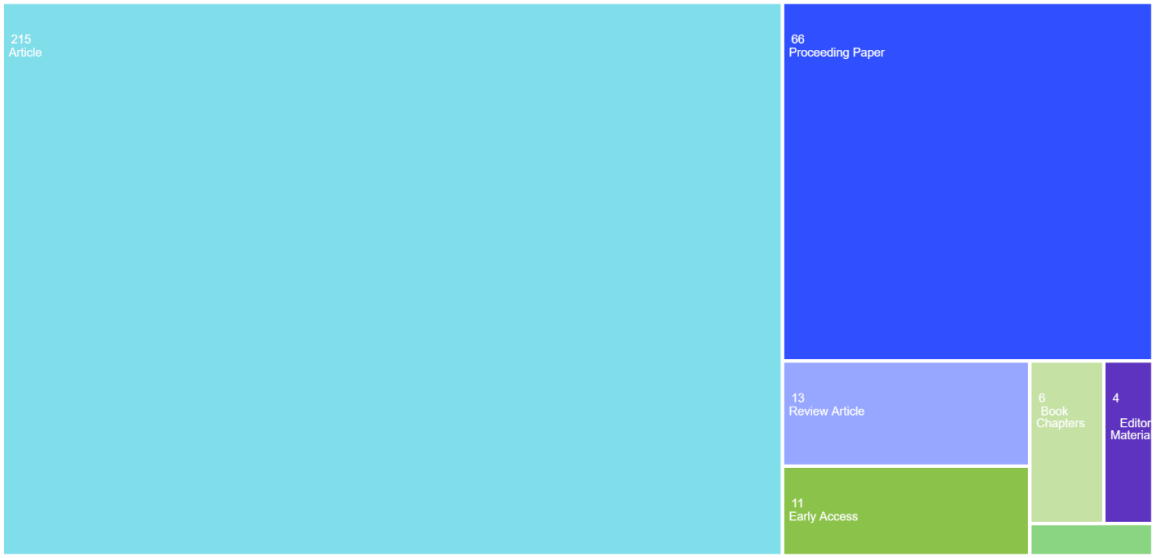


Figure 4. *Distribution by type of studies*

Upon examining Figure 4, it can be observed that the highest number of publications on sustainability in mathematics education is in the form of articles (n=215). This is followed by conference papers (n=66), review articles (n=13), early access publications (n=11), book chapters (n=6), editorial materials (n=4), and meeting abstracts (n=2).

The distribution of published studies on sustainability in mathematics education by subject area is presented below.

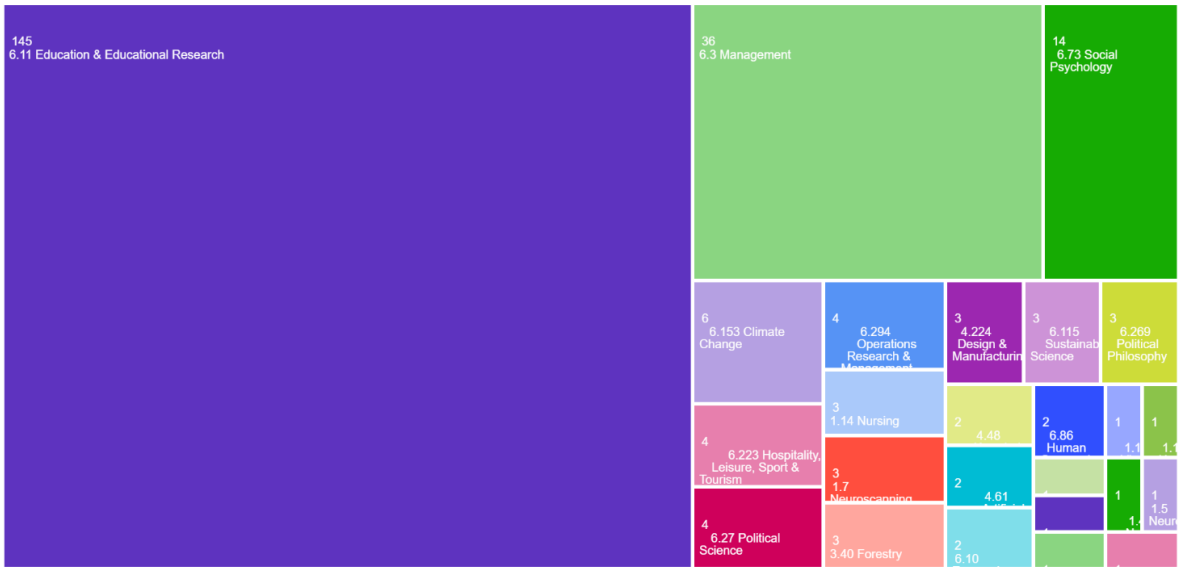


Figure 5. *Distribution by subject area of studies*

Upon examining Figure 5, it can be observed that the category with the highest number of studies related to sustainability in mathematics education is Education and Educational Research (n=145). This is followed by Management (n=36), Social Psychology (n=14), Climate Change (n=6), Hospitality (n=4), Leisure (n=4), Sport and Tourism (n=4), Political Science (n=4), Operations Research and Management Science (n=4), Nursing (n=3), Neuroscanning (n=3), Forestry (n=3), Design and Manufacturing (n=3), Sustainability Science (n=3), and Political Philosophy (n=3).

The distribution of published studies on sustainability in mathematics education in the Web of Science database by the top 25 journals is presented below.

Figure 6. *Distribution by the top 25 journals*

Upon examining Figure 6, it can be observed that the journal with the highest number of publications on sustainability in mathematics education is MDPI (n=71). This is followed by Springer Nature (n=37), Taylor and Francis (n=20), Elsevier (n=18), IATED-Int Assoc Technology Education and Development (n=11), Emerald Group Publishing (n=10), American Society for Engineering Education (n=9), IEEE (n=9), Wiley (n=7), Sociedad Española de Investigación y Educación Matemática (SEIM) (n=6), Frontiers Media SA (n=4), IATED-Int Assoc Technology Education and Development (n=4), SAGE (n=4), Anadolu University (n=3), IOP Publishing Ltd (n=3), and University of Cadiz, Department of Didactics (n=3).

In the studies published on sustainability in mathematics education within the Web of Science database, the category with the highest number of research articles is Education & Educational Research (n=145). The top 10 most cited studies in this category are presented below.

Table 1. *Top 10 most cited studies in the education & educational research category*

	Name of the Study	Author Name	Year of Publication	Number of Citations	Number of References
1	Decolonizing Methodologies And İndigenous Knowledge: The Role Of Culture, Place And Personal Experience In Professional Development	Pauline W. U. Chinn	2007	86	64
2	The Adoption Of Open Educational Resources By One Community College Math Department	John Levi Hilton Donna Gaudet Phil Clark Jared Robinson David Wiley	2013	80	14
3	Subject Teachers As Educators for Sustainability: A Survey Study	Anna Uitto Seppo Saloranta	2017	60	29
4	Global Citizenship Education, School Curriculum And Games: Learning Mathematics, English And Science As A Global Citizen	Cher Ping Lim	2008	57	31
5	Developing A Communal İdentity As Beginning Teachers Of Mathematics: Emergence Of An Online Community Of Practice	Merrilyn E. Goos Anne Bennison	2008	53	19
6	Ways Of Promoting The Sustainability Of Mathematics Teachers' Professional Development	Stefan Zehetmeier Konrad Krainer	2011	41	69
7	Online Mathematics Teacher Education: Overview Of An Emergent Field Of Research	Marcelo de Carvalho Borba Salvador Llinares	2012	37	25
8	Moving Towards Transdisciplinarity: An Ecological Sustainable Focus For Science And Mathematics Pre-Service Education In The Primary/Middle Years	Kathryn Paige David Lloyd Mike Chartres	2008	37	56
9	Evidence-Based CPD: Scaling Up Sustainable Interventions	Bettina Roesken-Winter Celia Hoyles Sigrid Blömeke	2015	36	82
10	Reforming Mathematics Learning In Indonesian Classrooms Through RME	Robert K. Sembiring Sutarto Hadi Maarten Dolk	2008	35	30

Upon examining Table 1, the most cited study in the field of sustainability in mathematics education is “Decolonizing Methodologies and Indigenous Knowledge: The Role of Culture, Place, and Personal Experience in Professional Development” published by Pauline W. U. Chinn in 2007 (citation count = 86). This is followed by the study “The Adoption of Open Educational Resources by One Community College Math Department” by Hilton et al. (2013) (citation count = 80), “Subject Teachers as Educators for Sustainability: A Survey Study” by Uitto et al. (2017) (citation count = 60), “Global Citizenship Education, School Curriculum and Games: Learning Mathematics, English and Science as a Global Citizen” by Lim (2008) (citation count = 57), “Developing a Communal Identity as Beginning Teachers of Mathematics: Emergence of an Online Community of Practice” by Goos et al. (2008) (citation count = 53), “Ways of Promoting the Sustainability of Mathematics Teachers' Professional Development” by

Zehetmeier et al. (2011) (citation count = 41), "Online Mathematics Teacher Education: Overview of an Emergent Field of Research" by Borba et al. (2012) (citation count = 37), "Moving Towards Transdisciplinarity: An Ecological Sustainable Focus for Science and Mathematics Pre-Service Education in the Primary/Middle Years" by Paige et al. (2008) (citation count = 37), "Evidence-Based CPD: Scaling Up Sustainable Interventions" by Winter et al. (2015) (citation count = 36), and "Reforming Mathematics Learning in Indonesian Classrooms Through RME" by Sembiring et al. (2008) (citation count = 35).

The network map showing the co-author relationship of the studies published on sustainability in mathematics education according to the authors is given below.

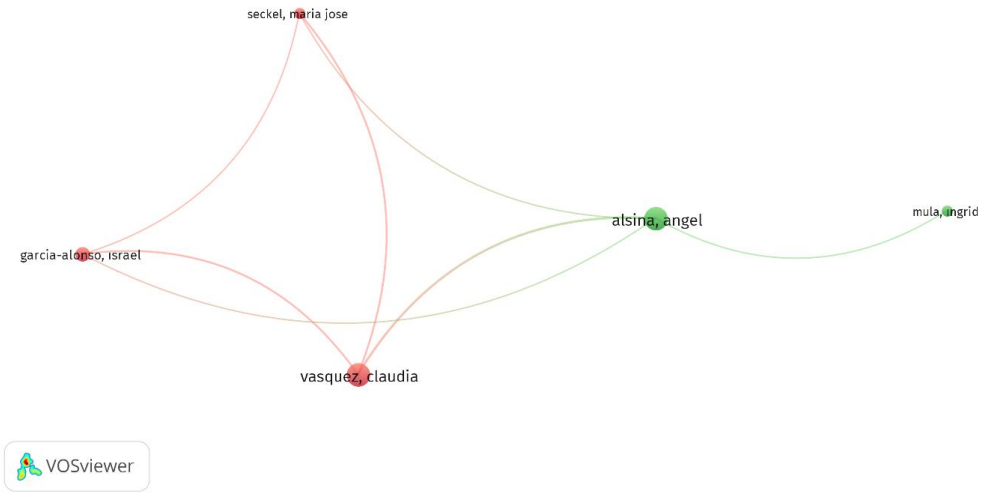


Figure 7. *Co-authorship network map of authors in the studies*

Upon examining Figure 7, it can be observed that to identify the co-authorship network of authors in studies on sustainability in mathematics education, the minimum publication count for an author was set to two, as was the minimum citation count. Based on these criteria, the total number of authors cited in the studies is 46, with the largest cluster consisting of 5 authors. The analyses revealed that the most connected author group comprises 2 clusters (connection count: 7, total connection strength: 11). Each of these clusters contains at least 2 and at most 3 authors. The prominent authors within these clusters include Angel Alsina (connection count: 4, total connection strength: 6, document count: 6), Claudia Vásquez (connection count: 3, total connection strength: 7, document count: 6), Maria Jose Seckel (connection count: 3, total connection strength: 4, document count: 2), and Israel Garcia-Alonso (connection count: 3, total connection strength: 4, document count: 3).

The network map illustrating the co-authorship relationships among countries in studies published on sustainability in mathematics education is presented below.

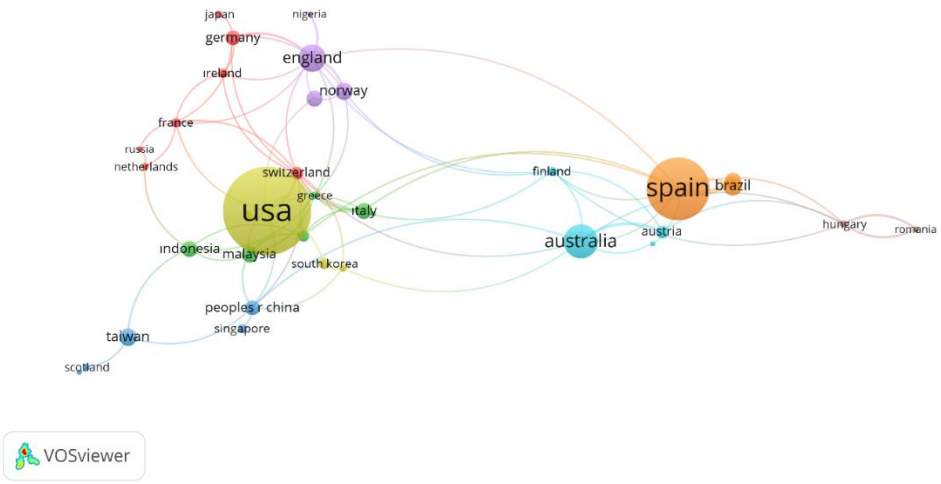


Figure 8. *Co-authorship network map by country in the studies*

Upon examining Figure 8, it can be observed that to identify the co-authorship network of countries in studies published on sustainability in mathematics education, the minimum publication count for an author was set to two, as was the minimum citation count. Based on these criteria, the total number of countries cited in the studies is 43, with the number of countries forming a large cluster identified as 37. The analyses revealed that the most connected group of countries consists of 8 clusters (connection count: 79, total connection strength: 95). Each of these 9 distinct clusters contains at least 3 and at most 7 co-authoring countries. Among these countries, the United States (connection count: 10, total connection strength: 11, document count: 74), Spain (connection count: 9, total connection strength: 15, document count: 47), Australia (connection count: 8, total connection strength: 10, document count: 21), United Kingdom (connection count: 10, total connection strength: 13, document count: 16), and Indonesia (connection count: 5, total connection strength: 5, document count: 8) stand out prominently.

The network map illustrating the co-occurring keywords in studies published on sustainability in mathematics education is presented below.

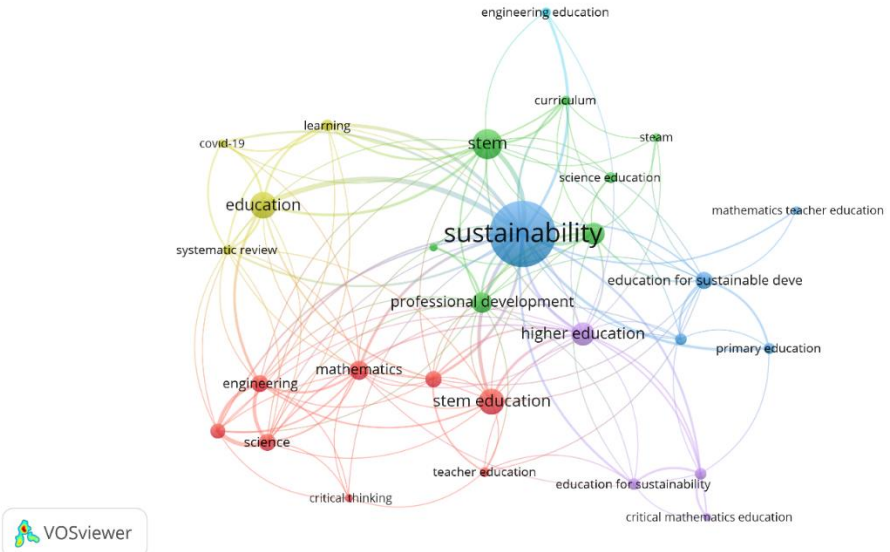


Figure 9. *Co-occurrence network map of keywords in the studies*

Upon examining Figure 9, it can be observed that the minimum count for co-occurring keywords in studies published on sustainability in mathematics education has been set to five. The total number of keywords analyzed is 29. The analysis revealed that the most connected group of co-occurring keywords consists of 6 clusters (connection count: 138, total connection strength: 269). Each of these 6 distinct clusters contains at least 1 and at most 8 common keywords. Among these shared keywords, the one with the highest connection strength is sustainability (connection count: 24, total connection strength: 87). This is followed by higher education (connection count: 19, total connection strength: 31), STEM (connection count: 18, total connection strength: 35), professional development (connection count: 14, total connection strength: 22), mathematics (connection count: 14, total connection strength: 21), education for sustainable development (connection count: 13, total connection strength: 19), and education (connection count: 10, total connection strength: 13) as the other commonly used keywords.

The network map illustrating the bibliographic coupling of institutions in studies published on sustainability in mathematics education is presented below.

Figure 10. *Bibliographic coupling network map of institutions in the studies*

Upon examining Figure 10, it can be observed that in the bibliographic coupling of institutions in studies published on sustainability in mathematics education, the minimum publication count for an institution was set to two, and the citation count for the works produced by these institutions was also set to a minimum of two. Based on these criteria, out of 58 institutions, 16 meet the specified requirements. These 16 institutions are organized into 3 clusters (connection count: 21, total connection strength: 23), with each cluster containing at least 4 and at most 7 institutions. Among these institutions, the following stand out: Univ Klagenfurt (connection count: 6, total connection strength: 7), Middle East Technical University (connection count: 4, total connection strength: 5), Comenius University (connection count: 4, total connection strength: 4), George Emil Palade University - Comenius University (connection count: 4, total connection strength: 4), Univ Jyväskylä (connection count: 4, total connection strength: 4), and Univ Miskolc (connection count: 4, total connection strength: 4).

The network map illustrating the co-citation relationships of cited works in studies published on sustainability in mathematics education is presented below.

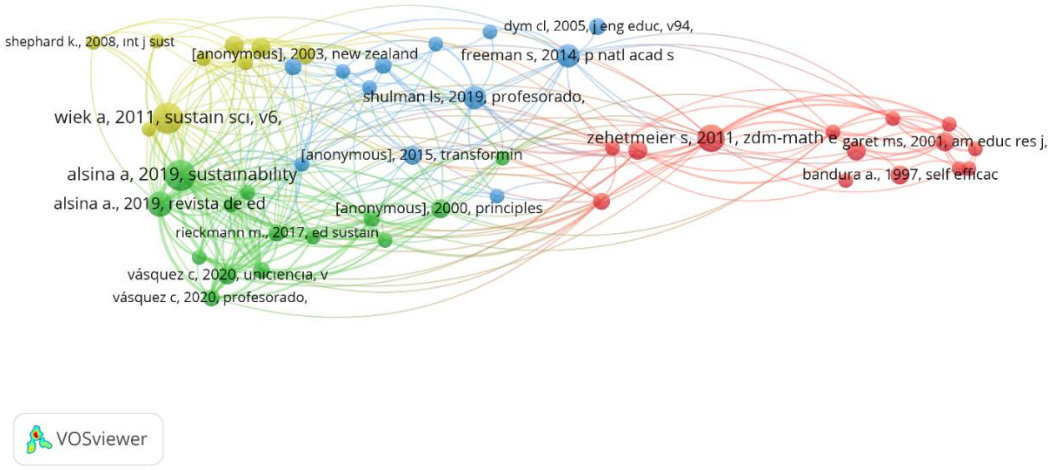


Figure 11. *Co-citation network map of cited works in the studies*

Upon examining Figure 11, it can be observed that the minimum co-citation count for the cited works in studies published on sustainability in mathematics education has been set to five. Accordingly, the total number of cited works is 12,077, with 49 works meeting the specified criteria. The analysis indicates that the network map comprises a total of 4 clusters (connection count: 288, total connection strength: 411), with each cluster containing a minimum of 9 and a maximum of 14 cited works. The most frequently cited works in these studies include Angel Alsina, Sustainability-Basel (2019) (connection count: 26, total connection strength: 54), Angel Alsina, Revista de Educación Ambiental y Sostenibilidad (2019) (connection count: 23, total connection strength: 46), Stefan Zehetmeier, ZDM - Mathematics Education (2011) (connection count: 19, total connection strength: 25), and Claudia Vásquez, Profesorado (2020) (connection count: 16, total connection strength: 33).

The network map illustrating the co-citation relationships of cited journals in studies published on sustainability in mathematics education is presented below.

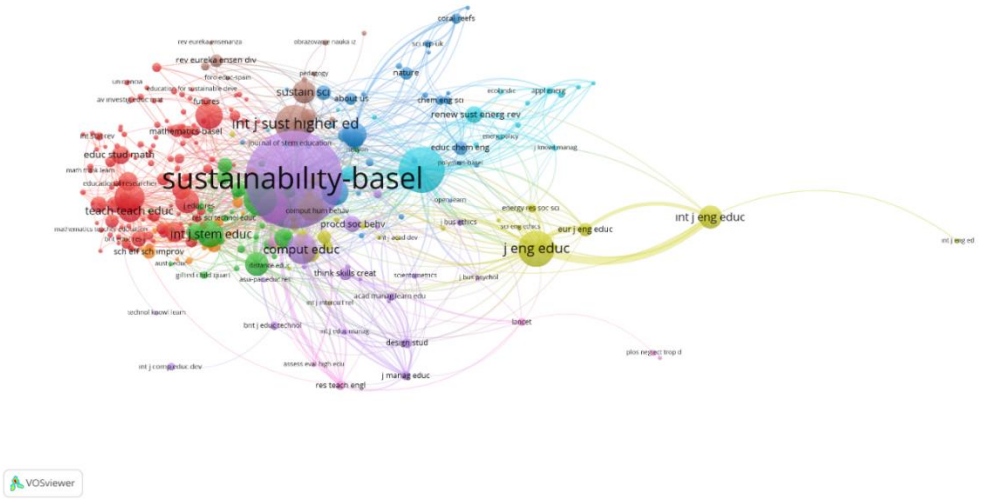


Figure 12. *Co-citation network map of cited journals in the studies*

Upon examining Figure 12, it can be observed that the minimum co-citation count for the cited journals in studies published on sustainability in mathematics education has been set to five. Accordingly, the total number of cited journals is 7,599, with 315 journals meeting the specified criteria. The analysis indicates that the network map comprises a total of 6 clusters (connection count: 1,056, total connection strength: 15,045), with each cluster containing a minimum of 3 and a maximum of 13 cited journals. Among these journals, the following stand out: Sustainability-Basel (connection count: 265, total connection strength: 7,629), Journal of Cleaner Production (connection count: 213, total connection strength: 3,418), Journal of Engineering Education (connection count: 143, total connection strength: 2,705), Educational Sciences (connection count: 231, total connection strength: 1,859), and Science (connection count: 204, total connection strength: 1,166).

The citation network map of authors in studies published on sustainability in mathematics education is presented below.

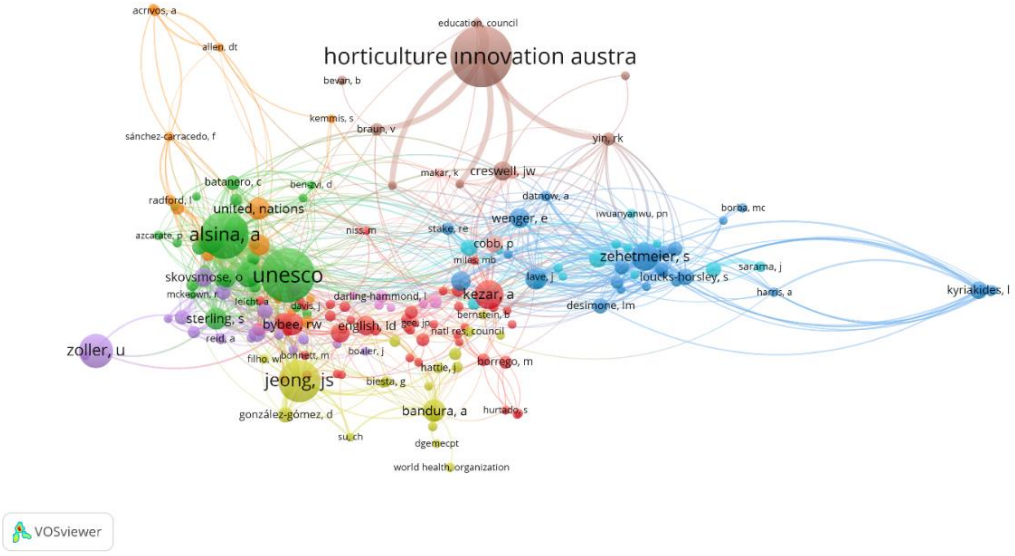


Figure 13. *Co-citation network map of cited authors in the studies*

Upon examining Figure 13, it has been determined that in studies published on sustainability in mathematics education, the number of citations for the referenced authors is set at a minimum of five. Accordingly, the total number of cited authors is 9,120, and the number of journals meeting this criterion is 194. The analysis reveals that the network map consists of a total of 10 clusters (number of connections: 2,539; total connection strength: 8,223), with each cluster comprising a minimum of 4 and a maximum of 46 cited authors. Among these authors are UNESCO (number of connections: 99; total connection strength: 636), Angel Alsina (number of connections: 70; total connection strength: 560), Horticulture Innovation Australia (number of connections: 6; total connection strength: 462), Stefan Zehetmeier (number of connections: 66; total connection strength: 389), Jin Su Jeong (number of connections: 41; total connection strength: 305), and Claudia Vásquez (number of connections: 57; total connection strength: 298).

DISCUSSION, CONCLUSION, RECOMMENDATIONS

It can be argued that sustainability in mathematics education provides conducive conditions for students to learn concepts related to sustainable development and to comprehend and solve the problems they encounter in their environment (Li & Tsai, 2021). Furthermore, by integrating sustainability, the various social, economic, and environmental issues that arise can be better understood through mathematics, along with potential solutions (National Council of Teachers of Mathematics, 2000).

The concept of sustainability plays a significant role in mathematics education (Renert, 2011). In this context, a bibliometric analysis of studies conducted on sustainability in mathematics education has been carried out using the Web of Science database. The data from Web of Science, encompassing studies on sustainability in mathematics education from 1997 to the present, have been examined, and a bibliometric analysis of research in this field has been conducted. It is anticipated that these analyses will provide important contributions to the field and that experts wishing to conduct research on this topic will identify gaps in the literature, allowing them to plan their future studies accordingly.

In the scope of this research, searches were conducted using the keywords "Sustainability in Mathematics Education," "Sustainability and Mathematics Education," "Sustainable Development in Mathematics Education," and "Sustainable Development and Mathematics Education." Studies that included these terms in their titles, keywords, or abstracts were identified and examined. The search resulted in the inclusion of all studies from the past to the present across all indexes, document types, publishers, institutions, authors, and published languages, as well as all categories in the Web of Science. This comprehensive search yielded a total of 296 studies.

An analysis of the number of studies by year reveals that research on this topic has been conducted since 1997, with a noticeable increase in the volume of work over the years. This rise can be attributed to the growing interest in sustainability in mathematics education, aligned with global sustainability goals, as mathematical thinking plays a critical role in addressing environmental, economic, and social issues (United Nations, 2015). Additionally, interdisciplinary approaches assist mathematics students in developing analytical thinking and data analysis skills, enabling them to tackle complex sustainability challenges (Barwell, 2018). Furthermore, the importance of fostering critical thinking and the ability to generate sustainable solutions has gained traction as part of 21st-century skills (Keitel et al., 2004). Another reason for this increased focus is the urgent nature of issues such as the climate crisis and the depletion of natural resources, which necessitate mathematical modeling (Sterling, 2001). The universal language of mathematics has also provided a foundation for global collaboration (Organisation for Economic Co-operation and Development, 2019). Reviewing the starting year of studies related to this topic and the number of studies conducted suggests that the significance of the subject has only recently begun to be recognized, resulting in a relatively low number of studies initially. Nevertheless, despite fluctuations over the years, a general upward trend has been observed. While a decline is noted for 2024, it is important to note that the data presented in the graph covers only the first seven months of that year.

When examining the distribution of published studies on sustainability in mathematics education across Web of Science categories, the top category is "Education Educational Research." This is followed by "Green Sustainable Science Technology," "Environmental Sciences," "Education Scientific Disciplines," "Environmental Studies," "Engineering Multidisciplinary," "Engineering Electrical Electronic," "Mathematics," "Computer Science Interdisciplinary Applications," "Psychology Educational," and "Engineering Environmental." This categorization indicates that the majority of research is concentrated in the field of education, followed by various studies in areas such as the environment, technology, engineering, and multidisciplinary fields.

Since 1997, the authors with the most publications on sustainability in mathematics education are Angel Alsina, David González Gómez, and Jin Su Jeong. Angel Alsina is an academic specializing in mathematics education. His work focuses particularly on mathematics education in early childhood and the development of problem-solving skills during this period. Alsina is developing pedagogical approaches for integrating concepts of sustainability into mathematical processes. In this context, he works on teaching methods that help students enhance their critical thinking and mathematical analysis skills, thereby fostering sustainable thinking capabilities. David González Gómez is a researcher specializing in educational technologies and science-mathematics education. He focuses on the integration of educational technologies, particularly online platforms and digital tools, into educational processes in connection with sustainable development goals. His research explores how mathematics

education can be made more effective in online learning environments and how these processes contribute to sustainable educational objectives. Jin Su Jeong is an academic specializing in teacher education and sustainability in mathematics teaching. He conducts research on the use of innovative teaching methods and technologies in education aligned with sustainable development goals. Jeong works on integrating sustainability concepts into the mathematics curriculum to enhance students' environmental awareness. Additionally, he develops educational materials to provide guidance for teachers in this process. As seen in the analyses, these authors have made significant contributions to the relationship between sustainability in education and mathematics teaching, thereby advancing the development of pedagogical approaches in this field.

The institution with the highest number of publications on sustainability in mathematics education is the Universitat de Girona. Following this, the order of institutions is as follows: Pontificia Universidad Católica de Chile, Universidad de Cádiz, Universidad de Extremadura, University of California System, University System of Georgia, Oregon State University, Pennsylvania Commonwealth System of Higher Education (PCSHE), State University System of Florida, Sungkyunkwan University (SKKU), Universidad de La Laguna, Universiti Kebangsaan Malaysia, University of California, Berkeley, and the University of Pittsburgh. When examining the countries with the most research conducted on sustainability in mathematics education, the United States ranks first. It is followed by Spain, Australia, the United Kingdom, Brazil, Norway, Taiwan, Chile, Indonesia, Italy, Malaysia, South Africa, Germany, China, Austria, Switzerland, Canada, and Turkey. These analyses indicate that sustainability in mathematics education is being addressed in various regions around the world, and significant research is being conducted on this topic.

In the field of sustainability in mathematics education, the majority of publications are in the form of articles. Following this, other types of publications include conference papers, review articles, early access articles, book chapters, editorial materials, and meeting summaries. One of the reasons for the predominance of article-type research on sustainability in mathematics education is its ability to facilitate rapid information sharing and respond to current issues. Articles allow for a focused exploration of specific aspects of the relationship between sustainability and mathematics education, offering opportunities to examine topics in depth, such as the contributions of teaching methods to sustainability. Additionally, articles provide new strategies through interdisciplinary collaborations and serve as valuable resources for educators.

In terms of categories, the "Education and Educational Research" category ranks first in sustainability in mathematics education. This is followed by categories such as Management, Social Psychology, Climate Change, Hospitality, Leisure, Sport and Tourism, Political Science, Operations Research and Management Science, Nursing, Neuroscanning, Forestry, Design and Manufacturing, Sustainability Science, and Political Philosophy. Analyzing the distribution of studies by subject area reveals that the majority of research is conducted in the field of education, while a variety of other subject areas are also represented.

The journal with the highest number of publications on sustainability in mathematics education is MDPI. Following MDPI are Springer Nature, Taylor and Francis, Elsevier, IATED-International Association of Technology Education and Development, Emerald Group Publishing, American Society for Engineering Education, IEEE, Wiley, Sociedad Española de Investigación y Educación Matemática (SEIEM), Frontiers Media SA, IATED-International Association of Technology Education and Development, Sage, Anadolu University, IOP Publishing Ltd., and the University of Cádiz Department of Didactics. An examination of the journals publishing research on sustainability in mathematics education indicates that most of them possess a substantial readership and have a strong publishing presence.

In the Web of Science database, the ten most cited studies within the "Education Educational Research" category related to sustainability in mathematics education are as follows: The study titled "Decolonizing Methodologies and Indigenous Knowledge: The Role of Culture, Place, and Personal Experience in Professional Development" by Pauline W. U. Chinn (2007) ranks first with 86 citations. This study has made significant contributions to the field by emphasizing the importance of indigenous knowledge and cultural contexts in education. It advocates for the inclusion of indigenous knowledge systems in educational practices, supporting the process of decolonization, and discusses the influence of culture and place on professional development. Moreover, in the context of teacher education and sustainability, it promotes a more inclusive and critical approach to education by integrating diverse knowledge systems.

It is followed by "The Adoption of Open Educational Resources by One Community College Math Department" authored by John Levi Hilton et al. (2013), which has received 80 citations. This study has made significant contributions to sustainability in mathematics education through the use of Open Educational Resources (OER). By promoting the low-cost and accessible nature of OER, the study supports economic sustainability in education while fostering environmental sustainability through the reuse and sharing of resources. Additionally, the adoption of OER enhances educational equity by enabling broader access to mathematical knowledge for more students, contributing to the development of a long-term, sustainable learning ecosystem. In this way, the study serves as a guide for transforming mathematics education into a more sustainable and inclusive framework.

The third study, "Subject Teachers as Educators for Sustainability: A Survey Study," by Anna Uitto et al. (2013), has garnered 60 citations. This study examines the role of teachers in sustainability education, indirectly contributing to the field of mathematics education. It emphasizes the potential for mathematics teachers to integrate sustainability principles into their lessons, highlighting the need to raise teachers' awareness and support interdisciplinary approaches. In this context, the study provides an important perspective on how mathematics lessons can help develop sustainability awareness through real-world problem-solving.

Additionally, "Global Citizenship Education, School Curriculum, and Games: Learning Mathematics, English, and Science as a Global Citizen" by Cher Ping Lim (2008) has 57 citations. The study integrates global citizenship education with mathematics lessons, exploring ways to equip students with knowledge about sustainability, environmental awareness, and global issues. By developing mathematical thinking skills in a global context, it offers a critical approach to problem-solving for worldwide challenges and highlights the role of education as a key tool in achieving sustainable development goals.

The fifth study, "Developing a Communal Identity as Beginning Teachers of Mathematics: Emergence of an Online Community of Practice," by Merrilyn E. Goos et al. (2008), has achieved 53 citations. The study promotes the sharing of experiences and knowledge among teachers through an online community, supporting continuous learning and professional development. This process helps teachers develop innovative and sustainable approaches to mathematics education, strengthens the culture of collaboration and partnership in education, and contributes to the creation of a long-term teaching practice ecosystem.

Following this, "Ways of Promoting the Sustainability of Mathematics Teachers' Professional Development" by Stefan Zehetmeier et al. (2011) has 41 citations. The study "Online Mathematics Teacher Education: Overview of an Emergent Field of Research" by Marcelo de Carvalho Borba et al. (2012) has received 37 citations, the same as "Moving Towards Transdisciplinarity: An Ecological Sustainable Focus for Science and Mathematics Pre-Service Education in the Primary/Middle Years" by Kathryn Paige et al. (2008). Moreover, "Evidence-Based CPD: Scaling Up Sustainable Interventions" by Bettina Roesken-Winter et al. (2015) has 36 citations, and lastly, "Reforming Mathematics Learning in Indonesian Classrooms Through RME" by Robert K. Sembiring et al. (2008) has 35 citations.

An analysis of the co-authorship network among authors of studies published on sustainability in mathematics education reveals a total of 46 identified authors. Among these, Angel Alsina, Claudia Vásquez, María José Seckel, and Israel García-Alonso are particularly prominent. The commonality among these authors lies in their collaborative focus on sustainability within the contexts of sustainable development, education, and, specifically, mathematics education. In their work, these authors investigate strategies for integrating sustainability principles into educational systems, methods for fostering sustainability awareness among students, and approaches for creating environmental consciousness in education.

An analysis of the co-authorship network of countries involved in studies on sustainability in mathematics education identifies a total of 43 countries. Among these, the United States, Spain, Australia, the United Kingdom, and Indonesia are notable. This ranking indicates that research on sustainability in mathematics education is being conducted by researchers in various locations and institutions around the world.

Additionally, an examination of the common keywords used in studies related to sustainability in mathematics education reveals that the most frequently used keyword is "sustainability." This is followed by keywords such as "higher education," "STEM," "professional development," "mathematics," "education for sustainable development," and "education." The prevalence of these keywords suggests that the concepts of sustainability and education are interrelated and intertwined. Furthermore, it is anticipated that by engaging with these concepts, researchers will be able to conduct clearer and more accessible studies related to the topic.

In the bibliographic matching of institutions involved in studies on sustainability in mathematics education, a total of 16 institutions have been identified based on the required criteria. Notable among these institutions are the University of Klagenfurt, Middle East Technical University, Comenius University, George Emil Palade University of Medicine, Comenius University, the University of Jyväskylä, and the University of Miskolc. The analysis of these institutions indicates that they are actively collaborating on research related to sustainability in mathematics education across various regions of the world. This further underscores the value of investigating this topic.

An analysis of the co-citation network of studies published on sustainability in mathematics education reveals the most frequently cited works, including Angel Alsina's Sustainability-Basel (2019), Angel Alsina's Revista de Educación Ambiental y Sostenibilidad (2019), Stefan Zehetmeier's ZDM-Math Educ (2011), and Claudia Vásquez's Profesorado (2020). These studies address the relationship between sustainability and mathematics education from various perspectives. Angel Alsina’s Sustainability-Basel (2019) examines how sustainability education can be integrated during early childhood. It emphasizes the critical role of mathematical thinking and education in fostering environmental awareness among children. The study discusses strategies and practical examples for incorporating sustainability awareness into mathematics education at an early age. Similarly, another work by Angel Alsina, published in Revista de Educación Ambiental y Sostenibilidad (2019), explores the integration of environmental education with mathematics education, offering recommendations on how mathematical concepts can be taught within the context of sustainability. It also aims to enhance students' sensitivity to environmental issues alongside the development of mathematical skills. Stefan Zehetmeier’s study in ZDM-Math Educ (2011) focuses on teacher education within the context of sustainable professional development. The work presents models for how mathematics teachers can sustainably advance their professional growth, while also investigating the long-term effects of such programs on educators. Claudia Vásquez’s study in Profesorado (2020) centers on how teachers shape mathematical pedagogy within the framework of sustainability education. It provides examples and practices regarding how sustainability themes are addressed in mathematics classes, with the aim of enhancing teaching methods in this context. Overall, the analyses highlight how the topics of mathematics education and sustainability are interconnected and how these two areas can mutually support each other in educational settings.

An analysis of the co-citation network of studies published on sustainability in mathematics education reveals that there are a total of 315 journals that meet the established criteria. Notable among these journals are Sustainability-Basel, Journal of Cleaner Production, Journal of Engineering Education, Educational Studies in Mathematics, and Science. The examination of these journals indicates that they publish research on a variety of topics, possess high impact factors, and ensure that the published studies undergo a rigorous peer-review process. Furthermore, it is noteworthy that international authors collaborate to produce joint works.

In the co-citation network analysis of authors cited in studies on sustainability in mathematics education, prominent figures include UNESCO, Angel Alsina, Horticulture Innovation Australia, Stefan Zehetmeier, Jin Su, and Claudia Vásquez. The works of these authors have significantly contributed to the field of sustainability in mathematics education.

In conclusion, this study presents a bibliometric analysis of research on sustainability in mathematics education published in the Web of Science database from 1997 to the present. This research exclusively includes studies published within the Web of Science database and provides an analysis of them. The findings indicate that the topic of sustainability in mathematics education has only recently begun to be explored, with a limited number of studies conducted. Researchers can examine this study to understand what has been explored in this field and how the research has been conducted, thereby gaining insights for their own investigations. Additionally, they may explore other databases to conduct more comprehensive bibliometric analyses. It is anticipated that this research will serve as a valuable data source for researchers interested in the topic and help them gain a deeper understanding of its nuances.

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The Relationship between Temperament Characteristics and Play Behaviors of Preschool Children [1]

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ABSTRACT

This research examines the relationship between play behaviors and temperament characteristics of preschool children from the point of parent and teacher evaluation. It is designed in survey model. The study group of the research consists of 313 children aged 60-72 months attending the educational institutions selected by cluster sampling method among the preschool education institutions in Istanbul in the 2017-2018 academic year and their mothers and teachers (n=21). The research used three data collection tools: the Parent and Teacher Form of the Penn Interactive Peer Play Scale (PIPPS) and the Short Temperament Scale for Children. The Short Temperament Scale for Children consists of four sub-dimensions (reactivity, persistence, approach/withdrawal, and rhythmicity). Penn Interactive Peer Play Scale has three sub-dimensions: play interaction, disruption, and disconnection. According to the evaluation of parents and teachers, the research indicates significant relationships between children's temperament characteristics and play behaviors. The role of temperament in forming the behavior patterns of children supports the results of the research on the relationships between temperament characteristics and play behaviors in peer-to-peer interactions from the point of parent and teacher evaluations.

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INTRODUCTION

Temperament is the sum of behavioral tendencies structured by heredity and experience that are thought to have a biological basis. Emotional reactions, too, are accepted as a part of temperament in this aspect. Although individuals' biological differences must be considered, temperament is stated as partially containing permanent and unchangeable features. While the concept of temperament has many different definitions in the literature, on an everyday basis, it is defined as the reactions of children to stimuli in early childhood and the setting of self-regulation due to individual differences (Eivers et al., 2012; Losonczy-Marshall, 2014; Rothbart, 2011; Rothbart & Bates, 2006). İndividuals reveal different emotional reactions to other experiences. However, the concept of temperament expresses that they have a general emotional style that shapes their tendency to react in specific ways to various events in their environment. While some people are typically shy and anxious, others can be brave, extroverted, aggressive, or angry (Levine & Munsch, 2018). Rather than their behaviors, temperament is related to the content of the individual's reactions to the situation (Prior, Sanson, Smart, and Oberklaid, 2000; Sanson et al., 2004).

The environment affects the psychological structure of the individual. Temperament is a dynamic structure that mediates the effect of the environment on the individual and shapes it against internal and external stimuli. The individual continuously interacts with family, school, and peers. These interactions that the individual is exposed to either reinforce or transform the various aspects of temperament. The intensity and dynamism of the interaction may cause the individual to behave dissonant to his/her temperament in some cases (Goldsmith, 1996).

The intense relationships preschool children have with their peers provide excellent opportunities to demonstrate adequate social cohesion and acquire the necessary social skills. In this era, children interact with their peers complexly but tend to play with same-gender peers mostly (Çetin et al., 2003). Children's demands for fulfilling their wishes in play or various interaction situations sometimes lead to conflicts. These conflict situations are social experiences for the child. She learns from these experiences that her friends also have wishes like hers and that she must fulfill some of their wishes to be with them. In addition, they learn to give up and postpone some of their wishes (Bakırcıoğlu, 2013). These conflicts are experienced intensely in plays. Children acquire social competence and confidence in relationships with peers through play. It is an essential life skill (Howes & Matheson, 1992; Singer & Singer, 2005). Such interactions that the child experiences in a play environment may transform some aspects of her temperament while reinforcing others.

Thanks to playing, children learn to cope with items and people not in their safe zone and their thinking and perception of the inner world (Artar, 2004). Play teaches children necessary behaviors, knowledge, and skills by themselves. The play has a vital role in a child's life and development. Play is a severe occupation and a source of entertainment, learning, and development for the child. Speaking, reasoning, finding out roles in life, solidarity, cooperation, sharing, connecting with the environment, and problem-solving are developed in the play environment (Aral et al., 2001; Çoban & Nacar, 2006; Darwish et al., 2001; Melendez et al., 2000; Swindells & Stagnitti, 2006).

Through play, the child can have the opportunity to experiment with different roles in social life, express her feelings and concerns, and examine her relations with other people. Thus, play is accepted as one of the critical factors in acquiring positive social behaviors. The richness of children's play experiences at young ages forms the basis for developing their social skills. Play has a unique place in the development and education of the child. Play ensures healthy growth, providing development and learning. The meaning and purposes of child play are to search, find, recognize, enhance or rearrange, and structure knowledge. Play is the most effective and straightforward way of learning (Adak-Özdemir & Ramazan, 2014; Mistrett & Bickart, 2009; Yavuzer, 2000).

Besides their interactions with people in their environments, such as family, peer group, and school, children's temperaments affect their reactions to events. It is expected that a child who has a low level of socialization with her environment is less likely to be an extrovert adult who has many friends. However, a child at a low level of socialization can also acquire social skills and become a perfect friend. In this respect, the temperamental characteristics of individuals are also accepted as a tool for developing social skills. Children with different temperaments can exhibit different social skills in playgroups, which helps to improve each other's social skills (Bee, 2000; Burger, 2006; Santrock, 2012). Thus, this research investigates the relationship between children's temperament characteristics and play behaviors. Considering the time children spend in a home environment, the mothers' observations on the children's play behaviors with their peers were consulted. In addition, the evaluation of preschool teachers was consulted due to the intensity of peer interaction provided by preschool education in early childhood. Therefore, the research examines the relationship between children's temperament characteristics and play behaviors from parent and teacher evaluation.

METHOD

Research design

The research study, which examines the relationship between temperament characteristics in the preschool period and play behaviors from the point of parent and teacher evaluation, is designed as a survey in a relational model. Relational studies are models designed to predict the relationship between variables (Christensen et al., 2015).

Study Group/Participants

The study group of the research includes children attending four independent kindergartens and six primary school kindergartens selected by random cluster sampling method among independent kindergartens and kindergartens affiliated to primary education in Kadıköy, Maltepe, Üsküdar and Ataşehir on the Anatolian side of Istanbul in Turkey. It consists of 313 children (171 girls, 142 boys) aged 60-72 months, their parents (mothers) and teachers (n=21). Twenty-one preschool teachers from selected ten preschool institutions who agreed to participate in the study made an announcement, and 313 mothers with 60-72-month-old children participated voluntarily.

Research Instruments and Processes

The study used three data collection tools: the Short Temperament Scale for Children and Penn Interactive Peer Play Scale-Parent Form and Teacher Form.

The Short Temperament Scale for Children

Yağmurlu and Sanson created the Turkish adaptation of the short temperament scale for children developed by Prior, Sanson, and Oberklaid (2009). The scale is designed in a six-point Likert type to evaluate the temperament characteristics of the child, and it consists of options between "almost always" and "almost never." The scale includes 30 items and four sub-dimensions (reactivity, persistence, approach/withdrawal, and rhythmicity), and 8 of the items are reverse coded (Yağmurlu & Sanson, 2009). Within the research, the internal consistency coefficients of the scale were calculated. They are determined as .80 for the reactivity sub-dimension, .78 for the persistence sub-dimension, .69 for the approach/withdrawal sub-dimension, and .72 for the rhythmicity sub-dimension.

Penn Interactive Peer Play Scale

Penn Interactive Peer Play Scale (PIPPS) was designed by Fantuzzo, Mendez, and Tighe (1998) to evaluate the quality of peer play behaviors of children in early childhood. Ahmetoğlu, Acar and Aral (2016) adapted the scale into Turkish. The validity-reliability studies of the PIPPS-Parent Form and the PIPPS-Teacher Form were conducted in 2016 and 2017, respectively. PIPPS has three sub-dimensions: "Play Interaction," "Play Disruption," and "Play Disconnection." It is a Likert-type measurement tool that evaluates

the subject scoring from 1 to 4, as "never (1)", "rarely (2)". "often (3)," and "always (4)". The original scale consists of 32 items. With the Turkish adaptation and validity-reliability studies, the Teacher Form took its final form with 29 items and the Parent Form with 28 items (Ahmetoğlu et al., 2016; 2017). The internal consistency reliability coefficients of the scale were calculated within the research. For the Teacher Form, they were determined as .80 for the Play Interaction sub-dimension, .84 for the Play Disruption sub-dimension, and .78 for the Play Disconnection sub-dimension. For the Parent Form, they were found to be .75 for the Play Interaction sub-dimension, .78 for the Play Disruption sub-dimension, and .76 for the Play Disconnection sub-dimension.

Data Collection Process and Analysis

In the study, four independent kindergartens and six primary school kindergartens were determined by random cluster sampling method in Kadıköy, Maltepe, Üsküdar, and Ataşehir on the Anatolian side of Istanbul in the 2017-2018 academic year. Twenty-one preschool teachers who agreed to participate in the study after the interviews with the preschool teachers in the selected preschool education institutions and 313 parents who voluntarily participated in the research among the parents who were informed through these teachers were included in the study group. Preschool teachers participating in the research were asked to evaluate the PIPPS-Teacher Form, and mothers were asked to assess the PIPPS-Parent Form and the Short Temperament Scale for Children.

The gathered data were imported into the statistical package program. The data showed normal distribution according to Kolmogrov-Smirnov Test results and skewness-kurtosis values. Pearson Correlation analysis was used to test the relationship between temperament characteristics and the play behaviors of the children participating in the study, according to the opinions of the teachers and parents. The significance level in the study was accepted as .05.

FINDINGS

This section contains the findings related to the data gathered within the scope of the research. First of all, the results of the correlation analysis regarding the relationship between preschool children's play behaviors and the opinions of the parents and teachers are presented in Table.

Table 1. *Correlation analysis results on the relationship between the opinions of parents and teachers on children's play behaviors*

PIPPS-Teacher Form		**PIPPS-Parent Form**		
		Play Interaction	Play Disruption	Play Disconnection
Play Interaction	r	,304	-.146	-.132
	p	,000*	,010*	,020*
	n	313	313	313
Play Disruption	r	-.188	,262	,124
	p	,001*	,000*	,028*
	n	313	313	313
Play Disconnection	r	-.279	,233	,240
	p	,000*	,000*	,000*
	n	313	313	313

Table 1 examines the relationship between the opinions of teachers and parents on the play behaviors of preschool children. Accordingly, the "Play Interaction" (r=,304), "Play Disruption" (r=,262), and "Play Disconnection" (r=,240) sub-dimension mean scores of PIPPS have a positive significant relationship between teacher and parent opinions (p .05). This result shows that the views of parents and teachers on children's play behaviors are compatible.

Table 2 presents the results examining the relationship between the temperament characteristics and the play behaviors of the children participating in the study according to the teacher's opinion.

Table 2. *Correlation analysis results on the relationship between children's temperament characteristics and play behaviors according to teacher's opinion*

PIPPS-Teacher Form		Short Temperament Scale for Children			
		Approach/ Withdrawal	Persistence	Rhythmicity	Reactivity
Play Interaction	r	,114	,202	,167	-.198
	p	,045*	,000*	,003*	,000*
	n	313	313	313	313
Play Disruption	r	,008	-.146	-.022	,170
	p	,891	,010*	,697	,003*
	n	313	313	313	313
Play Disconnection	r	-.092	-.215	-.076	,165
	p	,105	,000*	,179	,003*
	n	313	313	313	313

According to Table 2, the "Play Interaction" sub-dimension of the PIPPS-Teacher Form and the "Approach-Withdrawal" (r=.114), "Persistence" (r=.202) and "Rhythmicity" (r=.167) sub-dimensions of the Short Temperament Scale for Children are positively correlated and "Reactivity" (r=-.198) sub-dimensions are negatively correlated (p .05). There is a negative relationship between the "Play Disruption" and "Play Disconnection" sub-dimensions of the scale and the "Persistence" sub-dimension of the Short Temperament Scale for Children and a positive relationship between the "Reactivity" sub-dimension of this scale (p .05).

The results of the correlation analysis regarding the relationship between temperament characteristics and play behaviors of the children participating in the study according to the parents' opinions are presented in Table 3.

Table 3. *Correlation analysis results on the relationship between children's temperament characteristics and plays behaviors according to parents' opinion*

PIPPS-Teacher Form		Short Temperament Scale for Children			
		Approach/ Withdrawal	Persistence	Rhythmicity	Reactivity
Play Interaction	r	,114	,202	,167	-.198
	p	,045*	,000*	,003*	,000*
	n	313	313	313	313
Play Disruption	r	,008	-.146	-.022	,170
	p	,891	,010*	,697	,003*
	n	313	313	313	313
Play Disconnection	r	-.092	-.215	-.076	,165
	p	,105	,000*	,179	,003*
	n	313	313	313	313

Table 3 shows that the "Play Interaction" sub-dimension of the PIPPS-Parent Form and "Approach/Withdrawal" (r=,295), "Persistence" (r=,483), and "Rhythmicity" (r=.306) sub-dimensions of Short Temperament Scale for Children scale have a negative correlation. In contrast, the "Reactivity" (r=-.291) sub-dimension has a positive correlation (p .05). The "Play Disruption" sub-dimension of the scale and the "Persistence" (r=-.335) and "Rhythmicity" (r=-.132) sub-dimensions of the Short Temperament Scale for Children have a negative correlation. In contrast "Reactivity" (r=.339) sub-dimension have a positive correlation (p .05). "Play Disconnection" sub-dimension of the scale and the "Approach/Withdrawal" (r=-.368), "Persistence" (r=-.321) and "Rhythmicity" (r=-.208) sub-dimensions of the Short Temperament Scale for Children have a negative correlation. In contrast, the "Reactivity" (r=,303) sub-dimension has a positive correlation.

DISCUSSION, CONCLUSION, RECOMMENDATIONS

The research aims to examine the relationship between the temperament characteristics of preschool children and their play behaviors. It was deemed appropriate for the research to consult teachers' and mothers' evaluations of children's play behaviors. Lines, Miller, and Arthur-Stanley's findings (2011) show that children spend 70% of their waking hours outside school. Thus, in the research, mothers' observations were decisive in evaluating play behaviors. In addition, children interact with their peers and teachers in pre-school education institutions (Özdoğan, 2014). These places are their first natural social environment, where they are separated from family members and encounter social and behavioral problems for the first time (Carey, 1997). Accordingly, preschool teachers' observation of play behaviors in children's interactions with their peers is essential. Therefore, the preschool teacher and the mothers evaluated the children's play behaviors separately. According to the findings obtained in the study, there is a positive but low-level relationship between the Teacher Form and the Parent Form in "Play Interaction" (r=,304), "Play Disruption" (r=,262), and "Play Disconnection" (r=,240) sub-dimensions of Penn Interactive Peer Play Scale (Shavelson, 2016). This result supports the decision to evaluate children's play behaviors by both the teacher and parent observations. Research by Kesäläinen et al. (2023) on children's play behavior in early childhood special education (ECSE) settings similarly emphasizes that teachers' and parents' observations are crucial, especially when considering the complex interrelation of temperament and special educational needs (SEN) (Kesäläinen et al., 2023).

According to the findings obtained as a result of the research, there is a significant relationship between temperament characteristics and play interactions involving children's behaviors such as comforting their peers, helping them, showing creative behaviors in the play, and encouraging others to participate in the play, regarding the evaluation made by preschool teachers and mothers (Ahmetoğlu et al., 2016; 2017). Accordingly, there is a positive relationship between children's approach/withdrawal, persistence, and rhythmicity characteristics and their play interactions, while there is a negative relationship between their reactivity and play interactions. This finding is supported by the findings of other studies indicating that there is a relationship between children's temperament characteristics and their skills for play interaction behaviors such as positive peer interaction (Farver & Branstetter, 1994), positive communication skills (DiLalla, 1998) and playing (Mendez et al., 2002). Sousa et al. (2023) identified that persistence and approach/withdrawal positively predict emotion regulation in children, further supporting that these traits benefit positive play interactions (Sousa et al., 2023). In addition, as a result of the research conducted by Adak-Özdemir and Budak (2019), in which the relationship between children's temperament characteristics and play behaviors from the point of mother evaluation was examined, a positive relationship is found between children's play interaction behaviors and approach/withdrawal, persistence, and rhythmicity temperament characteristics and a negative significant relationship between reactivity temperament characteristics. This result shows high consistency with the results obtained in the study. The study of Mendez, Fantuzzo, and Cicchetti (2002) found that children with positive temperament exhibit successful peer play interactions.

In the sub-dimension of play disruption, which is one of the play behaviors of children, aggressive and antisocial behaviors that hinder the ongoing peer interaction in play are expressed (Ahmetoğlu et al., 2016; 2017). The research results indicate a positive relationship between children's play disruption behavior and reactivity temperament characteristics and a negative relationship between persistence temperament traits according to the evaluations of both teachers and mothers. In addition, according to the mother's evaluation, a negative relationship exists between children's play disruption behavior and their rhythmicity temperament characteristics. Play disruption behaviors represented by antisocial and aggressive behaviors indicate that the child does not have social competence. According to Sousa et al. (2023), children with higher levels of negative reactivity often struggle with social integration due to increased emotional volatility, impacting their play interactions negatively. The literature mainly supports the result that temperament characteristics are related to social competence, as in Rothbart and Bates (2006), Sanson et al. (2011), and Şendil (2010). Cohen and Mendez (2009) found that problems in children's social competencies also make playing with their peers difficult. While Yoleri (2014) found a positive relationship between the rhythmicity and persistence

temperament characteristics of preschool children and their social competencies, Walker, Berthelsen, and Irving (2001) stated that children with a difficult temperament exhibit more cases of aggressive behavior. Aggressive behaviors related to play disruption behavior are accepted as an indicator. The research conducted by Uçar (2017) shows a negative relationship between physical aggression and children's persistence and rhythmicity temperament characteristics. The study by Şendil (2010) shows that children with reactivity temperament exhibit more anger and aggression.

Play disconnection, expressed as another play behavior in children's interactions with their peers, indicates introverted behavior and not participating in plays created by their peers (Ahmetoğlu et al., 2016, 2017). According to the teacher's evaluation, examination of the result shows a positive relationship between children's play disconnection with reactivity temperament characteristics and a negative relationship with persistence temperament characteristics. According to the evaluation made by the mothers participating in the study, there is a positive relationship between their children's play disconnection and reactivity temperament characteristics and a negative relationship with their approach/withdrawal, persistence, and rhythmicity temperament characteristics. Studies have found that there is a relationship between the reactive behaviors of preschool and school-age children and behaviors that can be associated with play disconnection, such as not participating in peer groups and being reluctant to interact spontaneously with unfamiliar peers (Asendorpf, 1991; Rubin et al., 2009; Stevenson-Hinde et al., 2011). Kesäläinen et al. (2023) further highlight the role of supportive adult guidance in reducing play disconnection, especially in children with higher reactivity traits, indicating the potential for targeted interventions to support these children's social interactions (Kesäläinen et al., 2023). For children, using a passive coping approach often means avoiding or denying the problem (Blair et al., 2004). Therefore, it can be thought that the behavior of play disconnection is a kind of passive coping approach. Thus, the behavior of play disconnection, which is found to be negatively related to approach/withdrawal, persistence, and rhythmicity according to the mothers' evaluations, can be associated with adopting a passive coping approach. In the study conducted by Adak-Özdemir and Budak (2019), a positive relationship is found between the children's disengagement from play and the reactivity temperament feature according to the evaluation of the parents and a negative relationship with the warm-heartedness-shyness temperament feature. This result supports the research findings.

Since plays are the primary activity of social interaction with peers in early childhood, they are accepted as an excellent indicator of social competence (Gagnon et al., 2014). The findings of the research and the literature confirm that play behaviors are indicators of social interaction for children. The role of temperament in forming the behavior patterns of children supports the results of the research on the relationships between temperament characteristics and play behaviors in peer-to-peer interactions from the point of parent and teacher evaluations. Thus, studies that indicate that temperament characteristics can be evaluated differently by peer groups in a cultural context (Chen & Schmidt, 2015) can also be considered from the point of play behaviors. Ari Arat and Özdemir Beceren (2021) also emphasize that temperament's influence on peer interactions is critical for children's social adaptation in educational settings (Ari et al., 2021). The effectiveness of variables related to social-emotional development, such as self-regulation and self-perception, can be tested with further studies.

Considering the research results, a longitudinal study can first be designed to monitor how children's temperament and play behaviors change in different early childhood periods to deeply examine the effect of temperament characteristics on social skill development. Considering the relationship between reactivity and disruptive behaviors that may affect children's play behavior, intervention programs can be designed for the emotional regulation of children with high reactivity; thus, these children can be supported to gain more positive experiences in social interactions. A comparative analysis can be conducted across age groups and different contexts (home and school) better to understand the differences between teacher and parent evaluations.

LIMITATIONS AND IMPLICATIONS

Parents and teachers are assessed based on their perceptions when evaluating children's temperament characteristics and play behaviors. The data obtained in the study is limited to the observations of the participants.

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The Trend Analysis of Graduate Level Curriculum and Instruction Studies in Türkiye [1]

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ABSTRACT

Educational processes are reshaped by developing technologies, economic conditions, and cultural dynamics. Educational programs should be designed to provide the necessary skills for the future of individuals and societies. Careful analysis of these transformation processes is essential to improve the effectiveness of the systems. There is a need for trend analysis of the studies carried out so far in the field of curriculum and instruction in order to contribute to curriculum development studies, educational policy-making processes and to enable scientists to conduct more comprehensive literature review. Therefore, this study is designed to determine the trends in subject and research methods used in the graduate theses completed in the department of Curriculum and Instruction in Türkiye. This research was carried out using the case study approach. The collected data were analyzed using trend analysis and content analysis. Findings revealed that the most researched subject is curriculum, and the least researched subject is curriculum development. Quantitative descriptive research is the most preferred research method and questionnaires are the most common data collection tool. Educators and students were mostly selected as samples in studies. Usually, the preferred sample size range is between 101-500 in graduate theses. It is recommended that researchers include observation, document analysis and achievement test for the data collection to ensure data diversity. Finally, it is surprising that graduate theses written in the Department of Curriculum and Instruction are rarely conducted on the curriculum development. It is strongly recommended for future graduate studies to accommodate curriculum development as a subject.

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INTRODUCTION

Education systems change with the change of social needs. Educational processes are reshaped by developing technologies, economic conditions, and cultural dynamics (Spatar-Kozachenko et al., 2024). Educational programs should be designed to provide the necessary skills for the future of individuals and societies. Careful analysis of these transformation processes is essential to improve the effectiveness of the systems. Change in education manifests itself not only in educational programs but also in educational policies. The changing dynamics of societies have increased the expectations of flexibility and adaptation from education systems. In this context, trend analysis is a critical tool to understand transformations in education and to be able to adapt quickly when necessary.

Trend analysis is used to understand and improve the dynamic nature of education systems (Hwang & Xie, 2018; Kansal, et al., 2021; Shin, et al., 2021; Tieben & Wolbers, 2010). In today's world where changes in education are taking place rapidly, it is of great importance to evaluate the current situation and predict future trends. The curriculum is one of the cornerstones of the educational process. In the past, the education program was seen only as a tool for the transfer of knowledge and cultural heritage, but today a student-centered approach has been adopted. This transformation necessitates the adoption of a more systematic and scientific approach in education. Trend analysis is an important method to evaluate the effects of curriculum changes and to identify which areas are experiencing problems. Trend analysis follows current trends in education, allowing educators and administrators to develop more effective strategies. Thus, it becomes possible to improve the quality of education systems and make them suitable for needs.

Trend analysis not only assesses the current condition but also predicts the future directions of educational policies and practices (Kaplan & Jude, 2022). The direction in which changes in education will develop can be determined by systematic reviews. Which methods and approaches are more effective in education sheds light on future curriculum development processes. Such analyses provide guidance on updating teaching methods and materials. The fact that the education system is in constant change is possible not only with the adequacy of current practices but also with the prediction of future needs. Trend analysis is an important process for understanding the development of education systems and developing more effective education policies. It is critical for educators, students, and policymakers to benefit from such analyses to improve the quality of the education system and ensure sustainable development. In today's world where changes in education are taking place rapidly, trend analysis is an inevitable necessity to respond to the needs of education systems and to determine their future orientation. Therefore, the role of trend analysis cannot be ignored to ensure continuous innovation and development in the field of education. Continuous updating of education policies and practices will increase the effectiveness of education systems and allow individuals to be better prepared for the future.

Universities are among the institutions that conduct high-level education and scientific research, produce knowledge, reveal new discoveries and strive to make them more functional (Mohrman & Baker, 2008). Researchers working in these educational institutions examine the topics previously included in the research by conducting a literature review in order to determine their roadmaps. The number of books being published around the world is increasing, in the last half century, more information has been processed than in human history, and this rate is doubling every eight years. Failure to complete the literature review effectively can cause researchers to waste time and turn to the wrong areas. There is a need for trend analysis of the studies carried out so far in the field of curriculum and instruction in order to contribute to curriculum development studies, educational policy-making processes and to enable scientists to conduct comprehensive literature review (Erdem, 2011).

The purpose of this study is to determine the research methods and subject trends used in the master's and doctoral theses in the Department of Curriculum and Education in Türkiye by trend analysis.

Research on curriculum has been carried out by different researchers to determine the trend in different countries. In their study, Chang and Jeon (2022) analyze Korea's revised special education curriculum for 2015 by examining academic articles from the 2016-2022 period. It is emphasized that the curriculum aims to meet the special educational needs of students with disabilities and to comply with international education standards. The study focuses on the evaluation of the applicability of the curriculum and future revision aspects. According to previous research, difficulties in ensuring the connection of the curriculum with both special and general education have been identified. By examining 29 academic papers, the researchers focused on the main components of the curriculum, its applicability, and the main competencies. The study's findings show that the 2015 curriculum presents challenges for teachers in terms of implementing individualized approaches, and that some of the achievement standards are complex. However, the curriculum has been successful in providing autonomy and flexibility in schools. In conclusion, the curriculum has brought significant improvements, but the need remains to increase the alignment of achievement standards with student abilities and strengthen the implementation process. It is suggested that future revisions should focus on improving teacher education and strengthening the link between general and special education.

In another study, Kurt & Erdoğan (2015) examined the trends of curriculum evaluation research in Türkiye between 2004 and 2013. In the program development process, it is of great importance to conduct regular evaluations to determine the success of the programs and to reveal the improvement needs. Changes in education and current needs have increased the need for such studies. Although there is a lot of research on curriculum evaluation in literature," studies that systematically analyze trends in this area are limited. This study revealed that mathematics, science and English courses were evaluated especially at the primary education level with the content analysis and thematic analysis carried out with the meta-synthesis method. Surveys are the most common data collection tool, while teachers and students are the most frequently used sample groups. Evaluation models such as CIPP and objective performance models have also been widely used. The research identifies trends in curriculum evaluation studies in Türkiye, sheds light on future research and emphasizes the importance of systematic analyses to improve these processes.

Similarly, Kozikoglu and Senemoğlu (2015) examined the theses made in the field of curriculum development in Türkiye. The study aims to determine emerging trends, research designs and frequently studied topics by examining theses in the field of curriculum development and teaching between 2009-2014. As effective curriculum development in education gains importance, the study of these theses offers insights into how educational research is evolving and guides future studies. It has been stated that previous studies have covered the period before 2009, but there is no analysis made after this date. In the study, content analysis was made on 121 theses, and it was determined that topics such as teaching strategies, curriculum evaluation and teacher development came to the fore. Mixed methods were generally used in the studies, and questionnaires and scales were preferred as data collection tools. As a result, it is emphasized that future theses should make more theoretical contributions to the field of curriculum and instruction, turn to experimental designs, and explore understudied areas such as informal education curricula and special education programs.

In another study, Taşdemir and Kuş (2011) examined the news about the Renewed Primary Curriculum in national newspapers using Content Analysis. The research examines how the revised primary school curriculum between 2004 and 2007 was presented to the public through the national media. Emphasizing the importance of education reforms in shaping public opinion, the literature reveals that structural changes in Türkiye encourage student-centered learning. The research evaluated 484 news items in this period through content analysis on 14 national newspapers with a qualitative case study method. These contents, which first reached the highest number of news in 2004, have evolved from bureaucratic explanations to more detailed discussions about the philosophy and implementation process of the curriculum over time. Initially met with mixed reactions, the media gradually focused more on the

inadequacies of the curriculum and evaluation methods. As a result, the media's presentation of the curriculum has shifted from a positive vibe to a critical one as implementation challenges have arisen. This study highlights the need for continuous and accurate media coverage for the effective communication of education reforms to the public.

Trend analysis has also been used to determine trends in different areas of education. For example, Özüdoğru (2018) analyzed the foreign language curriculum evaluation studies carried out between 2005-2016. The increasing importance of curriculum evaluation in foreign language education, combined with the lack of comprehensive analyses, reveals the necessity of this research. Although there are many evaluations in the literature in fields such as science, social studies and mathematics, it is seen that comprehensive studies on foreign language curricula are limited. Using a descriptive content analysis method covering 87 studies, the study examined various criteria such as research methods and sample sizes. The results show that the assessments mostly focused on primary school curricula, and the most common data collection tools were questionnaires and interviews. However, the fact that many studies do not use a specific curriculum evaluation model reveals the deficiencies in systematic evaluation approaches. Overall, the findings of the study emphasize the preference for mixed methods and small to medium-sized samples, but the need to use more comprehensive evaluation models. It is suggested that future research incorporates more systematic models to improve reliability and validity.

Another area where trend analysis is used in education is distance education research. In their study, Yavuz, Kayalı and Tutal (2021) examined the trends in distance education research during the COVID-19 pandemic. The research, which was carried out through bibliometric and content analysis of 220 studies, addresses the research explosion created by the transition of institutions to online and distance learning after major disruptions in education during the pandemic process. While previous studies have focused on a variety of topics, such as student and teacher experiences and the effectiveness of distance education, this study aimed to fill the gap in the literature by analyzing the most cited authors, journals, and methodological trends. The results of the research show that the highest number of publications took place in the last quarter of 2020, with the USA and China being the leading contributors. It has been determined that quantitative research is the most common method, surveys are frequently used as a data collection tool, and keywords such as "COVID-19," "online education," "distance education" come to the fore. The study highlights important areas for future research, frequently used methodologies, and influential authors, suggesting comparative studies across larger sample sizes and education levels.

In another trend analysis study for distance education studies, Tuncay and Uzunboylu (2010) examined the current trends in the literature on distance education (UE) between 1972-2008. Despite the growing popularity of distance education, emphasis has been placed on the lack of a comprehensive literature review. In the study, 9866 documents were analyzed in databases such as Web of Science, Scopus, EBSCOhost and Science Direct, and 160 publications were examined in detail by content analysis method. Most of the studies were published in English and concentrated in fields such as social sciences, engineering and computer science. Since 1972, there has been a significant increase in distance education publications, with the highest number of publications reaching in 2006. Most of the documents are in the form of articles and conference papers, with English being the most common language. With the advancement of technology, the importance of distance education has increased, so it has been suggested that content and citation analysis should be used together in future research. In addition, similar studies are conducted every ten years, emphasizing a better understanding of distance education trends.

Utilizing the trend analysis method, Yılmaz and Banyard (2020) also emphasized the increasing importance of student participation in distance education and determined instructional design, media characteristics and student characteristics as factors affecting participation in their research examining 154 studies. While the results support the importance of student engagement in distance education, new factors such as teaching methods, course design, and instructor competencies should also be considered. In addition, the role of technologies such as LMS, Web 2.0 tools, and mobile learning in increasing

engagement is also highlighted. As a result, it is stated that student engagement should be prioritized for its success in distance education, and further research has been suggested.

Another study using trend analysis was conducted on cooperative learning studies. In this study, Akdemir & Arslan (2012) analyzed 2037 studies in the ERIC database between 1966 and 2010 and examined the trends in collaborative learning research. The study aimed to identify prominent researchers in this field, popular topics and at which education levels these methods are used. The results of the research show that the first article was published in 1988 and Robyn Gillies did the most work. In most studies, it has been determined that educational technologies are used, and the participants are generally high school and above students. The study identified popular topics and scientific journals to guide new researchers.

Another research aimed at determining the trend is the studies that use the keywords of physical education and program development together. Ghazali et al. (2021), in their study examined the literature published between 2013 and 2020 and revealed trends and patterns in curriculum research. The literature review determines the effects of the curriculum on teachers and the trends in its evaluation, and it is emphasized that the most effective study is the article titled "Management of Curriculum Implementation: Strategies for Strengthening the Implementation of the 2013 Curriculum". In the analysis carried out using the VOSViewer application, 89 articles were examined and the keywords "physical education" and "curriculum 2013" came to the fore. As a result, there has been an increase in the number of publications on the 2013 curriculum, indicating an increased interest in the curriculum. It has been determined that issues such as teachers' implementation strategies and evaluation methods should be examined for future research. It has been stated that this study constitutes an important step in developing a more comprehensive understanding of the effects of the curriculum and the ways in which it is implemented.

METHOD

Research design

This research was carried out using the case study approach, which is one of the qualitative research methods (Büyüköztürk, Kılıç-Çakmak, Akgün, Karadeniz, & Demirel, 2010). A case study is used in the in-depth study of a particular phenomenon or event (Tekindal & Uğuz-Arsu, 2020). The case study is used for a detailed understanding of the phenomenon within the scope of the study (Yin, 2018). In this study, it was focused on the selected situation to understand the changes and trends in graduate studies in the field of curriculum and instruction.

Document analysis was used in the collection of research data as a data collection technique based on revealing certain themes and trends by analyzing written materials (Tekindal & Uğuz-Arsu, 2020; Kıral & Kıral, 2011; Zulfiqar, 2022). In this context, the documents of the period determined in the research were examined and a trend analysis was carried out on these documents (Hwang & Xie, 2018; Kansal, et al., 2021; Shin, et al., 2021; Tieben & Wolbers, 2010). Trend analysis is preferred to determine the changes that occur over time.

Research Sample

The study population of this research consists of 294 graduate theses published between 2017 and 2023 in the pdf format in the Department of Curriculum and Instruction at the National Thesis Center of the Council of Higher Education (YÖK). Comprehensive sampling was used in the sample selection and all graduate theses in the population were included in the study.

Research Instruments and Processes

Document analysis was used in the collection of research data as a data collection technique based on revealing certain themes and trends by analyzing written materials (Tekindal & Uğuz-Arsu, 2020; Kıral & Kıral, 2011; Zulfiqar, 2022). In this context, the documents of the period determined in the research were

examined and a trend analysis was carried out on these documents (Hwang & Xie, 2018; Kansal, et al., 2021; Shin, et al., 2021; Tieben & Wolbers, 2010). Trend analysis is preferred to determine the changes that occur over time.

Data Analysis

The collected data were analyzed using trend analysis and content analysis. Trend analysis was used to examine and visualize the changes over time. During the analysis of some of the data, the content was created into categories by coding. Theses are categorized by years, type, province, universities, languages, rank of advisors, subjects, sample size, research methods, means of data collection and data analysis.

FINDINGS/RESULTS

This section contains the findings related to the data gathered within the scope of the research. First of all, the results of the correlation analysis regarding the relationship between preschool children's play behaviors and the opinions of the parents and teachers are presented in Table.

Table 1. *Distribution of theses by year and type*

Years	Master's Thesis f	Percentile %	Ph.D. Thesis f	Percentile %	Sum f
2017	27	11	6	14	33
2018	38	15	9	21	47
2019	64	25	10	23	74
2020	35	14	5	12	40
2021	53	21	7	16	60
2022	34	14	6	14	40
Sum	**251**	**100**	**43**	**100**	**294**

The year in which the least master's thesis was written was 2017, the number of master's theses written was 27 and the percentage rate was 11%. An increase in master's theses written up to 2019 has been observed. Shortly after the first COVID-19 case was seen in Türkiye on March 11, 2020, the distance education period started in universities (Budak & Korkmaz, 2020, p. 62-79). Due to the fact that the first days of this process, which have not been experinced before, were quite difficult, there has been a noticeable decrease in academic studies. In case studies and surveys, it can be thought that there are slowdowns due to the pandemic. Therefore, the number of Master's theses written in 2019 decreased from 64 to 35. With the decrease in restrictions, the number of theses written has also increased. In 2021, the total number of master's theses increased to 53, the percentage was 21%.

Distribution of Theses by Provinces

The distribution of 294 graduate theses according to the provinces in Türkiye is given in Table 2.

Table 2. *Distribution of graduate theses by provinces*

Cities Theses Written	Type Of Theses	Sum f	Percentage Rate %
Ankara	Master	71	28
	Doctoral	20	47
Zonguldak	Master	55	22
	Doctoral	0	0
Istanbul	Master	38	15
	Doctoral	3	7
Kahramanmaraş	Master	21	8
	Doctoral	0	0
Mersin	Master	11	4
	Doctoral	5	12
Eskisehir	Master	5	2
	Doctoral	6	14

Aydin	Master	9	4
	Doctoral	0	0
Elazığ	Master	6	2
	Doctoral	2	5
Konya	Master	0	0
	Doctoral	4	9
Antalya	Master	4	2
	Doctoral	0	0
Yozgat	Master	4	2
	Doctoral	0	0
Afyon	Master	3	1
	Doctoral	0	0
Gaziantep	Master	3	1
	Doctoral	0	0
Izmir	Master	3	1
	Doctoral	0	0
Bartin	Master	2	1
	Doctoral	0	0
Other Provinces	Master	18	7
	Doctoral	3	7
Sum	**Master**	**251**	**100**
	Doctoral	**43**	**100**

When Table 2 is examined, it is seen that the provinces with the highest number of graduate theses are Ankara, Zonguldak and Istanbul, followed by Kahramanmaraş, Mersin and İzmir. According to the data obtained, it is understood that the geographical regions where the universities are located do not influence the number of theses written (Figure 1).

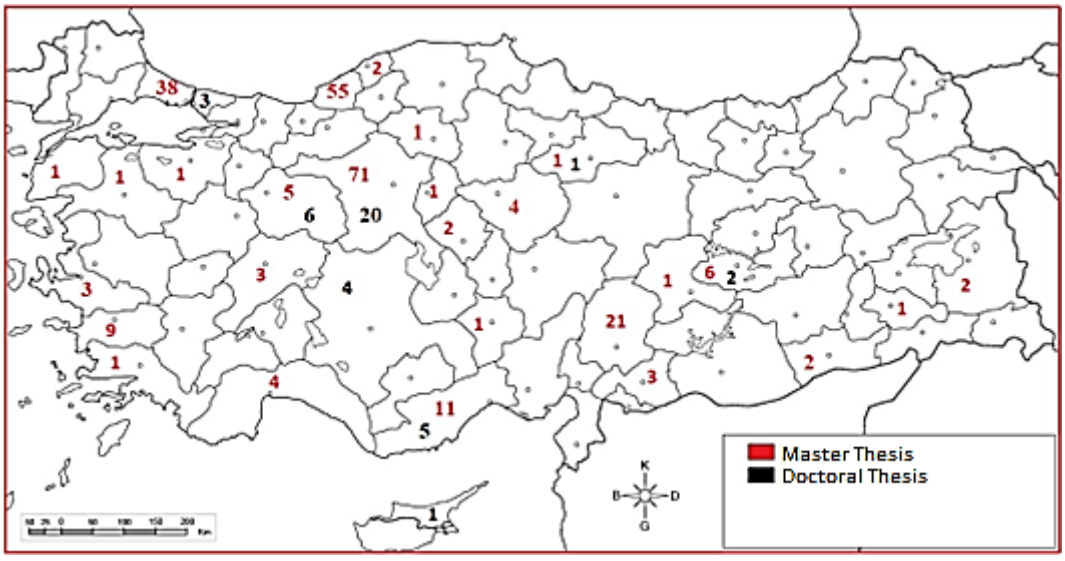

Figure 1: *Distribution of Graduate Theses by Provinces*

Distribution of Graduate Theses by Universities

The distribution of 294 graduate theses according to the universities where they were published is given in Table 3.

Table 3. *Distribution graduate theses by universities*

Universities Theses Written	Type Of Theses	Years						Sum	%
		2017	2018	2019	2020	2021	2022		
		f	f	f	f	f	f	N	
Zonguldak Bulent Ecevit University	Master	3	8	20	6	6	12	55	22
	Doctoral	0	0	0	0	0	0	0	0
İhsan Doğramacı Bilkent University	Master	11	13	7	3	16	3	53	21
	Doctoral	2	2	1	0	1	1	7	16
Istanbul Aydin University	Master	0	0	3	0	0	1	4	2
	Doctoral	0	0	0	0	0	0	0	0
Aydın Adnan Menderes University	Master	0	2	0	3	3	1	9	4
	Doctoral	0	0	0	0	0	0	0	0
Anadolu University	Master	0	1	0	0	0	2	3	1
	Doctoral	0	0	2	1	1	1	5	12
Yozgat Bozok University	Master	0	0	0	0	2	2	4	2
	Doctoral	0	0	0	0	0	0	0	0
Mersin University	Master	0	1	3	4	1	2	11	4
	Doctoral	0	1	0	0	1	3	5	12
Middle East Technical University	Master	2	0	3	1	7	1	14	6
	Doctoral	1	2	4	0	2	0	9	21
Yeditepe University	Master	3	3	8	1	4	4	23	9
	Doctoral	0	0	0	1	0	1	2	5
Fırat University	Master	2	1	1	1	1	0	6	2
	Doctoral	0	0	0	2	0	0	2	5
Kahramanmaras Sutcu Imam University	Master	3	1	6	6	5	0	21	8
	Doctoral	0	0	0	0	0	0	0	0
Marmara University	Master	0	1	1	1	1	0	4	2
	Doctoral	0	0	0	0	0	0	0	0
Necmettin Erbakan University	Master	0	0	0	0	0	0	0	0
	Doctoral	1	1	1	0	1	0	4	9
Akdeniz University	Master	1	1	1	0	1	0	4	2
	Doctoral	0	0	0	0	0	0	0	0
Gazi University	Master	0	0	0	1	1	0	2	1
	Doctoral	1	1	0	1	1	0	4	9
Afyon Kocatepe University	Master	0	0	2	1	0	0	3	1
	Doctoral	0	0	0	0	0	0	0	0
Eskisehir Osmangazi University	Master	0	0	0	1	0	1	2	1
	Doctoral	0	0	1	0	0	0	1	2
Ege University	Master	0	0	2	0	0	1	3	1
	Doctoral	0	0	0	0	0	0	0	0
Gaziantep University	Master	1	2	0	0	0	0	3	1
	Doctoral	0	0	0	0	0	0	0	0
Yıldız Technical University and Istanbul Aydın University (Jointly Conducted)	Master	0	0	0	4	1	0	5	2
	Doctoral	0	1	0	0	0	0	1	2
Other Universities	Master	1	4	7	2	4	4	22	9
	Doctoral	1	1	1	0	0	0	3	7
Sum	Master	27	38	64	35	53	34	251	
	Doctoral	6	9	10	5	7	6	43	
	Sum	33	47	74	40	60	40	294	

When Table 3 is examined, 55 of the 251 master's theses written between 2017 and 2022 came from the Zonguldak Bülent Ecevit University. This was followed by İhsan Doğramacı Bilkent University with 53 master's theses. According to the percentage rates, the theses written in these two universities constitute approximately 43% of the total theses. In the Department of Curriculum and Instruction, graduate theses were written in a total of 38 universities in 6 years (2017-2022).

When the doctoral theses published according to Table 3 are examined, is seen that the number of

doctoral theses has decreased compared to the universities that publish master's theses. A total of 13 universities have published doctoral theses in the field of Curriculum and Instruction. According to Table 3, the university that published the highest number of doctoral theses was the Middle East Technical University with 9 theses. This number corresponds to 21% of all doctoral theses in Table 3. This university is followed by İhsan Doğramacı Bilkent University with 7 doctoral theses and Anadolu University and Mersin University with 5 doctoral theses. The proportion of doctoral theses published by these four universities is 61%, which is more than half of the total doctoral theses.

Distribution of Graduate Theses by the Languages Written

Within the scope of the research, the master's and doctoral theses taken from the National Thesis Center of the Council of Higher Education (YÖK) were classified according to the languages in which they were written (Table 4).

Table 4. *Distribution of theses by languages*

	Master				Doctor				
Years	English	Percentile rate	Turkish	Percentile rate	English	Percentile rate	Turkish	Percentile rate	Sum
	f	%	f	%	f	%	f	%	n
2017	15	17	12	7	4	21	2	8	33
2018	14	16	24	15	4	21	5	21	47
2019	19	21	45	28	5	26	5	21	74
2020	7	8	28	17	1	5	4	17	40
2021	26	29	27	17	3	16	4	17	60
2022	8	9	26	16	2	11	4	17	40
SUM	**89**	**100**	**162**	**100**	**19**	**100**	**24**	**100**	**294**

According to the information given in Table 5, 89 of the master's theses were written in English, constituting 36% of all master's theses. Similarly, 19 of the doctoral dissertations were written in English. Therefore, 43% of the doctoral theses written in this field were written in English. Most graduate theses written in English have been published in universities where the medium of instruction is English.

Distribution of Theses by Rank of Advisors

Within the scope of the research, the advisors who took part in the master's and doctoral theses taken from the National Thesis Center of the Council of Higher Education (YÖK) were classified according to rank of their advisors (Table 5).

Table 5. *Distribution of theses by the rank of advisors*

	Years												
	2017		2018		2019		2020		2021		2022		
Rank of Advisors	Master	Doctoral	Master	Doctoral	Master	Doctoral	Master	Doctoral	Master	Doctoral	Master	Doctoral	Sum
Professor Doctor	3	3	6	4	20	5	19	5	8	4	4	4	85
Associate Professor	11	2	15	2	22	3	9	-	23	2	19	1	109
Assistant Professor	13	1	17	3	22	2	7	-	22	1	11	1	100
Sum	**27**	**6**	**38**	**9**	**64**	**10**	**35**	**5**	**53**	**7**	**34**	**6**	**294**

Although academicians with the title of Professor manage both master's and doctoral theses at the same rate, Associate Professor and Assistant Professor mostly supervised master's theses. Considering that doctoral theses require more expertise and are the last step of education the results are consistent (Table 6).

Distribution of Graduate Theses by the Subjects

The distribution of graduate theses by the subjects was presented in groups at Table 6.

Table 6. *Distribution of graduate theses by the subjects*

Subjects	Years						Sum	Percentage Rate
	2017	2018	2019	2020	2021	2022		
	f	f	f	f	F	f	n	%
Teaching-Learning Approaches	4	7	14	10	0	4	39	10,77
Teachers	2	6	5	5	2	12	32	8,84
Program Development	2	0	1	0	2	4	9	2,49
Program Assessment and Evaluation	3	4	3	2	5	4	21	5,80
Student	1	1	4	0	0	10	16	4,42
Values Education	2	3	5	6	1	6	23	6,35
Education and Information Technologies	4	3	5	4	4	4	24	6,63
Curriculum	1	2	17	7	7	3	37	10,22
Curriculum	8	12	15	3	3	2	43	11,88
Multicultural Education	2	2	1	1	2	3	11	3,04
Internationalization	4	3	2	2	1	3	15	4,14
Strategy Teaching	3	4	4	4	2	1	18	4,97
Comparative Education	2	2	3	1	1	3	12	3,31
Cinema in Education	0	0	0	1	1	0	2	0,55
Foreign Language Education	3	6	17	6	0	2	34	9,39
Natural Disaster Training	1	1	0	1	0	0	3	0,83
Guidance Training	0	1	1	0	0	0	2	0,55
Distance Education	0	1	0	6	7	5	19	5,25
Academics	1	1	0	0	0	0	2	0,55
Sum	**43**	**59**	**97**	**59**	**38**	**66**	**362**	**100**

Although 294 graduate theses were examined, 19 different topics were investigated 362 times. Therefore, it turns out that in some graduate theses more than one subject was studied in one thesis. It is observed that the most researched subject is "Curriculum" with a rate of 12%, and the least researched subjects are "*Curriculum Development*", "*Comparative Education*", "*Multicultural Education*", "*Natural Disaster Education*", "*Cinema in Education*", "*Guidance Education*", "*Academicians*" with a rate of less than 3% (Table 7). These data can give an idea to those who will do new research in the field of education.

Distribution of Graduate Theses by the Sample Size

The sample size is important in solving the investigated problem. The larger the sample size, the more sensitive a study can be performed. The sample sizes obtained from the researched theses are given in Table 7.

Table 7. *Distribution of graduate theses by the sample size*

Sample Size	Years						Sum	Percentage
	2017	2018	2019	2020	2021	2022		
	f	f	f	f	f	f	N	%
1-50	7	7	23	8	10	7	62	24,41
51-100	5	9	10	5	4	7	40	15,75
101-500	11	15	16	14	21	15	92	36,22
501-1000	1	4	8	8	8	6	35	13,78
1001 and above	1	6	10	1	5	2	25	9,84
Sum	**25**	**41**	**67**	**36**	**48**	**37**	**254**	**100**

101-500 sample studies were used among the sample groups, and it was the most preferred group with a rate of approximately 36.22% (Table 8). This is followed by 1-50 samples used with a rate of approximately 24%. The sample study with 1001 or more units was the least preferred group with 9.84%. In the selection of the size of the sample, the most important criterion is to collect sufficient data on the

subject investigated and to represent the study universe in the best way. Therefore, it is quite natural that the sample size varies according to the research topics in the theses.

Distribution of Graduate Theses by Research Methods

The distribution of graduate theses by research methods was presented at Table 9. The research methods are divided into 4 groups as "*Qualitative*", "*Quantitative Descriptive*", "*Quantitative Experimental*" and "*Mixed*". The obtained data are given in Table 8.

Table 8. *Distribution of graduate theses by research methods*

Research Methods	Years						Sum	Percentage Rates %
	2017	2018	2019	2020	2021	2022		
	f	f	f	f	f	f	n	
Qualitative	10	9	23	8	11	11	72	25,26
Quantitative Descriptive	12	13	24	19	10	32	110	38,60
Quantitative Experimental	4	5	10	2	2	4	27	9,47
Mixed Research	8	17	16	10	6	18	75	26,67
Sum	**34**	**44**	**73**	**39**	**29**	**65**	**284**	**100**

While the "Quantitative Descriptive" research method is used at a rate of approximately 40%, the "Quantitative Experimental" research method is used at a much lower rate of 10%. "Qualitative" and "Mixed" methods were used equally at a rate of 25%.

Distribution of Graduate Theses by the Means of Data Collection

The means of data collection are divided into 6 main groups: "*Questionnaire*", "*Interview and Interview*", "*Observation*", "*Achievement Test*", "*Documents*" and "*Other*", each group was detailed by dividing it into subheadings (Table 9).

Table 9. *Theses by the means of data collection*

Means of Data Collection		Years							
		2017	2018	2019	2020	2021	2022	Sum	Percentage
		f	f	f	f	F	f	n	%
Survey	Likert	19	27	41	18	16	22	143	22,45
	Open-ended	-	10	60	25	14	4	113	17,74
	Closed-Ended	1	1	-	-	-	-	2	0,31
	Semi-Structured Interview	13	12	24	10	5	13	77	12,09
Interview	Focus Interview	3	10	10	2	2	2	29	4,55
	Structured Interview	1	2	4	2	-	1	10	1,57
	Unstructured Interview	1	-	-	-	-	-	1	0,16
Observation	Participant Observation	14	5	19	10	4	5	57	8,95
	Non-Participatory Observation	1	-	2	-	1	1	5	0,78
Achievement Test	Multiple Choice Test	2	3	1	-	-	3	9	1,41
	Open-Ended Testing	2	1	5	2	1	1	12	1,88
	Open-Ended Written Question	-	3	-	-	-	-	3	0,47
Documents	Docs	10	11	13	4	6	3	47	7,38
	Logs	3	3	3	6	-	4	19	2,98
	Rubric	18	-	18	3	3	4	46	7,22
	Evaluation Form	2	1	8	2	4	2	19	2,98
Other	Scenario	-	-	-	1	-	-	1	0,16
	Student Products	3	1	-	-	-	1	5	0,78
	Video Recordings/ Audio Recording	5	5	13	3	1	3	30	4,71

Photos	1	-	2	-	-	1	4	0,63
Interview	-	-	4	-	-	-	4	0,63
Biography	1	-	-	-	-	-	1	0,16
Sum	**100**	**95**	**227**	**88**	**57**	**70**	**637**	

When Table 9 is examined, it is understood that the most used means of data collection is the "questionnaire". While questionnaires were used in approximately 40% of the graduate theses examined in the study, on the contrary, the least used means of data collection was the "Achievement Test" with a rate of 4%.

Distribution of Graduate Theses by the Data Analysis

When the data analysis methods used in 294 graduate theses it can be interpreted that these methods are grouped under 3 main headings: "Descriptive", "Predictive" and "Qualitative". The data obtained are given in Table 10.

Table 9. *Distribution of graduate theses by the data analysis*

Data Analysis			Years						Sum	Percentage
			2017	2018	2019	2020	2021	2022		
			f	f	f	f	F	f	n	%
Descriptive		Frequency / Percentage	6	14	16	12	11	6	65	7,98
		Tables	2	1	3	1	0	3	10	1,23
		Mean/Standard Deviation	10	15	21	17	13	24	100	12,27
Predictive	Parametric Test	T-Texts	14	18	24	19	15	5	95	11,66
		Pearson Correlation	7	4	7	15	6	6	45	5,52
		Anavo (Varying Analysis)	9	15	19	17	15	7	82	10,06
		Ancova (Covariance analysis)	1	1	3	2	0	0	7	0,86
		Manova (Multivariate)	5	5	8	4	0	1	23	2,82
		Regre. Analysis	5	4	3	8	4	5	29	3,56
		Path Analysis	-	1	3	1	0	0	5	0,61
	Non-Parameteric Test	Mancova	4	5	3	3	0	1	16	1,96
		Chi-square	1	2	4	0	2	0	9	1,10
		Spearmann Correlation	2	3	9	8	0	0	21	2,58
		Mann Whitney U	10	14	30	20	22	11	107	13,13
		Wilcoxon	1	0	1	0	1	1	4	0,49
		Kruskal Wallis Analysis	1	6	14	7	3	3	34	4,17
Qualitative		Content Analysis	12	15	25	8	8	7	75	9,20
		Descriptive Analysis	9	15	21	11	18	3	77	9,45
		MAXQDA	2	0	2	0	1	1	6	0,74
		Thematic Analysis	1	0	3	1	0	0	5	0,61
Sum			**103**	**138**	**213**	**158**	**119**	**84**	**815**	**100**

According to Table 10 approximately 60% of the "Predictive" data analysis method was used, while 20% of the "Descriptive" and "Qualitative" analysis methods were used at the same portion.

DISCUSSION, CONCLUSION, RECOMMENDATIONS

Examining the graduate theses by type, most of the theses consist of master's theses. It coincides with the work of Özenç et al., (2013), Erdoğmuş, (2009) and Çiltaş, (2021). When the distribution of theses by years is examined, it is observed that there is an increase in the number of theses until 2019. Like all countries in the world, Türkiye has been adversely affected by the COVID-19 epidemic that occurred at the end of 2019. As a result of the epidemic, researchers have not been able to focus sufficiently on their research. During this process, academic studies were postponed because students were given the right to suspend registration by universities (Ak, Şahin, Çiçekler, & Ertürk, 2020; Yükseköğretim Kurulu (YOK), 2020). After the effects of the COVID-19 pandemic began to decrease,

the number of graduate theses increased again. However, Türkiye has developed and proven itself in the field of distance education during the COVID-19 period, both in terms of educators and technological infrastructure. Thanks to the technological infrastructure used today, researchers can share information with each other in a virtual course environment and share their research more quickly.

When the cities where the graduate theses completed are examined, it seems that master's and doctoral theses should be examined separately. When the universities where master's theses are published is investigated, no significant connection has been established between the region where they are located and the number of master's theses. When the cities where doctoral theses are published investigated, it is seen that big cities such as Ankara, Eskişehir and Konya are mostly preferred (Erdoğmuş, 2009; Töngel et al., 2020). The advantage of these cities is that written materials are easier to access and the universities in these cities have a more established history and therefore more experienced academic staff.

When the languages are examined in which graduate theses are written, it is determined that 37% of them are written in English, this rate is 35% in master's theses and 44% in doctoral theses. It has been determined that most graduate theses written in English are written in universities where the language of instruction is English. It is understood that the authors of the English theses written in universities where the medium of instruction is Turkish are either foreign researchers or English language teaching graduates. When the doctoral theses are examined, it is understood that 58% of the titles of the academicians who provide consultancy are professors, 24% are associate professors and 19% are assistant professors. 24% of the titles of academicians who supervise master's theses are professors, 40% are associate professors, and 36% are assistant professors. It is obvious that professional knowledge and experience are much more important in the execution of the doctoral thesis. The findings reveal that language preferences and the academic titles of the advisors play an important role in the graduate theses completed in the field of Curriculum and Instruction. These findings can be a guide in terms of planning future thesis studies and organizing academic advising processes.

Since the theses were written in the Department of Curriculum and Instruction, as expected, the subject of "Curriculum" was mostly examined. On the contrary "Curriculum Development" is the least investigated subject in graduate theses.

When the samples used in the theses are examined, "Students " and "Educators", which are among the most accessibale sample groups in the field of education, were the most frequently used samples (Ahi et. al, 2013; Çiltaş, 2021; Erdoğmuş, 2009; Özenç ve et.al., 2013; Selçuk et. al, 2014; Töngel ve et. al., 2020). This sample was preferred in approximately 76% of all theses. Other sample groups were used less frequently due to both the limitations of the subjects studied and the difficulty of accessing the samples. When the selected sample size was examined, it was understood that the range of 101-500 was preferred with a rate of approximately 40%.

When the research methods used in graduate theses are grouped under 4 main headings: "Qualitative", "Quantitative Descriptive", "Quantitative Experimental" and "Mixed". It is understood that the quantitative descriptive research method was used in 39% of the theses, while the quantitative experimental research method was used in approximately 9% of the theses. Although experimental research methods are mostly used in the field of science, it is understood that they are also used in social sciences. According to the findings 61% of the studies conducted in the Department of Curriculum and Instruction used a case study from qualitative research methods. Other qualitative research methods were included in graduate theses at a rate of 16% which can be listed as "Phenomenology".

The means of data collection were selected with the highest number of questionnaires in the graduate theses examined (Ahi et. al., 2013; Erdoğmuş, 2009; Uzunbaz, 2019). The reason for this is that with the developing technology, survey studies can now be done face-to-face as well as remotely online. In this way, more people can be reached in a short time.

In the examined graduate theses, the authors tended to work with samples that they could access

more easily. Educators and students were mostly selected as samples. It may be useful to include more samples such as administrators, administrative staff, parents, course materials and books, etc., which are parts of education and training, in terms of bringing a different perspective to the subjects to be examined. Therefore, it may be recommended to select different samples instead of working with the same samples. In graduate theses, the maximum range of 101-500 was preferred as the sample size. The larger the sample range, the closer it gets to the population it represents. Therefore, it may be recommended to increase the selected sample size. The research methods selected in the studies were classified as "Qualitative, Quantitative Descriptive, Quantitative Experimental and Mixed" research methods. While methods other than the Quantitative Experimental research method are given enough space, the Quantitative Experimental research method is not used much. Although the creation and maintenance of the experimental environment causes various difficulties, the use of different methods in terms of diversity in research can be recommended in terms of giving a different perspective to the subject and guiding the future studies of the researchers. In the qualitative research methods used in graduate theses, "Case Study" was predominantly preferred, while "Phenomenology" method was not used sufficiently. Researchers may be advised to use these methods in their new studies. The authors predominantly preferred the use of "Questionnaire" as a data collection tool in graduate theses. In addition, "Observation, Document Analysis, Achievement Test" has been included very little in theses for the data collection. It is recommended that researchers include them for the data collection to ensure data diversity. Finally, it is surprising that graduate theses written in the Department of Curriculum and Instruction rarely focus on "Curriculum Development". It is strongly recommended for future graduate studies to accommodate curriculum development as a subject.

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