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Development Of Mathematics Skills in Preschool Period with Flipped Learning Education Model

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ABSTRACT
This study was conducted to examine the effect of the program designed with the flipped learning education model on preschool children's early mathematics skills. The study group consisted of children attending the official kindergarten affiliated with the Ministry of National Education in the Karatay district of the Konya province in the 2022-2023 academic year. There were 50 children in the study. The number of girls was 12 (48%) in the experimental group and 10 (40%) in the control group. A quasi-experimental model was used in the study. The "General Information Form" and the "Early Mathematics Aptitude Test-3 (TEMA-3)" were used to collect the research data. The education program designed with the flipped learning education model was implemented for 12 weeks with the children in the experimental group. The 12-week training program focuses on reinforcing each topic with children through daily activities. The program covers the fundamental topics of mathematics. As a result of the analysis of the research data, it was evident that the children in the study group had equivalent early math skills before the implementation. After the implementation of the program designed with the flipped learning model in the experimental group, it was determined that a significant difference existed between the experimental and control groups in the "TEMA 3" post-test application. It was determined that the children in the experimental group were more successful than the children in the control group in terms of math skills.

Keywords: Flipped Learning Method, mathematics skills, preschool education.

Introduction

In today's rapidly changing educational environment, studies on mathematics, research into effective teaching methods continue (Ernest, 2018; Hamami & Morris, 2020; Izmirli, 2020; Sriraman, 2021). Mathematics teaching is important in every level of education and, importantly, also, mathematics teaching gains importance in the preschool period. In this period, children's relationships with mathematics play a fundamental role in the mathematical skills they will acquire later in life. The preschool period is an important time for children to develop their relationship with mathematics. In this period, children begin to explore mathematical concepts, and this discovery process determines the mathematical skills they will acquire later in life (NCTM, 2007; Susperreguy, et al., 2022). In this context, the concept of "flipped learning" as an innovative educational model that goes beyond traditional learning methods is attracting more and more attention. Traditional learning methods have been used in education systems for many years. However, with the rapid development of technology and easy access to information, new educational models are emerging. Flipped learning stands out as one of these new educational models (Baker, 2000; Ünsal, 2018).

Flipped learning allows students to experience the learning process in a different way from traditional approaches. Instead of transferring knowledge to students, this method encourages students to explore, question, and apply knowledge. Using this model can help students develop mathematical skills by connecting abstract mathematical concepts with concrete experiences and developing a deeper understanding (Kates, Byrd, & Haider, 2015; Larcara, 2015).

The flipped learning educational model aims to make classroom time productive. In this model, learners perform tasks, such as acquiring knowledge outside of school, that require basic skills. Tasks that require higher-level skills such as application, problem-solving, and creativity are performed in the classroom under the guidance of the teacher (Aydın & Demirer, 2016). This education system is a teaching-learning method that enables students to engage more in subject-related activities on their own in the classroom environment and enables the teacher to deal with the learner one-on-one. In contrast to traditional education, the flipped classroom system is defined as a method that offers students the opportunity to learn theoretical knowledge at home on their own and apply what they have learned at school (Zownorega, 2013).Especially considering the development of technology and instructional technologies, it is believed that the limitations of learning environments can be minimized with these technologies (Torun & Dargut, 2015).

Flipped Learning offers a different perspective compared to traditional educational methods (Ihamaki & Heljakka, 2019) and can help children better understand and learn mathematical concepts. Mathematical skills are critical in modern society. These skills play an important role in the development of basic competencies such as problem-solving ability, logical thinking, and analytical thinking (Gürgah Oğul & Aktaş Arnas, 2020). Therefore, it is of great importance to provide a solid foundation for preschool children to establish a positive relationship with mathematics and develop these skills at an early age (Huntsinger, Jose, & Luo, 2016; NAEYC, 2002; NCTM, 2007).

Traditional mathematics teaching methods can reduce children's interest and motivation in this area. Students often struggle to understand abstract mathematical concepts and become bored with mathematics. This is where the flipped learning model comes in. This model can make learning mathematics more enjoyable and meaningful by increasing students' interaction with mathematics through games, applications, and concrete experiences (Cevikbas & Kaiser, 2020; Lessani et al., 2017; Lo & Hew, 2020).

Teaching in online environments can take place at different times with electronic materials such as text, video, audio recordings, or activities such as forum discussions; or it can take place simultaneously with applications such as instant messaging, audio, or video distance education platforms (Hayırsever & Orhan, 2018). To raise individuals with 21st-century skills, educational practices need to be adapted accordingly. In this context, with the developments in teaching-learning theories and approaches today, technology-supported and student-centered approaches are

being addressed rather than the teacher-oriented methods and techniques of traditional education. With the advances in information and communication technologies , differences in teaching approaches have become inevitable (Kozikoğlu et al., 2021).

The other positive aspect of the method is that it allows active learning activities in the classroom to be carried out in cooperation. In this context, group-based, interactive learning activities are included in various studies in the literature. Collaborative activities increase the communication skills of learners and help develop them into stronger individuals in the sociocultural context (Demirer & Aydın, 2017).

The flipped learning model has gained attention in recent years as an innovative approach in education. However, there are a limited number of studies on the effects of this model in early childhood education, particularly in mathematics instruction, where foundational skills are developed. At the preschool level, children tend to learn through concrete experiences, and traditional teaching methods are more commonly used. Therefore, it is important to examine how student-centered, digitally-supported approaches like flipped learning function with this age group and how they contribute to the development of mathematical skills (Nong & Cao, 2023; Rahman et al., 2020; Zownorega, 2013).

Existing literature has shown that the flipped learning model increases student engagement, personalizes the learning process, and supports deeper learning. However, these studies typically focus on middle school, high school, and university students (Bārdule , 2021;Hossein-Mohand et al., 2021; Sein-Echaluce et al., 2024; Tekin & Karakaya, 2020) . There is a lack of sufficient evidence regarding the applicability and effectiveness of this model in early childhood education. Additionally, it is well known that the development of mathematical thinking skills at an early age is critical for future academic success. Aiming to fill this gap in the literature, researching how the flipped learning model impacts preschool children's learning processes, in the context of mathematics education .

In summary, this study aims to investigate the effectiveness of the flipped learning model in early childhood mathematics education in order to address gaps in the existing literature and provide more insights into the applicability of this innovative approach within early childhood educationThis study will examine the effectiveness of the flipped learning model in preschool mathematics education. As a result, this research is planned to offer a perspective that goes beyond traditional approaches to developing mathematical skills in preschool. The flipped learning model will be tested to see whether it can help children develop mathematical skills. Furthermore, the aim is to make preschool mathematics education more effective by providing educators with practical suggestions on how to apply this model to make preschool mathematics education more effective.

Methods and Materials

Research Design

This study was conducted using a pre-test, post-test control group experimental model in which both the experimental and control groups were tested before and after the application. The dependent variable of the study is the early math skills of preschool children. The independent variable of the study is the program designed with the flipped learning model, which is carried out at school and at home. The method involving an experimental group, in which the application will be made, and a control group, in which only the tests will be conducted is called the quasi-experimental model with the pretest-posttest control group. The method is called quasi-experimental because the study group is determined by the purposive sampling method (Karasar, 1986).

Study Group

The study group of this research consists of children attending kindergartens affiliated with the Ministry of National Education in the Karatay district of Konya province. In the 2022-2023 academic year, two kindergartens in the district center were selected using the purposive sampling

method. Twenty-five children in one of these kindergartens constituted the experimental group, while 25 children in the other constituted the control group. Demographic information of the children and their parents, who participated in the study, is given in Table 1. The principle of volunteerism was observed in the study. A pre-test and post-test control group experimental design was used. Before the study started, a meeting was held with the families; the purpose, subject, and content of the study were explained, and information about the program was given. Permission was requested from the parents for their children's participation in the study, and the parents who agreed signed the "Consent Form for Participation in the Study." The demographic characteristics of the children and parents included in the program are given in Table 1.

Table 1. *Comparison of Descriptive Characteristics of Participants According to Groups*

	Group		Test (*p*)
	Experiment *n*=25	Control *n*=25	
Gender, n (%)			
Female	12 (%48)	10 (%40)	$\chi2$=0.325 *p*=0.569
Male	13 (%52)	15 (%60)	
Age (month)			
X ± SD	61.44 ± 2.40	61.96 ± 2.39	*t*=-0.768 *p*=0.446
M (min-max)	62 (56-65)	62 (57-66)	
Number of siblings (person)			
X ± SD	1.12 ± 0.83	0.96 ± 0.45	*t*=0.843 *p*=0.403
M (min-max)	1 (0-4)	1 (0-2)	
Mother's Education Level, n (%)			
Primary/Secondary Education	8 (%32)	4 (%16)	
High School	4 (%16)	5 (%20)	$\chi2$=1.873 *p*=0.599
Associate Degree/Bachelor's Degree	4 (%16)	4 (%16)	
Postgraduate	9 (%36)	12 (%48)	
Father's Education Level, n (%)			
Primary/Secondary Education	7 (%28)	2 (%8)	
High School	4 (%16)	3 (%12)	$\chi2$=3.987 *p*=0.263
Associate Degree/Bachelor's Degree	4 (%16)	6 (%24)	
Postgraduate	10 (%40)	14 (%56)	
Economic Status, n (%)			
Military pay	5 (%20)	3 (%12)	$\chi2$=0.595 *p*=0.440
Above military wage	20 (%80)	22 (%88)	

Independent Sample t Test (t); Chi-Square Test ($\chi2$); Descriptive statistics are given as mean (X), standard deviation (SD), Median (M), minimum (min), maximum (max), number (n), percentage (%).

Table 1 shows the distribution of the descriptive characteristics of the participants according to the groups. There were a total of 50 children in the study, 25 in the experimental group and 25 in the control group. The number of girls was 12 (48%) in the experimental group and 10 (40%) in the control group. The median age of the children was 62 months in the experimental group and 62 months in the control group. The median number of siblings in the experimental and control groups was one. The descriptive characteristics of the children and their parents in the control and experimental groups had a homogeneous distribution (p>0.05).

Research Instruments and Processes

Within the scope of the study, TEMA 3 Math Ability Test was used to evaluate the mathematics skills of the study group, and the General Information Form was used for demographic information.

General information form: In the General Information Form, information about the child and the family was obtained, including the date of birth, gender, number of siblings, parents' education level, and income level. This form was filled in by the parents of the children and submitted to the researcher.

Test of Early Mathematics Ability (TEMA-3): The Test of Early Mathematics Ability (TEMA), developed by Ginsburg and Baroody in 1983, assesses the mathematical abilities of children between the ages of three years and eight years and eleven months. The same test was revised in 1990 and updated as TEMA-2. After 3 years, the TEMA-2 test was revised updated and finalized as TEMA-3. In this test, the A and B forms of TEMA-3, children's mathematical skills are evaluated with applications using various materials, pictures, mathematical symbols, and countable small objects. Before starting the questions, the chronological age of the child is calculated. The test question appropriate for the child's chronological age is asked of the child. Each item is evaluated as 0-point or 1-point. To finalize the test, the child must score 0 on five consecutive questions. The children's correct answers are summed to obtain a raw score (Ginsburg & Baroody, 2003, p. 12). The standardization, adaptation, validity, and reliability studies of TEMA-3 were conducted, and it was determined that the scale is suitable for measuring Turkish children's mathematics skills (Erdoğan, 2006; Şeker & Ali Sinanoğlu, 2017; Yüzbaşıoğlu & Tepeli, 2022).

Data Analysis

This study aimed to evaluate the effect of the Family Involvement Mathematics Program on preschool children's mathematics skills. the program was prepared by reviewing the literature, drafting by the researchers, and finalizing with input from 5 experts in child development. All necessary permissions (such as permission to use the scale and parental permissions) and ethical approval were obtained for the implementation of the program. As a pretest, Form A of the Theme 3 test was administered to both the experimental and control groups in February. In March, April, and May (12 weeks), the education program designed with the flipped learning education model was applied to the experimental group. The program included geometric shapes, sorting, grouping, patterns, graphing, reading, numbers, and simple operations (addition and subtraction), which are the basic topics of mathematics. These topics are taught to children in a planned and systematic way through the Google Class application and in-class activities. The math concepts and skills learned at home are reinforced at school. One of the strengths of this program is that it is based on the inclusion of families in education, allowing concepts to be learned at home and reinforced at school, enabling children to spend quality time with their families and fostering teacher-parent collaboration. The program's topics and concepts range from simple to difficult and include concepts that children are familiar with and topics that they will encounter in daily life, all of which are based on developmental principles. The 12-week education program is based on reinforcing one topic per day with an activity. The program was applied to the experimental group alongside their regular pre-school education. There are three phases in the program. The first phase is the flipped phase. This phase is conducted at home. For example, children are asked to watch a short video with their parents. The video includes: Introduction of numbers from 1 to 10. Demonstrations of counting with various objects (like apples, toys). Examples of grouping objects by color, size, shape, etc. Parents are encouraged to engage with their children by asking questions and helping them practice counting and grouping with their own toys or household objects while watching the video. In the class phase, the teacher starts by reminding the children about the video they watched at home and asks them to share what they learned. A counting song is sung together to help the children recall the numbers. Children are given different objects, such as blocks and

plastic animals, to count. Each child takes turns counting the objects they have chosen and says how many there are. The teacher supports each child's counting and encourages participation from the rest of the class. In the conclusion and review phase, the teacher summarizes what the children did and praises their progress in counting and grouping. The children can take home a small counting kit (e.g., number cards and objects) to repeat the activity with their parents. Parents were informed about the program before and during the implementation process through informative letters. The activities to be shared on Google Class at home were explained to the parents, and they were asked to photograph the activities and share them with the researcher. The control group was only included in pre-school education.

The data collected in the study were evaluated in SPSS statistical package. Descriptive statistics are given as mean (X) and standard deviation (SD) values.

At the decision stage, if the absolute skewness (Skewness) value is between -2.0 and 2.0 and the kurtosis (Kurtosis,) value is below 7.0, it is decided that the data are normally distributed (Kim, 2013). Accordingly, the skewness and kurtosis values of the variables used in the study are given in Table 2, indicating that the data are suitable for normal distribution. In addition, Shapiro-Wilk normality test results showed that the data were not suitable for normal distribution ($p<0.05$).

Table 2. *Normality Analysis For TEMA-3 Scores*

	Skewness	Kurtosis	Shapiro Wilk	
			Test	p
TEMA-3				
Pre-test	0.578	0.069	0.950	0.060
Post-test	0.540	0.291	0.966	0.109

Independent Sample t test was used to compare the numerical descriptive characteristics of the participants between groups, and chi-square tests (Pearson chi-square/Fisher exact test) were used to compare the categorical descriptive characteristics between groups.

Mixed-effects analysis of variance (ANOVA) was used to compare the variables according to the follow-up times. Bonferroni correction was applied for the comparison of main effects in the analysis. A value of $p<0.05$ was considered statistically significant.

Ethical Considerations

This study was conducted in accordance with scientific ethical principles and complied with research and publication ethics. It was found "appropriate" by Konya Necmettin Erbakan University Social and Human Sciences Scientific Research Ethics Committee with decision dated

2023 and 2025.

Findings

The findings regarding the effect of the flipped learning model on mathematics skills are presented below in tables and figures.Table 3 shows the comparison of TEMA-3 scores, at follow-up times according to the groups.

Table 3. *Comparison Of TEMA-3 Scores By Groups At Follow-Up Times*

	Group		**Test Statistics †**
	Experiment *n*=25	Control *n*=25	
TEMA-3			
Pre-test	18.12 ± 1.56	18.20 ± 1.26	F=0.040 p=0.843 η2=0.001
Post-test	21.12 ± 2.05	19.24 ± 1.23	**F=15.457 p<0.001 η2=0.244**
Test Statistics ϕ	**F=229.983 p<0.001 η2=0.827**	**F=27.639 p<0.001 η2=0.365**	
Difference & (Post-Pre)	3.00 ± 1.16	1.04 ± 0.79	**F=49.083 p<0.001 η2=0.506**

Mixed Design ANOVA (F), Effect Size (η2), ϕ Intra-group comparison, † Inter-group comparison, & Comparison of Initial and Final score differences between groups, Descriptive statistics are given as mean (X), standard deviation (SD) values. Bolded sections are statistically significant (p<0.05).

It was found that the mean TEMA-3 scores did not show a statistically significant difference between the groups at the pre-test measurement time (F=0.040, p=0.843). At the post-test measurement time, the mean TEMA-3 score of the experimental group was statistically higher than the control group (F=15.457, p<0.001).

In the control group, the mean TEMA-3 scores in the post-test were statistically higher (F=229.983, p<0.001) compared to the pre-test. In the experimental group, the mean TEMA-3 scores in the post-test were statistically higher (F=27.639, p<0.001) compared to the pre-test.

As a result, there was a statistically significant increase of 3.00 ± 1.16 units in the experimental group and 1.04 ± 0.79 units in the control group, in TEMA-3 scores. This increase was statistically higher in the experimental group than in the control group (F=49.083, p<0.001). The change in TEMA scores at measurement times is shown in Figure 1.

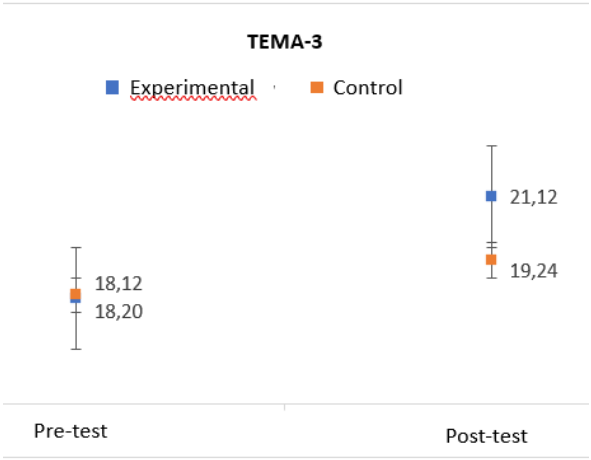

Figure 1. *Change in TEMA-3 scores according to groups at follow-up times*

Discussion

The study, which examined the effect of the mathematics education program designed with the Flipped Learning Model on the mathematics skills of preschool children, found that this program had a significant effect on children's mathematics skills as a result. When the results of the study were examined, statistically significant differences in the TEMA-3 Mathematics Aptitude Test mean scores were found in favor of the post-tests, after the education program was applied to the experimental group. There was no statistically significant difference between the pre-test and post-test scores of the children in the control group. According to these results, the mathematics education program designed with the Flipped Learning Model, applied to the children in the experimental group, was effective in supporting children's mathematics skills.

In the preschool period, a critical time in the development process, the quality educational environment offered to children in the home and at school will positively affect the development of mathematics skills. In this respect, it is necessary to plan and develop practices and activities for mathematics skills to be carried out in cooperation with home and school. There are various studies in the literature addressing the development of preschool children's mathematical skills. Susperreguy and Davis-Kean (2016) examined the relationship between the amount of mathematical talk that preschool children heard from their mothers at home and their early mathematics skills one year later. The study found that more exposure to mathematics talk in the home environment was positively associated with early mathematics skills. Anders et al. (2012) examined the effect of the quality of home and preschool learning environments on the development of early math skills. They found that the learning quality of the home environment was significantly associated with early mathematics skills in the first year of preschool education, and this advantage had a positive effect in the following years. On the other hand, the quality of preschool education did not have a significant relationship with early mathematics skills in the first years of preschool education; however, it had a significant effect on the development process. This draws attention to the different effects of home and preschool learning environments on the development of math skills. Karademir and Akman (2019) examined the effect of inquiry-based mathematics activities on preschool children's mathematics skills. The study found that inquiry-based mathematics activities had a positive and lasting effect on preschool children's operation and number skills. It was also emphasized that these activities enable preschool children to develop their mathematical concepts, learn new ones, and apply their mathematical skills meaningfully. Özkan and Baydar (2021) investigated the effects of mothers' encouraging parenting practices and children's verbal skills in early childhood on mathematics skills, at the age of 7, using data from a 5-year longitudinal study on children who started at age 3. The study found that encouraging parenting significantly predicted 7-year-old math skills. In addition, it was concluded that the mathematics education program

integrated with drama (Erdoğan, 2006), the mathematics education program for young children (Çelik & Kandır, 2013; Kumaş & Ergül, 2021), and the early mathematics comprehension program (Starkey et al., 2004) also had significant effects on the mathematical skills of preschool children.

When the literature are examined, it can be seen that the studies conducted with the flipped learning model in the preschool period are limited. Halili and Razak (2018) examined the effect of the flipped learning approach on preschool children's English language learning and concluded that this approach had positive effects on children's learning processes. Janwan, Lestary, and Simpol (2021), conducted a study with 17 preschool children to develop the flipped learning model during the COVID-19 pandemic, evaluate its efficiency, and examine the attitudes of preschool students and their parents who applied this model. As a result of the research, it was found that the flipped learning model increased student achievement, positively affected students' attitudes towards learning, and satisfied parents. Malekshahi, Esmaeeli, and Shojaee (2022) investigated the effect of play-based mathematics education on preschool children's social skills and academic self-efficacy through flipped learning. As a result of the research, it is emphasized that play-based mathematics teaching can increase preschool children's social skills and self-efficacy, and this can be achieved through flipped learning. Türk and Ev Çimen (2022) examined the views of mathematics teachers on the flipped learning model. In the study, it was concluded that the majority of pre-service teachers emphasized the strengths of the flipped learning model and noted it is applicable in the mathematics teaching process. Yüzbaşıoğlu et al. (2023) examined the effect of educational practices designed with the flipped learning model on children's science process skills and concluded that it had a significant effect. In the study conducted by Ünlütürk (2022), it has been determined that science education supported by out-of-school learning, structured with flipped learning, increases students' academic achievement and self-directed learning skills with technology. Additionally, it has been found that these methods reduce students' anxiety about science. It was also concluded that there is no significant relationship between self-directed learning and anxiety towards science (Ünlütürk, 2022).

The Flipped Learning Model has many advantages, such as supporting more hands-on learning, being student-oriented, enabling collaborative learning, and providing immediate and regular formative feedback (Altemueller & Lindquist, 2017). However, difficulties in preschool children's independent access to digital teaching platforms and making adaptations according to their needs can be seen as limitations in the application of this model (Pozo Sánchez et al., 2019). Research that examined studies conducted with the Flipped Learning Model in mathematics education concluded that this model had positive effects on student engagement, academic achievement, and attitude. In addition, it is emphasized that studies on the Flipped Learning Model in mathematics education are mostly carried out in the middle and high school groups, and there are insufficient studies in the pre-school and primary school groups (Ezentaş & Karakaş, 2021). The literature shows that there are limited studies on the use of the Flipped Learning Model in the preschool period. However, despite this limitation, it is an accepted model. Considering the important role of early mathematics experiences at home and school in the development of children's mathematics skills, it is thought that the Flipped Learning Model can be used in early childhood mathematics education.

Result and Recommendation

The mathematics education program developed for preschool children was designed using the flipped learning model, and the findings of the study show that this program has a significant effect on children's mathematics skills. In the experimental group where the program was implemented, it was observed that the post-test scores of the TEMA 3 mathematics ability test increased compared to the pre-test scores. This result indicates that the educational program is suitable for preschool children and supports their mathematical skills. The study was designed with the flipped learning model, and was limited to mathematics skills. Based on flipped learning model results, some recommendations can be given for parents, teachers, and researchers . Since flipped learning begins at home and deepens in the classroom, spending quality time with the child during home learning sessions helps the math learning. Providing short videos and interactive materials for

students to review and engage with at home can support math skills. These resources should be simple, clear, and age-appropriate. The effect of the flipped learning model on different skills and disciplines can be tested in preschool and other educational levels. In the education system, new learning-teaching approaches, models, methods, techniques, and various applications are emerging every day, and all these applications are gradually becoming widespread at different levels of education. Educators can be informed about making applications on educational technology-related subjects, such as the Flipped Learning Model, at all levels of education. The Flipped Learning model has distinct characteristics from the traditional method. This situation shows that students, teachers, and families need an adaptation process. Future studies can be conducted to examine the factors affecting the acclimatization process of students, educators, and families. It is also recommended to conduct qualitative studies to gather opinions from researchers who have applied this method and students who are trained in this method. Planning to investigate the long-term effects of the flipped learning model on preschool children to examine how early development of math skills benefits later educational outcomes can be undertaken. One can study how the flipped learning model influences other cognitive abilities, such as problem-solving and abstract thinking, to gain a broader understanding of its effects. It can also involve developing new strategies for effectively integrating technology with the flipped learning model for preschool children. These recommendations can help promote the wider adoption and effective implementation of the flipped learning model.

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E-Shield:Design, Implementation, And Evaluation of a Cybersecurity Education Program – a 6th Grade Example

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E-Shield: Design, Implementation and Evaluation of a Cybersecurity Education Program – A 6th Grade Example

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ABSTRACT

This study examines the development, implementation, and evaluation processes of the e-Shield instructional program, designed using the Morrison, Ross, and Kemp model to enhance sixth-grade students' knowledge, skills, and awareness of cybersecurity. With the rapid advancement of technology, cybersecurity has become a crucial issue for both individuals and society. However, a review of the literature indicates that students lack sufficient knowledge and awareness regarding cybersecurity. To address these deficiencies, effective instructional programs must be developed. Accordingly, the e-Shield instructional program was implemented with 18 students over 16 lesson hours. The study was designed as a single-group quasi-experimental research model using a pre-test and post-test to examine changes in students' knowledge, skills, and awareness. The results showed a significant increase in students' cybersecurity knowledge and awareness. In particular, students became more conscious about safe internet use, cyberbullying, creating secure passwords, and social media security. Additionally, the findings revealed that the program was highly effective in developing cybersecurity skills throughout the process. This study emphasizes the importance of cybersecurity education at the elementary school level and highlights the contribution of instructional programs in this field. The research serves as a guide for future cybersecurity education programs and represents a significant step in equipping students with the ability to navigate the digital world consciously and securely.

Keywords: Cybersecurity, Instructional Program, Program Development, e-Shield, Digital World, Social Media Rules

Introduction

Today, technology is being used highly effectively in every aspect of our lives; however, while it provides us with great conveniences, it also brings certain problems. These issues include privacy and confidentiality violations (Cybersecurity Ventures, 2019), technology addiction and its associated social problems (Huang & Huang, 2024), new ethical challenges introduced by artificial intelligence (Nguyen et al., 2023), and cybersecurity concerns (Namukasa et al., 2025). The concept of the Internet of Everything (IoE), which refers to the interconnection of all electronic devices, has particularly increased concerns regarding cybersecurity. Due to the Internet of Things (IoT), even cyberattacks through baby monitors have become a common type of attack (Ahmad, 2023). The rapid integration of technology into our lives has necessitated the need for more conscious users at both individual and institutional levels (Nguyen et al., 2023).

Currently, the rate of digital media and technology use among children is rapidly increasing, with usage times among young people and children reaching remarkable levels (Sağlam, 2024). It is known that individuals who actively use the internet encounter significant problems such as online sexual abuse, exposure to obscene or harmful content (Çakır, 2022), personality disorders, addiction, the development of negative habits, an inability to distinguish which personal data can be shared, and oversharing details of private life (Donat Bacıoğlu, 2022). Reports in the media frequently highlight numerous dramatic cases of computer fraud, theft, and abuse that lead to large-scale crimes (Whitman & Mattford, 2021). To mitigate the negative aspects of the internet, individuals must develop an awareness of online security, understand potential risks, and acquire the necessary knowledge to protect themselves (Ahmad et al., 2022). The online environment presents numerous risks, particularly for children. The primary dangers they encounter while using the internet include cyberbullying, personal information security threats, harmful content, and unwanted communication with strangers (Livingstone & Stoilova, 2021). For this reason, it is essential to raise children's awareness of internet security.

Studies have shown that children do not fully comprehend the risks they encounter in the digital world and require guidance on online security (Broadband Commission for Sustainable Development, 2019). Research has shown that children do not fully comprehend the risks they encounter in the digital world and need guidance on online safety (Broadband Commission for Sustainable Development, 2019). Since children perceive the internet as an entertaining and informative environment, they do not adequately consider the potential dangers they may face (Ali et al., 2023). Since they are in a period where they begin to gain independence in technology use and value this independence, raising awareness and providing guidance on this issue are highly important (Ayyash et al., 2024).

According to a 2024 report prepared by cybersecurity experts from STM, an organization that provides technological and intellectual infrastructure for the Ministry of National Defense and the Turkish Armed Forces, data from 26 billion users has been leaked. Similarly, a study conducted by the Ponemon Institute in 2020 revealed that data breaches in large corporations worldwide resulted in billions of dollars in losses, primarily due to inadequate security measures. The National Institute of Science and Technology (NIST) in the United States has projected a significant demand for cybersecurity professionals, with an estimated shortage of nearly 3 million experts in the coming years (Whitman & Mattford, 2021). The same report predicts that by 2030, the increasing number of internet-connected electronic devices will create even greater vulnerabilities, making them potential targets for cyber threats.

Research on safe internet use has been conducted worldwide, and training programs have been designed to raise awareness in this field. Various organizations, such as the Australian Computer Society in Australia, the Cybersecurity Centre in the United Kingdom, and the National Centers of Academic Excellence and the National Initiative for Cybersecurity Education in the United States, have been working on designing and implementing cybersecurity education programs (Hajny et al., 2021).

Videnovik et al. (2024) conducted a training program using collaborative learning and game-based learning methods to impart knowledge and skills in cybersecurity. Although the research focused on

methodology, it demonstrated that the training effectively contributed to students' acquisition of knowledge and skills as well as the development of positive attributes. Similarly, Pirta-Dreimane et al. (2024) developed and implemented a technology-supported cybersecurity program called CAPE and examined its outcomes. The research findings indicated that the implemented cybersecurity education program positively influenced students' cybersecurity awareness and behaviors.

In Australia, a cybersecurity awareness scale was applied to mining company employees. The results showed that while 65% of the workers had general awareness of information security, their actual knowledge level was 77%, their attitudes toward the subject scored 76%, and their ability to demonstrate secure behaviors was only 54% (Yılmaz, 2015). Özçakanat et al. (2021) examined cybersecurity risks in banks in their study. The research emphasized that security vulnerabilities in institutions largely stem from human factors and that, due to a lack of knowledge and awareness, individuals can sometimes become part of a cyber attack.A study conducted in Kahramanmaraş among 2,449 primary and secondary school students used a researcher-developed scale to assess their awareness of cybersecurity in information technologies (Tekerek & Tekerek, 2013). The study found that students had very low awareness levels regarding critical security topics, mainly due to inadequate education and training programs. Consequently, it recommended that cybersecurity education be strengthened. Similarly, Sel (2013) conducted interviews with a group of 60 middle school students to assess their awareness of privacy settings on social media platforms. The study found that 70% of the students had no knowledge of social media privacy policies. After an awareness campaign, an improvement in their understanding was observed, reinforcing the importance of educational interventions.

The integration of the digital world into every aspect of our lives, especially with people becoming producers through social media accounts, has brought along digital data traces. A digital footprint, commonly referred to as a "digital trace," consists of data left behind in digital environments (Buitrago-Ropero, 2020). A deeper examination of digital traces reveals that even if an individual deletes a piece of online information, data mining techniques may still retrieve it. As a result, a digital profile is constructed based on users' online activity, allowing artificial intelligence to analyze behavior and capture their attention. For instance, even without actively engaging with advertisements, users may encounter targeted ads simply because they previously viewed a product, often due to lengthy and unread privacy policies (Erdem Erkul, 2021).

Sanin (2022) conducted a study with secondary school students to examine their awareness of cybersecurity, particularly in relation to digital footprints and data security. The findings indicated that many students were either unaware of the risks associated with their digital footprints or did not take them seriously, exposing them to potential cyber threats. Similarly, Demir (2021) studied university students' awareness of cybersecurity and concluded that education is the most effective solution for addressing cybersecurity challenges.

Based on these findings, the need for education on cybersecurity has become evident, leading to the development of the E-Shield instructional program. Given that students at the 6th-grade level are at a transitional stage, where they increasingly interact with technology (Haddock et al., 2022), it was deemed appropriate to design the program at the middle school level.

Research Purpose

This study aims to design, implement, and evaluate the E-Shield instructional program. Accordingly, the study seeks to answer the following research questions:

1. How effective is the E-Shield program in helping students acquire knowledge on cybersecurity?

2. To what extent does the E-Shield program help students develop cybersecurity-related skills and behaviors?

3. How does the E-Shield program impact students' awareness levels regarding cybersecurity?

4. Do the program’s learning objectives fully meet the identified needs?

5. Is the sequence of objectives appropriately structured?

6. Are the allocated instructional times aligned with students' learning needs?

7. Are the materials and instructional strategies used in the program effective and sufficient?

This study employs the Morrison, Ross, and Kemp instructional design model to structure the E-Shield program. This model is known for its flexibility, student-centered approach, and cyclical structure, allowing for necessary revisions and improvements (Morrison et al., 2012). A review of the literature confirms that cybersecurity challenges have increased alongside technological advancements, emphasizing the growing importance of cybersecurity knowledge and awareness. Therefore, the development and implementation of an educational program in this field are considered essential.

Methods and Materials

Research Design

For the purpose of this study, a one-group pretest-posttest design, one of the pre-experimental designs within quantitative research, was deemed appropriate. This model includes only one group, referred to as the experimental group. The impact of the intervention is assessed by administering tests before and after the intervention (Özmen & Karamustafaoğlu, 2019). In this study, the dependent variables are students' knowledge, skills, and attitudes, while the independent variable is the E-Shield instructional program.

Study Group

The study group consists of 6th-grade students from a middle school in the Gemerek district of Sivas, Turkey. The demographic characteristics of the study group are presented in Table 1.

Table 1. Demographic Information of the Study Group

Gender	Number of Participants	Percentage
Male	8	45%
Female	10	55%
Total	18	100%

Data Collection Tools

For data collection, an achievement test, an attitude scale, and a checklist were used. The achievement test was created with a pool of 25 questions and was reviewed by subject matter experts for content validity. A measurement and evaluation expert provided feedback on face validity, leading to modifications in some questions. Four questions, which measured similar learning outcomes, were merged into a single question. After the initial implementation, item discrimination and item difficulty analyses were conducted. Questions 5 and 15 were found to be too easy, while the first sub-question of Question 1 was too difficult, so adjustments were made accordingly. Items 13, 14, and 16, which had discrimination values below 0.20, were removed from the test, while questions 1, 3, 9, 22, and 23 were revised and strengthened. Ultimately, the final version of the achievement test consisted of 19 questions. The Digital Data Security Awareness Scale (DDSAS) is an attitude scale consisting of 32 items. The awareness statements were structured using a five-point Likert scale, with the following options: Strongly Agree (5), Agree (4), Neutral (3), Disagree (2), Strongly Disagree (1). Higher scores on the scale indicate higher awareness of digital data security. All items in the scale are positively worded. The exploratory and confirmatory factor analyses were conducted as part of the validity and reliability analyses of the scale. The suitability of the data for factor analysis was assessed using the Kaiser-Meyer-Olkin (KMO) test and Bartlett's Test of Sphericity, and the appropriateness of the data was confirmed by the KMO and Bartlett statistics (KMO = .951, $\chi^2 = 15113.267$, $p < .001$). Since the KMO value is greater than the threshold value of .600 and the Bartlett's Test of Sphericity result is significant, the sample is considered suitable for factor analysis. The factor loadings of the items range between .506 and .689, and the Cronbach's Alpha (α) internal consistency coefficient is .945. Accordingly, the measurement results can be considered highly reliable.

The checklist was developed to assess psychomotor behaviors within the program. Each behavior was broken down into its subcomponents, and a total of 10 skills were assessed. Students were asked to

demonstrate the expected behaviors, and their performance was recorded as "Yes" (if they performed the behavior) or "No" (if they did not). Student performance was evaluated in percentages.
The study was approved by the Institutional Ethics Committee.

Design of the E-Shield Cyber Security Instructional Program

The E-Shield program, as the independent variable in this study, was developed following the Morrison, Ross, and Kemp instructional design model. The key steps in the development process are as follows:

1. Needs Assessment. The program was designed for 6th-grade middle school students. Initially, a needs analysis was conducted to determine whether such an instructional program was necessary. A literature review confirmed the need for a cybersecurity instructional program. From a needs classification perspective, the program addresses both normative needs and felt needs. Other need types were not assessed in this study. Normative need is the evaluation of the target audience according to national standards. In this context, if a "digital citizen" is considered the norm defined as an individual who understands their rights and responsibilities in online environments then students' lack of alignment with this norm suggests an educational need. Perceived need can be defined as the desire to close the gap between the target audience's current performance and the ideal performance (Morrison, Ross & Kemp; 2012, pp. 31-50).

2. Learner and Context Analysis. Following the identification of the need, a learner and context analysis was conducted. The target audience consists of 6th-grade students at Middle School. Given their age group, their cognitive, emotional, and developmental characteristics were considered during the program design. The students' previous academic performance was evaluated by analyzing their grades from previous years, particularly in Information Technologies and Software courses, to assess their prior knowledge.
Individual learning styles were not specifically analyzed in this design; instead, general effective teaching methods and techniques for this age group were examined. A widely recognized model for learning styles is Fleming's VARK model, which classifies learners based on their visual, auditory, reading/writing, and kinesthetic preferences. Research suggests that visual and kinesthetic methods are more effective for 6th-grade students, as they tend to prefer interactive and visually engaging learning approaches (Fleming & Baume, 2006). An analysis of students' previous report cards showed that 26 students (63%) had a year-end average of 70 or above. Additionally, two students were identified as having learning difficulties.
The context analysis was conducted in terms of: Directive Context, Instructional Context, Transfer Context. Directive Context: Students have high motivation and interest in using new technologies. They recognize that this instruction will help them protect themselves from online threats. In the privacy and security unit, which briefly covers this topic, students showed curiosity and interest but lacked adequate knowledge and awareness. The analyses related to the instructional context are presented in Table 2.

Table 2. Instructional Environment Context

Factor	Considerations
Lighting	The lighting in the school's Information Technologies classroom is suitable for education.
Noise	The Information Technologies classroom is in a separate building along with the library, making it a quiet environment.
Temperature	The heating system with radiators is sufficient. Ventilation is available.
Seating Arrangement	The seating arrangement has been predetermined, and each student has an assigned computer.
Equipment	Each student has the necessary equipment.

In the analysis related to the transfer context, it was determined that students will be able to apply the knowledge and skills gained from the instruction in real-life experiences in the future. Since technology is integrated into all aspects of life, regardless of the career paths they choose, students will continue to interact with technology throughout their lives.Even if cybersecurity does not contribute directly to their professional careers, they will still use technology for entertainment or communication. Therefore, ensuring security in digital environments is a crucial skill that they will need throughout their lives.

3. Task Analysis. Within the scope of task analysis, both content analysis and method analysis were conducted.Content Analysis,The instructional content includes the following key topics:Basic Concepts of Cybersecurity,Safe Internet Usage,Malicious Software,Social Media and Digital Identity Management,Firewalls and Access Control,Cloud Data Storage and Data Security,Steps to Take When Facing Cybersecurity Issues
The method analysis is presented in Table 3 below;

Table 3. E-Shield Program Method Analysis

Objective	Step	Tip
Configuring Privacy Settings	1.Open your profile. 2.Click on the three dots in the upper right corner. 3.Select the 'Privacy' tab. 4.Set your account privacy settings to 'private'.	
Activating Antivirus and Security Software	1.Locate and open the antivirus software installed on your computer. 2.In the antivirus interface, find the 'Settings' or 'Protection' option. 3.Locate and enable the 'Real-Time Protection' or 'Real-Time Scanning' option. 4.Activate this option.	It is usually represented by an icon on the desktop or in the taskbar. This option is typically found on the main screen, at the top, or in the side menu.
Managing Cookie Settings	1.Open your browser. 2.Click on 'Settings'. 3.Select the 'Privacy and Security' option. 4.Choose the option related to cookies. 5.Modify the cookie settings as needed.	
Clearing Browser History and Cache	1.Open your browser. 2.Go to 'Settings'. 3.Select 'History'. 4.Clear browsing data. 5.Select the time range. 6.Select and clean the types of data to be cleaned.	The settings menu is usually represented by three dots in the upper right corner. Cookies, history, cache, etc.
Check firewall settings.	1.Click on the Start menu and go to Settings. 2.Select the 'Privacy and Security' option. 3.In the left menu, click on 'Windows Security'. 4.Choose the type of network you are connected to. 5.Select the type of network you are connected to 6.Select the "Enable firewall" option and save.	It may appear as a gear icon. Private or public
Storing data in the cloud.	1.Log in to your preferred cloud application. 2.Find the upload option. 3.Select the file or folder you want to upload.	You can choose which users can access the file.

	4.Click the upload option to start the upload. 5.Set your sharing and access settings.

4. Instructional Objectives. The learning objectives of the program were determined and categorized into facts, concepts, principles and rules, methods, interpersonal skills, or attitudes. The purpose of this categorization is to design instruction aligned with the objectives and to conduct objective-based assessments. The objectives were then sequenced in the next stage. The prerequisite method was used to determine the sequence of objectives. This method is based on a hierarchical structure of prerequisite skills, ensuring that prerequisite learning occurs before more advanced topics. Additionally, the objectives were arranged from simple to complex, easy to difficult, and known to unknown, while also prioritizing topics that are expected to engage students' interest. The elaboration theory was used for sequencing the skill-based learning objectives. The task expertise order was followed, meaning that tasks were taught from the simplest to the most complex (Morrison, Ross & Kemp, 2012).

5. Instructional Strategies. After sequencing the objectives, an expanded content-performance matrix was developed, and appropriate instructional strategies were identified.The content-performance matrix, developed by Merrill (1983, Morrison, Ross & Kemp, 2012, pp. 161-185), is used to determine the strategies necessary to achieve each objective.For the development of this instructional program, the matrix included details such as:What the content is? Which objective it addresses? Which category it falls into (fact, concept, principle, rule, method, interpersonal skill, or attitude)The steps to be followed in the initial presentation and generative strategies.This ensures standardization, so that any instructor implementing the program follows the same structured approach.

6. Instructional Message. To prepare instructional materials, including text, visuals, videos, and activities, a guidebook was developed as part of the message design phase.The content was structured according to the predetermined sequence of objectives, ensuring that every step of the instructional process was clearly outlined. Upon completing this stage, it was determined that the program should have a total duration of 16 hours.In the message design, pre-instructional strategies such as summaries and advance organizers were used. The key points in texts were highlighted, and a consistent typology was maintained throughout the guidebook (Morrison, Ross & Kemp; 2012, pp. 81-102). Additionally, images and graphics were selected based on their explanatory functions rather than decorative purposes.

7. Evaluation Tools. To measure the effectiveness of the program, the following assessment tools were developed:1. Achievement Test,2. Digital Data Security Awareness Scale (DDSAS),3. Checklist.

Data Collection Process

The data collection process began in the first week of February and was completed in ten days. At the beginning of the process, the achievement test and the attitude scale were administered as a pre-test. The E-Shield program, designed as a 16-hour intervention, was implemented. Throughout the program, students' psychomotor skills were assessed using a checklist. After the instructional program, the achievement test and the attitude scale were administered again as post-tests. A paired-samples t-test and effect size analysis were conducted to determine the significance of the difference between pre-test and post-test scores.

Data Analysis

The Digital Data Security Awareness Scale (DDSAS) was analyzed using a statistical program. Responses on the 5-point Likert scale were scored and ranked from highest to lowest. A normality analysis of the scale was conducted, confirming that the data followed a normal distribution. The internal consistency of the scale was assessed using Cronbach's Alpha coefficient. As a result of the analysis, the overall reliability coefficient of the scale was found to be $\alpha = .83$. This value indicates that the scale has a high level of reliability.

For the achievement test, Shapiro-Wilk test was conducted to analyze t he normality of score distributions, as the group size was less than 50. Since the distribution was normal, a paired samples t-test was used for comparison. The internal consistency of the achievement test was assessed using

Cronbach's Alpha coefficient. The analysis results indicated that the overall reliability coefficient of the test was α = .86, which demonstrates a high level of reliability.
The checklist was used to evaluate whether students acquired the intended psychomotor behaviors. The checklist was completed for each student throughout the process. The percentage of students demonstrating the expected skills was calculated.

Findings

In the findings section of the study, a performance test and an attitude scale were used to determine the effectiveness of the program from the pre-test to the post-test. The performance test and attitude scale were administered in a pre-test and post-test format at the beginning of the process and after the program was implemented, and the obtained scores were analyzed using a statistical program. Additionally, a checklist was completed by observing students throughout the process to assess the extent to which they acquired the skills.

Findings on Students' Academic Performance

The distribution of scores from the achievement test is presented in the table below. Since the sample size was less than 50, the Shapiro-Wilk test was used to assess normality distribution. For the reliability analysis, the test-retest method was used, and the correlation between tests was above 0.80, indicating high reliability.

Table 4. Normality Test for the Achievement Test

	Shapiro-Wilk Test		
	Statistic	Df	*p*
Pre-test	.927	18	.172
Post-test	.951	18	.447

As seen in Table 4, the pre-test and post-test distributions of the group ($p>.05$) are normal distributions. Therefore, a paired sample t-test was conducted for the change between the pre-test and post-test.

Table 5. Achievement Test Statistics

	$\bar{X}$	*N*	SD	Std.Error
Pre-test	12.78	18	2.211	,521
Post-test	16.44	18	1.617	,381

As seen in Table 5, the mean score of the group's post-test (16.44) is higher than the mean score of the pre-test (12.78).

Table 6. Paired Samples t-Test for Change in Group Performance

Comparison	$\bar{X}$	*SD*	Std. Error	*t*	*p*
Pre-test - Post-test	-3.667	1.328	.313	-11.710	.000

As shown in Table 6, when examining the group's pre-test and post-test results ($t_{(17)}$= -11,710; $p < .05$), a significant difference was observed in favor of the post-test scores. When examining the effect size, Cohen's d value was calculated as 2.76. This result indicates that the e-Kalkan instructional program has a significant impact on addressing students' knowledge gaps in cybersecurity.

The data obtained from the checklist also revealed that students generally acquired the expected skills. Specifically: 84% of students (15 out of 18) were successful in 3 of the skills, 78% of students (14 out of 18) were successful in 1 skill, All students successfully demonstrated the remaining skills. Thus, it can be concluded that the E-Shield program was highly effective in teaching cybersecurity-related skills.

Findings on Students' Attitudes

First, the Shapiro-Wilk test was conducted to examine the distribution of scores obtained from the attitude scale. The results are presented in Table 7.

Table 7. Attitude Scale Normality Test

To examine the distribution of scores obtained from the attitude scale, the Shapiro-Wilk test was conducted. The results are presented in Table 7.

	Statistic	Df	*p*
Pre-test	,936	18	,247
Post-test	,961	18	,629

As shown in Table 7, the scores obtained from the attitude scale exhibit a normal distribution for both the pre-test and post-test ($p > .05$). Therefore, changes in student attitudes were measured using a paired samples t-test. The reliability of the scale, measured using Cronbach's Alpha, was 0.83 for the pre-test and 0.87 for the post-test. Based on these results, it can be concluded that the scores obtained from the scale are reliable.

Table 8. Statistics for Scores Obtained from the Attitude Scale

	$\bar{X}$	Sd	Std. Error
Pre-test	124.61	19.321	4.554
Post-test	144.11	16.859	3.974

As seen in Table 8, the average pre-test scores obtained from the attitude scale were 124.61, whereas the post-test average scores were measured as 144.11. This indicates an increase in students' post-test scores compared to their pre-test scores.

Table 9. Paired Samples t-Test for Pre-Test and Post-Test Scores of the Attitude Scale

Comparison	$\bar{X}$	*SD*	Std. Error	*t*	*p*
Pre-test - Post-test	-19.500	15.966	3.763	-5.182	.000

As seen in Table 9, the paired samples t-test results indicate a significant difference between the pre-test and post-test scores obtained from the attitude scale ($t_{(17)}$= -5.182; $p < .05$). When examining the effect size, Cohen's d value was calculated as 1.22. This result indicates that the e-Kalkan training program has a strong impact on enhancing students' awareness and attitude levels.

Discussion And Conclusion

The results of the E-Shield educational program indicate that students' knowledge levels on cybersecurity significantly increased. This finding aligns with the existing literature. For example, Quayyum et al. (2021) reviewed 56 peer-reviewed studies and concluded that the most frequently used method to prevent cybersecurity issues and address information security deficiencies is education. Similarly, Yiğit and Seferoğlu (2019) evaluated information security based on five factors and found that undergraduate students who received education on this topic had a more substantial knowledge base. In the United States, the CyberPatriot competition is implemented as an educational program aimed at informing students about cybersecurity, and the program has been reported to increase students' knowledge levels (CyberPatriot, 2025). Likewise, many organizations conduct initiatives to enhance digital security awareness and increase students' knowledge and consciousness about online safety. Examples include:Google’s "Be Internet Awesome" initiative, Australia’s "Cyber Smart Challenge", Global Digital Citizen Foundation's cybersecurity training programs.

The E-Shield program was also found to positively influence students' attitudes toward cybersecurity and significantly enhance their awareness. In their research, Kweon et al. (2021) examined the relationship between cybersecurity education and organizational security issues. Their study of 7,089 companies found that those that provided cybersecurity training faced fewer security incidents. This

indicates that awareness, along with knowledge and skills, plays a crucial role in cybersecurity. The use of videos, role-playing, and dramatizations in the E-Shield program helped students internalize the topic, making the learning process engaging and interactive. This result is consistent with findings in the literature. For instance, Mages (2018) emphasized that incorporating drama activities into classroom settings has a positive impact on student engagement and active participation.

Educational programs are considered essential and effective in raising awareness of cybersecurity. Ünver (2012) noted that, in Turkey, graduate programs, non-governmental organizations (NGOs), and government institutions are actively involved in conducting awareness initiatives on this topic. On a global scale, significant efforts are being made to increase cybersecurity awareness. For example:"Safer Internet Day" is celebrated in 150 countries, promoting awareness through educational events and activities (SID, 2025). The UK CyberFirst program provides cybersecurity training and competitions for female students, supporting their career planning in this field (CyberFirst, 2025).

The E-Shield program was also found to be effective in equipping students with essential cybersecurity skills. The "demonstration and practice" method was primarily used in skill acquisition, and this approach was found to be effective. This finding aligns with prior research. For instance: Keskinkılıç (2019) concluded that the demonstration and practice method led to more permanent learning outcomes in geometry classes. Şahin (2024) found that using the demonstration and practice method in coding education significantly improved students' coding skills. Kan (2008), in his study on effective teaching methods in mathematics, determined that the most effective method for enhancing student achievement was the demonstration and practice approach.

A cybersecurity-themed song created for the program was also observed to have a positive impact on students' awareness. Students were able to quickly learn and enjoy singing the lyrics. Similar findings are reflected in previous studies, which highlight the role of music in enhancing learning experiences. For example, Tandoğdu Kılıç (2023) emphasized in his research that music positively influences brain functions related to learning.

However, the analysis of achievement test and attitude scale results revealed that there were two topics that students struggled to grasp. This suggests that the E-Shield program was not entirely effective in conveying these specific objectives:1. Types of Digital Footprints: This topic was part of the program's objectives, but since it was explained through a lecture-based approach, it may not have been effectively learned. Designing interactive activities for this topic could improve understanding.2. Safely Removing Hardware: This topic was not included in the program's objectives, indicating a gap that needs to be addressed in future revisions.

The time allocated for learning objectives in the E-Shield program was found to be appropriate. However, it is suggested that more time be allocated for lessons involving role-playing and creative drama since students enjoyed these activities, engaged creatively, and focused better on the topics. Overall, the E-Shield program successfully covered its intended objectives. However, it was found to be less effective in teaching "types of digital footprints" (as indicated by the achievement test) and "safely removing hardware" (as indicated by the attitude scale). The sequence of objectives was deemed appropriate, and the activities and strategies used in the program were found to be effective and suitable for achieving the goals. Additionally, the time allocated for each objective was considered appropriate.

Suggestions

1. Cybersecurity education should not be limited to a specific age group but should be designed to be adaptable for all age groups. The program should be expanded with more advanced or more fundamental modules based on age levels.
2. To enhance children's cybersecurity knowledge, it is essential to involve families in the learning process. Information sessions for parents can be organized, and guidance on safe internet usage at home can be provided.
3. Follow-up studies should be conducted to track the long-term impact of the program. The retention and sustainability of the knowledge, skills, and awareness gained should be evaluated.
4. Efforts should be made to contribute to the development of national and international cybersecurity education policies. The program's outcomes can provide valuable data to inform educational policies.

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The Effectiveness of Online Text-To-Speech Tools in Improving EFL Students' Pronunciation[1]

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ABSTRACT
This study attempts to investigate the effectiveness of an online text-to-speech application as a pedagogical tool in improving Turkish EFL students' pronunciation. Learners' pronunciation is expected to be accurate and intelligible to ensure clear and successful communication, allowing for meaningful interaction with native speakers and enhancing overall language proficiency. This study aimed to explore a free web-based text-to-speech tool implemented in one class during a 4-week pronunciation training. The study was conducted with 14 university students in prep classes at a private university in Türkiye. The current investigation employed an experimental design with a pre- and post-test. Quantitative data were collected through a read-aloud test for both the pre- and post-test. The investigation also aimed to shed light on university students' perceptions regarding text-to-speech training using the online application TTSReader. The results indicate that the learners have shown improvement in their pronunciation at the word level, and students have also expressed positive attitudes relating to the online text-to-speech application.

Keywords: Artificial intelligence, text-to-speech, speech-to-text, speech recognition, pronunciation

Introduction

A crucial component of language learning is communication. Accurate pronunciation and grammar are essential for effective communication, particularly in settings where English is used as a foreign language (EFL). As a fundamental aspect of language acquisition, pronunciation significantly influences learners' ability to comprehend and express themselves effectively. Therefore, improving pronunciation is crucial for gaining confidence and fluency in a second language; emphasizing the need to examine technology's role in facilitating this process. As technology continues to transform educational methods, its ability to improve pronunciation learning through AI-powered technologies deserves more research.

In educational contexts, the internet and other digital technologies have become increasingly beneficial. Incorporating communication and information technologies makes learning more effective than conventional educational methods. Similarly, artificial intelligence (AI)-based technologies offer multiple benefits to learners, especially in improving pronunciation. This highlights the expanding role of technology in language learning, especially through AI-powered tools such as Speech-to-Text Recognition and Text-to-Speech.

Vargas (2023) conducted a phenomenological study on teachers' perceptions of AI as an instructional tool in secondary English Language Arts (ELA) classrooms. The findings of this research revealed an overwhelming number of positive perceptions, mainly indicating the need for effective training for educators, leaders, and students to successfully integrate AI into education. These findings highlight the increasing need to provide educators with the necessary skills as this is crucial for successfully integrating AI-driven technologies such as Speech-to-Text and Text-to-Speech into language learning.

With the support of AI-driven technology, such as Speech-to-Text Recognition (STR), or Text-to-Speech (TTS), students can study and practice beyond the classroom at their own pace. Several studies have demonstrated that these technologies are invaluable resources for language instruction (Liu & Shadiev, 2023; McCrocklin, 2019; Zou et al., 2023). By facilitating self-paced learning, these tools provide opportunities for continuous practice, which emphasizes the need for further research on their impact on pronunciation development.

Shadiev et al. (2014) reviewed previous research on STR technology and its potential to enhance learning. They mentioned that STR technology was primarily used to support individuals with special needs, such as learning disabilities or physical impairments, as well as international students. Over time, a wider range of target consumers has been included in STR technology research. According to Liu & Shadiev (2023), several studies have been conducted on STR to assist with a variety of language skills. These include listening, speaking, writing, grammar, vocabulary, word recognition, communication, and pronunciation. Nevertheless, the use of technology, including TTS, in EFL courses specifically for improving pronunciation remains underexplored in previous studies.

A variety of techniques aimed at teaching L2 pronunciation have gained widespread acceptance and approval. Among these are shadowing and self-recording for error identification. While these approaches can help L2 students improve their pronunciation, most of them don't provide an opportunity for feedback on how they sound when they speak; and students are often unable to identify their pronunciation errors (McCrocklin, 2019). Consequently, to help them improve their L2 pronunciation, it may be necessary to provide precise and quick feedback (Saito & Lyster, 2012). Using technologies, including TTS and STR, students can receive instant feedback on their pronunciation using technologies, including TTS and STR, allowing them to make corrections and improvements quickly. Studies have indicated that these technologies are beneficial in improving learners' phonetic accuracy while minimizing pronunciation-related anxiety, as they create an encouraging environment for continuous practice and development. Therefore, AI-powered tools appear to be a valuable solution to the pronunciation challenges faced by language learners.

Problem statement

Pronunciation is an essential task for Turkish EFL (English as a Foreign Language) students due to a variety of related difficulties. Some frequent pronunciation errors made by Turkish students learning English are due to the characteristics of their mother tongue. For instance, according to Demirezen (2009), a very common pronunciation error occurs when Turkish English language learners pronounce the /ng/ sound combination, as /Ink/ instead of the correct pronunciation of /Iŋ/. It is important to note that poor pronunciation obscures and interferes with automatic control of pronunciation in the target language, as well as intelligibility, accuracy, and fluency (Demirezen, 2009). The absence of phonetic parallels in the native language, in particular, hinders the smooth acquisition of English word pronunciations. Furthermore, the short time allocated for pronunciation practice in educational contexts worsens the problem. As a result, Turkish EFL learners often struggle to effectively and accurately reproduce English words that lack direct counterparts in their mother tongue, hindering their overall proficiency in spoken English.

Chen (2011) states that most Taiwanese students struggle with communicating effectively and efficiently with individuals from all over the world. According to Kung (2017), many learners are unable to speak and express themselves successfully in English, as English education in Taiwan places a lower priority on oral training. A similar situation exists in the Turkish educational setting with EFL students. When students begin their education at university, the pronunciation errors they have acquired become fossilized, making these errors incredibly difficult to change (Selinker, 1972). However, Acton (1984) asserts that fossilized pronunciations can be reversed.

Purpose of the study

Given the challenges posed by fossilized pronunciation errors, particularly in the context of EFL learners, it is essential to explore possible solutions, such as the audio-articulation pronunciation instruction approach and emerging AI-powered tools. Since accurate pronunciation is essential for proper intonation and since good pronunciation is a necessary component of communicative ability, the audio-articulation pronunciation instruction approach may be very helpful in addressing this issue (Demirezen, 2009). However, technological advancements and the creation of AI-powered tools such as automated speech recognition or text-to-speech may also be useful in solving this pronunciation problem. A limited number of studies, however, have investigated the effectiveness of AI-driven TTS tools in enhancing learners' pronunciation. Therefore, the current study aims to investigate the efficacy of the free online text-to-speech program TTSReader, particularly, focusing on learners' pronunciation improvement at the word level. Consequently, the following set of research questions served as a guide for the current study:

1. Is the text-to-speech tool an effective way to improve EFL students' pronunciation?
3. Does the TTSReader-Text-to-Speech online play a role in improving English pronunciation accuracy?
4. What are students' attitudes towards the web-based TTSReader in their language learning?
5. Is there a noticeable improvement between the pre-test and post-test scores of the EFL students?

Literature review

Text-to-Speech

Text-to-speech (TTS) technology is a tool that transforms written text into spoken words. With read-aloud software, like text-to-speech, users may read along while listening to written text. It was around the 1980s that TTS technology began to take shape. As technology has advanced, educators and researchers have increasingly adopted text-to-speech, alongside related tools, not only to support children with reading disabilities but also to enhance language learning for a broader range of students (Wood et al., 2018). It can transform several forms of text input, including written documents, e-books, and other written information, into speech. Instead of having people read the information, TTS software

analyzes the text and generates a spoken version. Speech synthesis, to put it simply, is "the process of making the computer talk" (Handley, 2009). In simple terms, they are built using two modules. The first module converts the text into phonemes, while the second module translates those phonemes into voice (Handley, 2009).

This capability of TTS technology makes it particularly valuable in language learning contexts. Peters and Bell (2007) state that hearing a book or passage read aloud may be helpful for novice readers, both adults and children. Individuals studying a second language can also benefit, particularly if the software is advanced enough to provide accurate vocalization of the spoken language, potentially even in several dialects. Handley (2009) suggests that TTS technology can be utilized as a model for pronunciation in exercises emphasizing both segmental (practice of individual and combined phonemes) and supra-segmental (prosody and intonation) levels.

Google Text to Speech

There are numerous text-to-speech tools and services available, both commercial and open-source. Although we will not be reviewing every TTS tool in this study, we will highlight a few of the most well-known ones. One popular application is Google Text-to-Speech, which is part of the Google Cloud Platform and offers high-quality TTS voices. A broad spectrum of voices in many languages and dialects, is available through Google TTS. A wide range of voices is available for users to select from, meeting their needs and preferences.

Natural Reader

Natural Reader (www.naturalreaders.com) is also a popular TTS program that turns written material into spoken words. It is used to assist those who might have trouble comprehending or reading text because of visual impairments, learning difficulties, or they are searching for an alternative method to take in written information. Natural Reader comes with a variety of features and voices. Users can adjust the speech pace, voice type, and other parameters using Natural Reader to create a more customized listening experience.

TTSReader

TTSReader is a web-based application that provides TTS features. It enables users to convert written material into speech from a variety of sources, including webpages, documents, eBooks, and PDFs. Customization options available with TTSReader include the ability to change the voice, highlight text being read aloud, and adjust the speech pace. This functionality can help users follow along with the spoken text and improve their understanding. Students may improve their pronunciation and understanding by listening to the text read aloud. TTSReader offers both free and premium versions. Generally, the free version can read aloud and convert text to speech; however, some advanced features or additional voices may only be available in the premium version, which a subscription. This tool is user-friendly for pedagogical purposes, which is why we employed TTSReader in the current study during the training sessions.

Pronunciation

Considering TTSReader's potential to improve both pronunciation and comprehension, it is important to recognize the significance of pronunciation in language learning and its contribution to effective communication. Pronunciation refers to how a word or language is uttered, including the sounds, emphasis, rhythm, and intonation used when speaking words or phrases. According to Burgess & Spencer (2000), pronunciation in language learning involves the use of the target language's phonological components in speaking. Phonology encompasses both segmental and suprasegmental aspects of the target language's sound system, which includes theoretical knowledge (Burgess & Spencer, 2000). Exposing learners to the target language's sound system is essential in language

education as it sets the groundwork for correct pronunciation, fosters effective communication skills, and enhances listening comprehension.

It is crucial to consider how exposure to language input plays a key role in helping learners acquire all aspects of the language, including pronunciation. Language is primarily learned by individuals through the input they are exposed to (Krashen, 1982). To help students acquire all aspects of language—pronunciation, vocabulary, grammar, and discourse—educators should work to increase their exposure to the language of instruction and motivate them to broaden their areas of linguistic competency (Celce-Murcia et al., 2010).

While increasing exposure to language input is essential, it is also important to recognize that the goal of pronunciation instruction is not to make learners sound like native speakers but to help them communicate effectively. Instead, encouraging students to overcome barriers so that their pronunciation doesn't interfere with their communication skills is a more reasonable and achievable objective (Celce-Murcia et al., 2010). According to Celce-Murcia et al. (2010), when instructing pronunciation, the focus has mostly been on teaching students how to pronounce words correctly at the word level, whether they are working with single words or words in highly controlled and unnatural sentence structures. In response to the question, "How can pronunciation be taught as part of Communicative language teaching?", they offered a list of various pronunciation techniques. This list, according to them, is considered fairly comprehensive: listen and imitate, phonetic training, minimal-pair drills, contextualized minimal pairs, visual aids, tongue twisters, developmental approximation drills, practice of vowel shifts and stress shifts, recitation, reading aloud, and recordings of learners' production (Celce-Murcia et al., 2010). In addition to these established pronunciation techniques, it has been accepted that promoting active learner participation is important for attaining successful pronunciation outcomes.

As stated by Morley (1991), teaching pronunciation is more beneficial and enjoyable when students actively participate in their own learning rather than passively repeating exercises. Morley (1991) also adds that learner self-engagement should be developed at an early stage in the learning process. Educators and instructional materials might help students get involved (Morley, 1991). Today, when it comes to tools to enhance language teaching and learning, AI-driven technology is essential in creating innovative and successful solutions for educators and learners.

While active learner participation is critical in pronunciation instruction, it is also important to examine other external factors that influence L2 pronunciation, such as the quality of input and the learner's linguistic background. Several factors affect L2 pronunciation teaching. The quality and quantity of L2 input, particularly the amount of native target language input, might improve learners' pronunciation. Additionally, the learner's L1 background and phonetic variations between the L1 and L2 may create obstacles in perception and production (Piske, 2012; Piske et al., 2001). As researchers continue to explore factors influencing L2 pronunciation, technological tools like speech recognition and text-to-speech software have emerged as potential resources for improving pronunciation instruction.

Previous research on TTS Technology

In a recent review article, speech recognition technologies have received little attention in previous studies, while researchers who have used speech recognition tools in their studies have primarily focused on facilitating pronunciation skills (Liu & Shadiev, 2023). In a meta-analysis study, Wood et al. (2018) found that text-to-speech technology enhances reading comprehension among individuals with reading difficulties. They pointed out that there is an increasing number of studies into the effectiveness of text-to-speech and comparable read-aloud tools in improving reading comprehension. However, additional empirical research is required, as it remains unclear whether AI-based voice recognition and TTS software can help language learners improve their pronunciation. In addition to studies focusing on pronunciation and reading comprehension, other research has explored the use of AI tools in improving a variety of language skills.

Some researchers have focused on improving specific language skills, while others have addressed different aspects of language learning. For instance, Cavus and Ibrahim (2017) studied how to improve both listening and pronunciation, whereas Tsai (2019) used speech recognition technology to improve students' oral performance only. According to Cavus and Ibrahim (2017), students who used the

developed speech recognition application in the experimental group showed statistically significant improvements in their learning outcomes. The study, which was experimental in nature, focused on the potential of using an interactive speech recognition engine that works entirely on a mobile phone. These findings demonstrate that speech recognition technology may help language learners improve their speaking skills.

Building on this, additional studies have further supported the effectiveness of speech recognition technology in improving speaking proficiency. For example, Ahn & Lee (2016) discovered that students had positive attitudes toward using speech recognition technology for speaking exercises, suggesting that such tools not only improve proficiency but also engage students in the learning process. This implies that voice recognition software can help learners improve both their speaking skills and their motivation to practice.

Further expanding on the advantages of AI-driven tools for language learning, some studies have examined the impact of TTS technology on pronunciation improvement. In their pre- and post-test experimental study, Eksi and Yesilcinar (2016) explored the pedagogical potential of AI-based text-to-speech websites for self-study, examining how English language teacher trainees used these tools for pronunciation development. According to the pre- and post-test findings, text-to-speech websites can be a useful tool for self-study aimed at improving pronunciation. Additionally, the results of the reflection questionnaire used in their study showed that web-based text-to-speech tools were efficient and easy to use (Eksi & Yesilcinar, 2016).

In addition to studies focusing on pronunciation in English, research has also extended to other languages, such as Chinese, exploring the use of AI-driven technology in foreign language teaching. In a multiple- case study, Yeh (2014) investigated effective strategies, based on teachers' perspectives, for instructing and learning Chinese as a foreign language using various tools, such as TTS, SRT, and machine translation technologies. The research found that instructors' trust in technology, administrative support, ease of use, and accessibility all played a significant role in their adoption of these tools for teaching. On the other hand, students' social behaviour, motivation, learning attitude, and guidance from parents all had an impact on their capacity to successfully use technology tools when learning Chinese.

Similarly, research on pronunciation training for Arabic-speaking learners highlighted the potential of CAPT (Computer Assisted Pronunciation Teaching) to offer individualized learning experiences, free from peer pressure. Ehbara (2021) states in her research on the impact of CAPT training on Arabic-speaking young learners that the use of CAPT can assist students in working individually, at their own speed, and with fewer worries about peer criticism. Such applications can be employed as additional practice in combination with regular teaching settings.

Computer Assisted Pronunciation Teaching (CAPT)

CAPT is gaining attention from language educators due to its potential to enhance pronunciation skills through technological advancements. Hismanoglu (2006) highlighted that language instructors and experts are becoming more interested in CAPT because of the progress in computer technology. CAPT offers learners a private, relaxed setting where they can practice at their own pace and receive immediate feedback (Hismanoglu, 2006). In this context, the present study utilized a CAPT system to teach English pronunciation to Turkish-speaking students, offering them native English speaker input generated by TTS technology. Thus, the integration of CAPT systems, such as those using TTS technology, presents an innovative approach to improving pronunciation, particularly for language learners like Turkish-speaking students.

Methodology

This study aims to investigate whether a course incorporating TTS tools can help improve EFL students' pronunciation. A pre-test and post-test approach was used to examine the effectiveness of the web-based TTS application TTSReader. Data were collected using two quantitative instruments: a read-aloud test administered both as a pre-test and a post-test, and a questionnaire measuring students' beliefs,

attitudes, and perceptions of the effectiveness of the TTS tool. The 4-week pronunciation training with the TTS tool was also embedded in the course. Descriptive statistics were employed to analyze the data. For the read-aloud test, the number of correct answers was counted, and an overall score was calculated as a percentage.

Participants

The research study included 14 university students as participants in preparatory classes at a private university in Türkiye. A convenience sampling strategy was employed for this quantitative study as participants were willing and available to participate (Creswell & Creswell, 2018). The students' ages ranged from 18 to 24, with an equal distribution (7 female and 7 male students). Initially, there were 20 participants; however, six participants dropped out due to absences during training sessions and failure to complete the post-test. Consequently, the study was completed with 14 participants. The students had an A1 level of English and faced various pronunciation challenges. Students in preparatory classes take three different language courses. The main course focuses on grammar, while the other courses emphasize reading and writing skills. Lastly, the listening and speaking course develops students' abilities in listening, speaking, and pronunciation.

Instruments

A read-aloud test was utilized in the study as both the pre-test and post-test. The read-aloud test was generated using the AI-driven technology ChatGPT, which was instructed to create sentences containing 45 targeted words. Each sentence included one target word, focusing on specific pronunciation challenges such as consonant clusters and silent letters—voiced th, voiceless th, engma -ŋ, -ng, -ph, silent k, silent h, silent t, silent l, and silent b. In total, 45 targeted words were embedded in the read-aloud test.

The read-aloud test was recorded by the researcher, using a voice recorder app. The researcher then evaluated the recordings by providing correct/incorrect feedback on the targeted words. When the particular phoneme was pronounced correctly in the targeted word, it was considered correct. When the targeted phoneme was mispronounced, the word was evaluated by the researcher as incorrect. The test was evaluated by the researcher herself, as she was also the teacher of the participants.
Example: Targeted word**:** There /ðeər/
For instance, if the voiced th in the word *there* is not pronounced correctly, the pronunciation is considered incorrect.

To complement the pre- and post-test assessments, participants' perceptions of the TTS technology were also gathered to gain a more comprehensive understanding of their experiences with the tool. Participants' opinions and perceptions of the TTS technology were collected using a twelve-item questionnaire with two response options: *agree* and *disagree*. The questionnaire used in this study was adapted from Noviyanti (2020), who developed a questionnaire based on relevant literature. The reliability coefficient of the instrument was reported as 0.75, indicating moderate reliability. Since the students' proficiency levels were too low to fully comprehend the English version, the Turkish translation of the questionnaire was used.

Training

The study included a four-week pronunciation training period. Due to the short duration of the course, it was not feasible to address all segmental differences that posed challenges for the learners. Instead, the training focused on pronunciation problems at the word level. Specifically, the study emphasized the acquisition of consonant clusters and silent letters, as these features are either uncommon or challenging for native Turkish speakers to pronounce. We targeted these phonemes because Turkish students often struggle with pronouncing consonant clusters. Additionally, silent letter rules are not always evident to Turkish learners, as every letter in a Turkish word is pronounced.

The pronunciation training covered the phonemes displayed in *Table 1*.

Table 1
Phonemes, Letters, and Transcription Examples

Phoneme description	Letters	Transcription	Example
The voiced dental fricative	th	/ð/	this
The voiceless dental fricative	th	/θ/	three
Velar nasal phoneme (engma)	ng	/ŋ/	sing
Consonant digraph	ph	/f/	photo
Silent ⟨k⟩	k	—	knife
Silent ⟨h⟩	h	—	honest
Silent ⟨l⟩	l	—	could
Silent ⟨t⟩	t	—	listen
Silent ⟨b⟩	b	—	debt

Each pronunciation session lasted 40 minutes. ChatGPT generated new passages for every phoneme, incorporating the targeted phonemes into context-related passages derived from the students' curriculum. The university computer lab was used for pronunciation practice. The lab contained 20 PCs, each equipped with headphones with built-in microphones and an internet connection. This setup allowed each student to practice independently on a computer.

Procedure

A four-week training program was planned, with each session lasting 40 minutes. The training was divided into four stages. First, the teacher explained the pronunciation topic, showed the IPA phonetic symbols, demonstrated sound articulation with particular examples, and modeled the correct pronunciation.

Second, the teacher projected a passage generated by ChatGPT (containing words with the targeted phonemes) onto the board. Students listened to the paragraph, which was read aloud by an AI voice generator called TTSReader: Text-to-Speech (TTS), while following the text on the screen. The students had to pay attention to the specific phonemes or consonant clusters while listening. Dual coding was applied in this part, as students listened to the projected paragraph, they visually tracked the specific phoneme being taught in that session. TTSReader allows users to read along by highlighting the current sentence and instantly scrolling to keep it in view. This allows learners to follow the passage with their eyes while simultaneously listening. This approach can help learners read faster, comprehend more effectively, and focus on the pronunciation of the targeted words. Students listened to the paragraph twice, ensuring they heard the correct pronunciation of the words in context.

The third stage was the most active and intensive part of the training: shadowing practice. Students read the passage aloud, checking their pronunciation and assessing whether they pronounced the targeted words correctly. Learners could attempt as many times as desired to achieve the perfect pronunciation of the words. Peer evaluation was also incorporated at this stage. After each session, students recorded themselves while shadowing the passage, paying particular attention to the targeted words. They then sent their recordings via WhatsApp to an assigned partner, who listened to the recording and provided some feedback on their peer's pronunciation. When the pronunciation was correct, the students had to give positive feedback, and when they noticed mispronunciation of the words in the passage, they could give constructive feedback to help improve pronunciation. Finally, there was a group discussion on the difficulties and pronunciation errors they made. Students also received a printed document of the paragraphs, with the targeted words in bold, to help them identify which words and phonemes to focus on. An overview of the four-week training sessions is provided in *Table 2.*

Table 2
Training Sessions: Pronunciation training with TTSReader-Text-to- Speech (TTS)

Week	Pronunciation Training	Phonemes	AI-Driven Programs Used
1	The voiced dental fricative ⟨th⟩ The voiceless dental fricative ⟨th⟩	/ð/, /θ/	ChatGPT (creating passages) TTSReader-Text-to-Speech (TTS) Online
2	Silent ⟨k⟩ Silent ⟨h⟩ Velar nasal phoneme ⟨ng⟩	—, —, /ŋ/	
3	Consonant digraph ⟨ph⟩	/f/	
4	Silent ⟨l⟩ Silent ⟨t⟩ Silent ⟨b⟩	—, —, —	

Ethical Considerations

In this study, all rules stated within the scope of "Higher Education Institutions Scientific Research and Publication Ethics Directive" were followed. None of the actions stated under the title "Actions Against Scientific Research and Publication Ethics," which is the second part of the directive, were taken.

Ethical review board name: Konya Food and Agriculture University
Date of ethics review decision: 14/12/2023
Ethics assessment document issue number: 2023/06

Findings

We present the results using descriptive statistics in percentages due to the study's narrow focus and small number of participants. For the read-aloud test, the correct answers were counted, and an overall score was calculated. Table 3 shows an increase in students' pronunciation accuracy across all nine categories. Average percentages of correct answers were collected for each category, as shown in *Table 3.*

Table 3

Average accuracy percentages for all 9 categories

	Pre-test	Post-test
	%	%
Voiceless- th	27.14	67.14
Voiced -th	48.56	68.56
Engma -ng	42.84	87.16

Ph	59.98	81.42
Silent -k	60.00	95.74
Silent-h	38.58	64.30
Silent-l	15.70	68.56
Silent-t	60.00	78.56
Silent-b	8.58	48.56

In the voiceless th **/θ/** category, the average correct answer percentage in the pre-test was 27.14%, **while** in the post-test, it rose to 67.14%. In the voiced th **/ð/** category, the average percentage of correct pronunciation in the pre-test was 48.56%. The average percentage of correct answers in the post-test increased to 68.56%. In the **engma-ng** category, the average percentage of correct answers in the pre-test was 42.84%. In the post-test, the rate rose to 87.16%. The average percentage of correct answers in the Ph category, in the pre-test, was 59.98%. In the post-test, the rate rose to 81.42%. In the silent **-k** category, the average percentage of correct answers in the pre-test was 60%, **while** in the post-test, the rate increased to 95.74%. In the silent **-h** category, the average percentage of correct answers in the pre-test was 38.58%, **while** in the post-test, the rate increased to 64.30%. In the silent **-l** category, the average percentage of correct answers in the pre-test was 15.70%, **and** in the post-test, the rate increased to 68.56%. In the silent **-t** category, the average percentage of correct answers in the pre-test was 60%, **while** the rate increased to 78.56% in the post-test. In the silent -b category, the average percentage of correct pronunciation in the pre-test was 8.58%, while in the post-test the rate increased to 48.56%. The read-aloud pre- and post-test findings indicate that learners' pronunciation **accuracy** improved.
To gather participants' user perceptions and attitudes about the TTS technology used during training sessions, a questionnaire with a dual Likert scale is administered. The results of the participants' perceptions and attitudes about the TTS tool, TTSReader, are presented in *Table 4*.

Table 4

Distribution of answers to the 12-item evaluation questionnaire

Article no.		**Agree**		**Disagree**	
		n	%	n	%
1	I believe that the application has pedagogical value	13	92.9	1	7.1
2	I believe that this application can improve my pronunciation	14	100.0	0	0
3	I believe that this application gives opportunities to improve my pronunciation accuracy	14	100.0	0	0
4	I think that students need to use this application to increase their pronunciation accuracy	14	100.0	0	0
5	I believe that I cannot improve my pronunciation with this application.	0	0	14	100.0
6	I believe that this application cannot support independent learning.	2	14.3	12	85.7

7	I believe that this application can be time-consuming.	6	42.9	8	57.1
8	I find it difficult to use this application	0	0	14	100.0
9	I believe that this application can decrease my anxiety toward pronunciation learning	14	100.0	0	0
10	I believe that this application is not too effective for pronunciation learning	0	0	14	100.0
11	I believe that this application promotes pronunciation accuracy	14	100.0	0	0
12	I believe that this application promotes independent learning	14	100.0	0	0

Items 2, 3, 4, 9, 11, and 12 were answered by 100% of respondents with "I agree." 100 percent of the respondents answered "I do not agree" with articles 5, 8, and 10. Forty-two point nine percent (42.9%) of respondents said "I agree" with article 7. Based on the results of the first question, the majority of students believe that using the TTSReader application will help them pronounce words more accurately. The responses to questions 2, 3, and 4 indicate that every participant believes the application offers students the chance to improve their pronunciation skills. The responses to question 5 show that all participants disagree with the claim that the program cannot enhance students' pronunciation. All of the participants stated that this application can decrease anxiety toward pronunciation learning and that they believe it promotes independent learning. Question 8 demonstrates that learners generally do not have problems operating the TTSReader; however, almost half of the students stated that this application can be time-consuming. All the participants disagreed with question 10, suggesting that they believe in the effectiveness of the application for pronunciation learning, though the contents of question 10 are not specified here.

Discussion

Technology and English language instruction are closely linked, as digital tools and platforms facilitate interactive and immersive learning experiences that improve language proficiency, enhance communication skills, and provide access to a variety of learning materials. The primary goal of this study was to explore improving EFL students' pronunciation via TTS technology, specifically TTSReader, as a pedagogical tool. The purpose of using TTS technology was to determine whether it might help EFL learners accurately pronounce words in English with particular phonemes and consonant clusters.

A 4-week pronunciation training program using TTSReader was conducted with 14 EFL students at a private university in Türkiye. The pronunciation training focused on consonant clusters (voiced and voiceless -th, -ph, -ng) and silent letters (-k, -l, -t, -b, -h). Following the pronunciation training sessions, a dual Likert questionnaire was used to investigate participants' attitudes, perceptions, and beliefs regarding the TTSReader technology employed in the sessions. The TTSReader tool employed in this research is a free online text-to-speech platform. According to the responses of the participants, this tool was perceived as user-friendly and effective for pedagogical purposes.

The findings of this experimental study confirm earlier findings of several studies about the incorporation of technology to enhance language teaching success. The results of research conducted by Zou et al. (2023), for instance, confirm that AI speech evaluation programs were beneficial for

enhancing speaking skills, grammatical accuracy and range, pronunciation and oral rhythm, reading aloud skills, spontaneous speaking, and idea-organization.

In a similar vein, the findings of Noviyanti's (2020) study showed that students' pronunciation improved based on the speaking test results. The average pre-test score increased by about 30 points, rising from 56 in the pre-test to 90 in the post-test.

While AI speech evaluation programs have proven beneficial in many areas of language learning, other forms of technology, such as Automatic Speech Recognition (ASR) software, have been shown to improve pronunciation skills by providing learners, more autonomy, and a low-anxiety practice environment. A different study indicates that using ASR software is a simple and useful way to give students more control while learning pronunciation. The same research also states that with the help of ASR, students were able to conduct significant language experimentation in a safe setting, free from the potential anxiety that comes with speaking with others (McCrocklin, 2016).
Pronunciation-related anxiety can often hinder effective communication; therefore, the use of AI-driven technologies, such as ASR or TTS tools, offers a practical solution to overcoming such barriers in language learning settings. In this study, all participants agreed that the TTS application helped reduce their anxiety toward pronunciation learning, supporting the findings that such technologies can promote a more relaxed and effective learning environment.
Similarly, Neri et al. (2008) found that CAPT helps children pronounce words accurately. In their study, one group received teacher-led pronunciation training, while the other used a computer-based system (Parling) with an ASR component. Furthermore, research conducted by Eksi and Yesilcinar (2016) on the effectiveness of online TTS tools found that these tools are both efficient and easy to use. Additionally, teacher candidates, who participated in the study, said that they would utilize such tools in the future, which is noteworthy. Additionally, Gilakjani and Narjes Banou Sabouri (2017) found in their research that pronunciation software is an affordable and useful technique for teaching pronunciation. Interviews with Iranian instructors showed that using pronunciation software improved their teaching skills. However, while these studies highlight the benefits of technology in pronunciation learning, other research has examined the varied impacts of technology, shedding light on both its potential advantages and limitations.
In his study, Chiang (2019) explored how well students performed when dictating English vocabulary using dictation conducted by the teacher and TTS technology. The findings revealed that students did not prefer TTS technology in the language classroom. However, in a recent single-case research study on how learners with disabilities comprehended and enhanced their listening comprehension using Text-To-Speech software and a human reader, Brunow and Cullen (2021) concluded that reading proficiency and individual experiences affected how effective TTS was.

This contrasts with other studies that highlight the broader applicability of TTS technology across languages. Soler-Urzúa (2011) found that employing TTS effectively can help Spanish learners acquire the English /ɪ/ in an educational context and concluded that educators might benefit from its use. She mentions several benefits of using TTS in educational settings, such as taking on repetitive tasks and listening to texts repeatedly as learners wish. Instructors may feel uncomfortable reading a text repeatedly during a class to help learners understand distinct linguistic elements. Additionally, TTS can save teachers time searching for listening material by allowing them to enter written content and reuse it for aural exercises. This demonstrates several advantages of TTS technology, which not only promotes pronunciation improvement but also leads to significant advances in pronunciation accuracy, as evidenced by the pre- and post-test results.

The pre- and post-test findings of this study reveal improvement in learners' pronunciation accuracy across all categories, with percentages increasing significantly for both voiced and voiceless sounds, as well as silent letters. Notably, the silent-k category experienced the highest gain, increasing from 60% in the pre-test to 95.74% in the post-test, indicating significant improvement in overall pronunciation accuracy.

The participants' perceptions of the TTSReader application were overwhelmingly positive. All of the participants agreed that the TTS tool may help them improve their pronunciation, promote independent learning, and reduce anxiety toward pronunciation practice. While all students reported no trouble using the application, nearly half believed it could be time-consuming. Overall, the findings indicate that TTSReader is highly effective in pronunciation learning, with participants expressing trust in its potential.

Limitations and Recommendation

Limitations

It must be acknowledged that the current study has several limitations. Firstly, the lack of a control group and the 4-week duration of the training might affect the validity of the results. Furthermore, the group's size was not large enough to adequately generalize the results. Future research might use a greater number of participants and set up the experimental and control groups at the same time in the study. One limitation of the study is related to the questionnaire used to collect participants' opinions. The original questionnaire employed two-choice response options (agree/disagree), which may not have allowed for a nuanced understanding of participants' attitudes, particularly for those who were indifferent or neutral towards certain items. While a 5-point Likert scale could have provided a more objective assessment of the responses, the choice of a binary scale was made for simplicity from the participants' perspective. Despite this limitation, the findings provide valuable insights into participants' general perceptions of the TTS tool used in the study. In light of these limitations, the study might offer helpful insights and suggestions to educators across various environments who want to utilize AI-driven TTS tools for instructional reasons, to improve learners' pronunciation. Additionally, it provides suggestions for AI-driven TTS program makers worldwide to help them discover which AI programs could be more advantageous for language learners.

Conclusion

In conclusion, the study suggests that the web-based text-to-speech program improved Turkish EFL students' pronunciation skills, as evidenced by increased read-aloud performance and favorable student views. The research findings demonstrated that the web-based TTSReader technology assisted students while learning English as a foreign language. Their pronunciation improved at the word level across nine categories, including consonant clusters and silent letters. The questionnaire revealed that users found the TTSReader user-friendly and gave positive reviews of it. All participants stated that this application can decrease anxiety toward pronunciation learning and that they believe it promotes independent learning.

Based on these results, it can be concluded that TTSReader tool can be used as a pedagogical tool for teaching pronunciation in EFL classes, especially for learning correct pronunciation at the word level. Additionally, TTS technology allows students to refine their pronunciation at their own pace and comfort. Learners can repeat words or entire sentences as many times as needed to improve proper pronunciation. Individualized learning with TTS can be beneficial for students with diverse learning styles and preferences. Furthermore, TTS offers learners the opportunity to work on their pronunciation in a wide range of contexts, including the classroom, at home, and on the road. This ability to adapt fosters constant learning and practice.

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Examination of Pre-service Science Teachers' Opinions on Vee Diagrams

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Examination of Pre-service Science Teachers' Opinions on Vee Diagrams

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ABSTRACT

This study examines pre-service science teachers' perceptions regarding the Vee Diagram. The descriptive survey method was utilized in the study since it was intended to reveal the students' perceptions about the Vee Diagram implementation. The study was conducted with 36 pre-service science teachers who were studying in the first year of the Department of Science Teaching and enrolled in the Chemistry I laboratory practices course over a period of 14 weeks. In the experiments conducted in the second and third weeks, the students were expected to prepare their experiment reports in the classical experiment report format. In the fourth week, the students were asked to prepare the reports of nine experiments in Vee diagram format. 'Attitude scale towards Vee diagram' and 'Semi-structured opinion form on the utilization of Vee diagram' were employed to determine the opinions of pre-service science teachers about the studies they carried out in laboratory practices. In analyzing the quantitative data collected in the study, percentage and frequency were calculated from descriptive statistics. Qualitatively collected student responses were subjected to content analysis. In the quantitative findings of the study, 80% of the pre-service teachers responded positively to the statement, "Vee diagrams are a very helpful tool for observing the experimental process as a whole." In the study's qualitative findings, most of the pre-service teachers stated that they prefer to prepare their experiment reports in "Vee diagram format." The pre-service teachers stated that utilizing the Vee diagram as an experiment report was beneficial in "demonstrating the relationship between theory and practice, eliminating misconceptions, learning new information and facilitating meaningful learning".

Keywords: Experiment reports, Vee diagram, pre-service science teachers' opinions.

Introduction

In the current education system, students are aimed to provide a qualified service in line with their abilities and to carry out practical studies. The most important environments that come to mind in the teaching of science courses are laboratories (Alkan, Çilenti & Özçelik, 1991; İlhan, 2013). Student-centered laboratory practices that focus on learning by making and experiencing provide meaningful and lasting science teaching (Tobin, 1990; Telli, Yıldırım, Şensoy & Yalçın, 2004; Hofstein & Lunetta, 2004; Hofstein & Mamlok-Naaman, 2007; Tatar, Korkmaz & Ören, 2007). The written presentation of results and comments obtained as a result of an experiment or an activity is called an "experiment report". The reports include the name of the experiment, the experiment's purpose, its execution, tools and materials, theoretical information about the experiment, a graphical or tabular representation of the data, the experiment's result, and comments (Yenice & Aktamış, 2004). At the end of the experiment, the benefits of expressing what was accomplished in written form were as follows (Ergin, Şahin-Pekmez & Öngel-Erdal, 2005). Experiment reports provide a holistic view of each stage of the study.

a) Students acquire the ability to express their knowledge, process steps, and results in written and visual form while preparing an experiment report.

b) Experimental reports can be utilized as an assessment tool.

c) Students can observe their progress through experiment reports.

The evaluation of science experiments in our country is usually carried out using classical experiment reports. Classical experiment reports include the name, purpose, tools and equipment, theoretical information, conduct, graphical or tabular representation of data, result, and comments about the experiment (Yenice & Aktamış, 2004). When the classical laboratory sheets are examined, the aim is to achieve learning as a result of guiding the students, by listing what should be carried out at each step (Tamir, 1977; Kyle, 1979; Shymansky & Penick, 1979). This situation prevents students from structuring information in their minds and establishing connections between old and new knowledge (Nakiboğlu & Meriç, 2000; Atılboz & Yakışan, 2003). The most important purpose of laboratory studies is to provide a real learning environment by forming meaningful relationships between the theoretical knowledge students learn in class and the phenomena they observe in the laboratory. In the 1970s, Gowin and his students developed the Vee diagram to better understand and structure knowledge and laboratory practices. The Vee diagram is utilized as an experimental report in laboratory studies.

In Novak and Gowin's (1984) study that the first documented source on Vee diagrams was the book "Learning How to Learn. In the book, the Vee diagram was discussed extensively. In the literature, this instrument is called "Vee heuristic", "Vee diagram" (Novak & Gowin, 1984), Vee map (Roth & Roychoudhury, 1993; Roth & Bowen, 1993; Roehrig, Luft & Edward, 2001), or V-diagram (Nakiboğlu & Meriç, 2000). Nakhleh (1994) emphasized the importance of Vee diagrams and concept maps by stating that active learning, responsibility, and encouragement are essential for students to construct knowledge in the laboratory environment.

According to Ausubel (1968), learning occurs when linked to the student's existing knowledge. Therefore, before conducting laboratory experiments, students must associate the new information with concepts or generalizations they already know. In this sense, Vee diagrams allow students to research the concepts they will learn before the experiment. Like other cognitive theories, the theory of meaningful learning proposed by Ausubel (1968) focuses on the cognitive processes involved in learning rather than how knowledge is formed. Ausubel's (1968) view is based on the concepts of "learning" and "meaningful learning." According to Ausubel's (1968) theory of meaningful learning, instructional tools are necessary for meaningful learning. In their study, Novak and Gowin (1984) invented two learning tools called "Concept map" and "Vee map" based on Ausubel's Meaningful Learning theory to help students understand scientific concepts and construct knowledge (Ebenezer & Connor, 1998). Various teaching tools, such as Vee and concept maps, enable theoretical knowledge to be put into practice (Ramahlape, 2004).

Novak and Gowin (1984) define a concept map as an instructional tool that both taps into students' cognitive structures and expresses them. A concept map can be used with a Vee diagram. The Vee diagram, invented by Gowin, is a heuristic tool that has been proven to be effective in helping people understand complex concepts or relationships. A Vee diagram is both a teaching and a learning tool. According to Novak and Gowin (1984), concept maps and Vee diagramming allow educators and students to generate new ideas. With a Vee diagram, students can make connections between the results of the experiment and what they already know. Thus, systematically learning information enhances the permanence of learning (Novak & Gowin, 1984). Since the preparation of the Vee diagram takes place before the experiment, students conduct detailed research on the subject of the experiment and achieve more efficient learning (Roth & Bowen, 1993). The Vee diagram is an instrument that connects theoretical knowledge and practice and leads to results in a systematic way (Tatar, Korkmaz & Ören, 2007). The Vee diagram provides a significant benefit in understanding and evaluating the relationship between the observed and interpreted situations (Aydoğdu & Kesercioğlu, 2005). There are scientific studies in which Vee diagrams, which allow theoretical knowledge and practice to be combined, are utilized in laboratories (Atılboz & Yakışan, 2003; Morgil, Seçken & Karaçuha, 2005; Thoron & Myers, 2007). While creating the Vee diagram, five effective questions were emphasized to reveal the knowledge, (Novak & Gowin, 1984). These questions can be sorted as follows (Torres and Marriott, 2010).

What is an influencing question?

a) What is a keyword?

b) Which methods are employed in the research?

c) What are the main knowledge claims?

d) What are the valuable claims?

The main epistemological components of the Vee diagram are illustrated in Figure 1 (Novak and Gowin, 1984).

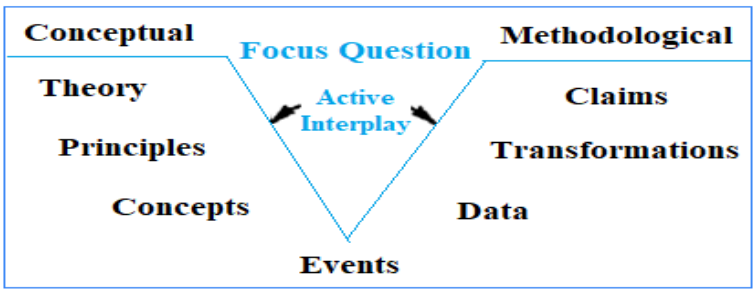


Figure 1. Vee heuristic

As shown in Figure 1, the Vee diagram consists of three main parts. It starts by drawing a large letter V. The focus question in the middle space is intended to connect the left and right sides of the Vee diagram (Gurley Dilger, 1992). The left part of the Vee diagram is called the conceptual part. This part consists of the student's knowledge before starting the experiment (Gurley Dilger, 1992). The conceptual part includes "theories, principles, and concepts. The right part of the Vee diagram is called the methodological part. The methodological part consists of empirical claims; knowledge claims; data transformations; and records. First, objects and events are identified. Answers to the focus question are sought. Afterward, they are asked what they need to know about the study. "What do I need to know to answer the focus question?" is the basis of the conceptual part on the left (Mintzes & Novak, 2005). The Vee diagram ensures a proper understanding of the basic concepts by establishing a connection between theoretical knowledge and methodology (Karamustafaoğlu, Yaman & Karamustafaoğlu, 2005). The parts of the Vee diagram to be filled in by the student are explained below (Nakiboğlu & Meriç, 2000).

Focus Question: Questions indicating the starting point and purpose. It should interact with the conceptual and methodological parts. There may be one or two focus questions.

Tools and Materials: It is placed at the bottom of the Vee diagram at the pointed end of the **V-shape**. This section includes the tools and materials used in the experiment.

Theory and Principles: It assists in determining which tools and materials will be utilized in the experiment.

Concepts: This is the part where the concepts, symbols, and expressions necessary for understanding the experiment are written. This part was prepared before the experiment.

Knowledge Claims and Experimental Claims: The answers to the focus questions are knowledge claims. These claims provide ideas about new questions that can guide research. The practical details, that is, those related to the experiment, are included in the empirical claims section.

Valuable Claims: These are considered valuable in research produced in or outside the field.

Data Transformations: These are the sections where the information obtained as a result of the experiments and the observations obtained beforehand are compared and converted into tables and graphs.

Registrations: This is where all the results, measurements, and observations gathered during the experiment are recorded.

Roth and Verechaka (1993) state that the Vee diagram can be regarded as a map illustrating the path to be followed in reaching new knowledge from previous knowledge, and that when students look at this diagram, they will understand how and why the experiment was conducted and what results were achieved. In their study, Roth and Verechake (1993) expressed the Vee diagram as a Vee map. In this context, the concepts relevant to understanding the experiment in the Vee diagram can also be expressed using concept maps (Roth and Verechake, 1993). In the Vee map, students learn the relationships between concepts by creating a map in the concepts section before the experiment. With this feature, the concepts section provides meaningful learning (Tekeş, 2011). The Vee map utilized by Luft, Tollefson, and Roehrig (2001) in their study is displayed in Figure 2.

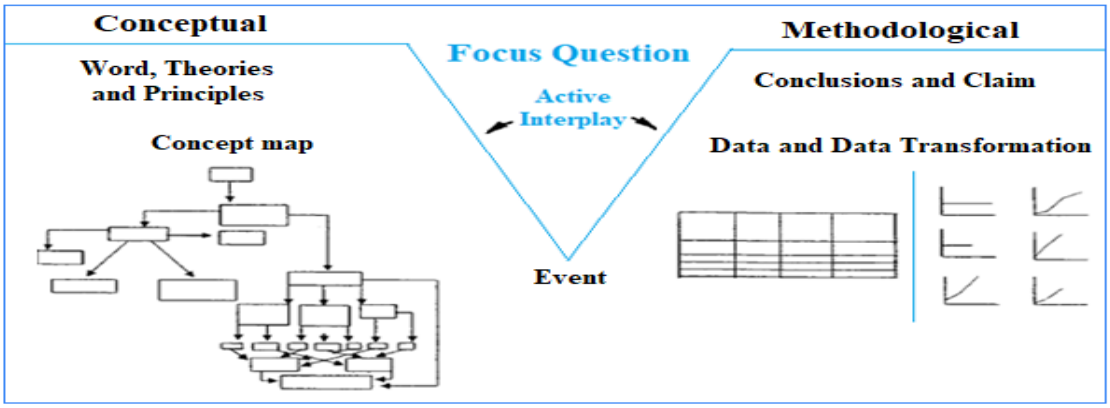


Figure 2. Vee map components

The advantages of utilizing the Vee diagram can be summarized as follows.

a) Vee diagrams are effective in structuring knowledge by providing a standardized format (Roehring, Luft & Edward, 2001).

b) Students improve their discussion skills by working in groups while preparing Vee diagrams (Nakiboğlu & Meriç, 2000).

c) Constructing a Vee diagram is more practical and less time-consuming than the classical experiment format (Novak & Gowin, 1984).

d) Vee diagrams effectively develop communication skills by allowing students to work together (Luft, Tollefson & Roehrig, 2001).

e) The Vee diagram can also be employed as an evaluation tool (Novak & Gowin, 1984; Roehring, Luft & Edward, 2001).

f) Vee diagrams can be useful in concept learning and identifying misconceptions (Ault, Novak & Gowin, 1984; Passmore, 1998; Nakiboğlu, Karakoç Topal & Benlikaya, 2002; Nakiboğlu & Özkılıç Arık, 2006; Alvarez & Risko, 2007).

In the studies conducted on laboratory practices, it was concluded that having students conduct classical experiment reports had no impact on learning except for psychomotor behavioral changes and that there was no relationship between the theoretical part of the experiment and observations (Nakiboğlu & Meriç, 2000). This study examines pre-service science teachers' perceptions regarding the Vee diagram. For this purpose, the study seeks answers to the following research questions.

1. What are the opinions of pre-service science teachers regarding the Vee diagram utilized in the laboratory?
2. What are pre-service science teachers' opinions regarding utilizing the Vee diagram?

Methods and Materials

In this study, the descriptive survey method was preferred since it aimed to reveal the students' perceptions, regarding the implementation of the Vee Diagram (Karasar, 1991). In the field of education, the descriptive survey model is adopted to learn people's attitudes, opinions, and beliefs (Johnson & Christensen, 2014).

Sampling

In the fall semester of the 2021-2022 academic year, a total of 36 first-year students studying in the Department of Science Teaching at Alanya Alaaddin Keykubat University, and enrolled in the Chemistry I laboratory practices course were included in the study. Within the scope of this study, it is important to ensure that students create and finalize Vee diagrams in different experiments (pre-experiment and post-experiment) in the laboratory practices course.

Applications process

This study was carried out for 14 weeks. Within the scope of the laboratory practices course, in the first week, the students were informed about the functioning of the course, laboratory safety rules, tools and equipment used in the laboratory, laboratory reports, including classical reports, and Vee diagrams. Pre-service teachers were also trained in the concept maps in the concepts section of the Vee diagram. In the experiments conducted in the second and third weeks, the students were expected to prepare their experiment reports in the classical experiment report format. In the experiments conducted after the fourth week, the students were asked to prepare their experiment reports in the Vee diagram format. The Chemistry I laboratory practices course was considered suitable for preparing Vee diagrams as it includes basic chemistry topics and involves preparing experimental reports. In the Chemistry I laboratory practices course, 9 experiment reports, "Separation of Mixtures, Separation by Distillation, Types of Reactions, Law of Conservation of Mass, Physical States of Matter, Ionic Solids and Conductivity, Comparison of Propagation Rates of Gases, Surface Tension of Liquids, Fluidity and Viscosity in Liquids", were prepared in Vee diagram format.

Data collection tools

"Attitude Scale Towards Vee Diagram" was administered to determine pre-service teachers' opinions regarding the Vee diagram. The 18-item, five-point Likert-type questionnaire specified intervals as "Strongly Agree, Agree, Neutral, Disagree, Strongly Disagree. Based on the data from this study, Cronbach's Alpha value was calculated as 0.902. In the literature, Cronbach's alpha value is defined as "a scale is highly reliable if $0.80 \leq \alpha < 1.00$" (Terzi, 2017). According to these values, the reliability of the scale utilized in the study is high. Semi-structured Student Opinion Form on the Utilization of Vee Diagram" was utilized to determine pre-service teachers' views on using the Vee Diagram. The "Semi-structured Focus Group Interview Questions Vee Diagrams" form prepared by Savran Gencer, Sevim, and Kaska (2015) was adapted by the researcher to be suitable for the study and renamed as the "Semi-structured Opinion Form on the Use of Vee Diagram. The questions posed to the prospective teachers in the study are as follows.

1. In which format do you prefer to prepare your experiment reports (Vee diagram-Classical experiment format? Did you prepare the Vee diagram every week? If not, can you explain why?

2. Did you research while preparing the Vee diagram? Which sources did you consult?

3. Did you have any difficulties while preparing the Vee diagram? What are the challenging points?

4. Did preparing a Vee diagram influence the learning process?

5. How did utilizing Vee diagrams in laboratory practices contribute to your learning?

6. Will you likely use the Vee diagram when you become a teacher?

Data analysis

The pre-service teachers' responses to the quantitative scale were coded separately in Excel for each question. The Jamovi (jamovi.org) software was employed to calculate the scale's reliability. In the study, percentage and frequency calculations from descriptive statistics were made during data analysis. The Tableau 2021.1 program was used to visualize the data. In the qualitative dimension of the study, pre-service teachers' views on laboratory practices were revealed through content analysis. Student responses collected qualitatively in the study were subjected to content analysis. Content analysis is generally a form of interpretation that enables the transition from qualitative data to quantitative insights to reveal the common aspects of a large number of text contents, structuring and classifying the important meanings (Gökçe, 2006). A code was formed for the students' comments when they were . For example, it was expressed according to S1.

To ensure the validity and reliability of the qualitative dimension of the study, student opinions were analyzed by experts in the field. The consistency of the codes used by the researchers, independently of each other, was determined by marking "Consensus" or "Disagreement. The codes the researchers made, in conjunction with student opinions, were accepted as unanimity of opinion, while different codes were accepted as disagreement. In the sections where there were contradictions among researchers, the opinions of different researchers were gathered, and coding was carried out. The reliability of the study conducted in this way was calculated using the formula: Agreement/(Agreement + Disagreement) x 100. To ensure reliability, the agreement between the researcher and the expert should be at least 90% (Miles & Huberman, 1994). In this study, the average reliability was found to be 92%.

Ethical Considerations

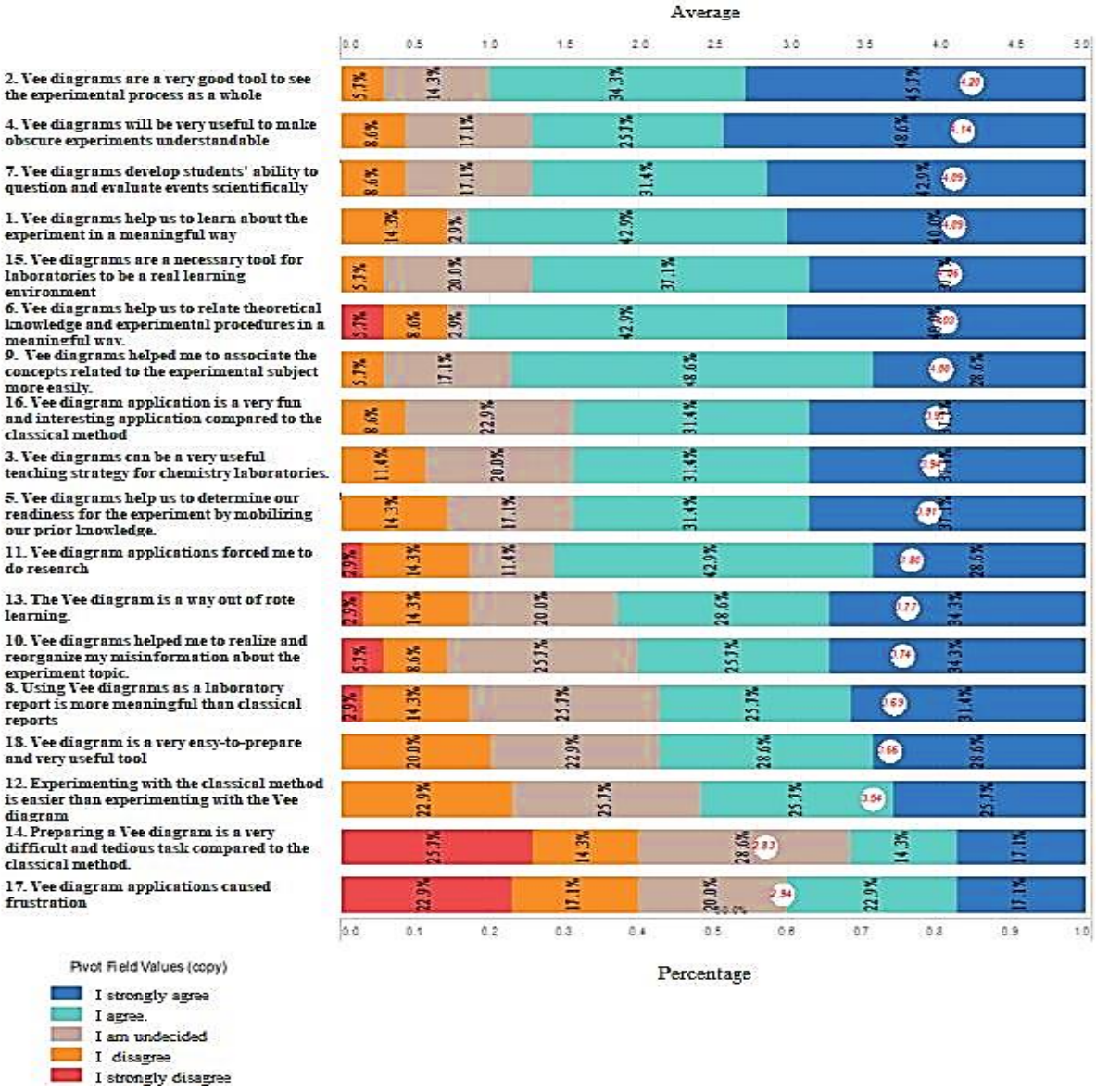
In this study, all rules within the scope of the "Higher Education Institutions Scientific Research and Publication Ethics Directive" were followed. None of the actions stated under the title "Actions Against Scientific Research and Publication Ethics," which is the second part of the directive, were not taken. Ethical review board name: Alanya Alaaddin Keykubat University Social and Human Sciences Scientific Research Ethics Committee Decision
Date of ethics review decision: 30.09.2021
Ethics assessment document issue number: 2021/06

Findings

Quantitative Findings

The results of the scale administered to determine the views of pre-service science teachers on Vee diagrams are presented in Table 1.

Table 1. The views of pre-service science teachers on Vee diagrams



When Table 1 is analyzed, the majority of the pre-service teachers, accounting for 45.7% and 34.3% respectively, responded positively to the item "Vee diagrams are a very useful tool for understanding the experimental process as a whole. In this item, 5.7% of them chose the option to disagree. No one chose the option of disagreeing. The highest mean was calculated as 4.2. The mean was 4.14 for the item "Vee diagrams will be very useful for making difficult experiments understandable." The rate of pre-service teachers who expressed positive opinions (strongly agree and agree) in this item was 74.3%, while that of those who expressed disagreement was 8.6%.

In the item "Vee diagrams develop students' ability to question and evaluate events scientifically.", the mean was 4.09. The rate of pre-service teachers who expressed a positive opinion on the item was 74.3%, while those who expressed disagreement was 8.6%.
In the item "Vee diagrams assist us in learning the subject of the experiment in a meaningful way," the mean was 4.09. The percentage of those who expressed a positive opinion in this item was 82.9%, while the percentage of those who disagreed was 14.3%. In the item "Vee diagrams are a necessary tool for laboratories to be a real learning environment.", the mean was 4.06. For this item, 74.2% expressed a positive opinion, while 5.7% disagreed. In the item "Vee diagrams assist us in establishing a meaningful relationship between theoretical knowledge and experimental procedures," the mean was 4.03. In this item, 82.9% of the pre-service teachers selected strongly agree, and agree, while 14.3% selected strongly disagree, and disagree.

The mean of the item "Vee diagrams enabled us to associate the concepts related to the subject of the experiment more easily" was 4.00, and the rate of pre-service teachers who agreed with the statement was 77.2%. In comparison, the rate of those who disagreed with the statement was 5.7%. In the item "Vee diagram implementation is a very enjoyable and interesting practice compared to the classical method," the mean was 3.97. At the same time, the rate of those who agreed was 68.5%, and the rate of those who disagreed was 8.6%. The mean score for the item "Vee diagrams can be a very useful teaching strategy for chemistry laboratories." was calculated as 3.94. While 68.5% agreed with this item, disagreed with it was 11.4%. The mean of the item "Vee diagrams assist us in determining our readiness for the experiment by stimulating our prior knowledge." was 3.91. At the same time, the rate of those who agreed was 68.5%, and the rate of those who disagreed was 14.3%.

"Vee diagram implementations encouraged me to conduct research." The mean was calculated as 3.80. In this item, the rate of pre-service teachers who strongly agreed on options was 71.5%, while the rate of pre-service teachers who strongly disagree was 17.2%. The mean for the item "Vee diagram is a way to get rid of rote learning." was 3.77, while the rate of those who expressed positive opinions was 62.9%, and the rate of those who expressed negative opinions was 17.2%. The mean of the item "Vee diagrams assisted me in realizing and reorganizing my misinformation about the experimental subject" was 3.74. At the same time, the rate of those who agreed was 60%; the rate of those with negative opinions was 14.3%. The mean of the item, "The utilization of Vee diagrams as a laboratory report is more meaningful than classical reports," was calculated as 3.69. In this item, 57.1% of the pre-service teachers selected either strongly agree or agree, while 17.2% selected either strongly disagree or disagree.
"The Vee diagram is a very useful tool that is prepared quite easily"; the mean was 3.66, while the rate of those who expressed positive opinions was 57.2%. The rate of negative opinions expressed was 20%. In the item "It is easier to conduct experiments with the classical method than with the Vee diagram," the mean was calculated as 3.54. The rate of pre-service teachers choosing strongly agree and agree options was 51.4%, while those choosing disagree options was 22.9%. In the item "Preparing a Vee diagram is a very difficult and boring task compared to the classical method," " the mean was calculated as 2.83. The proportion of pre-service teachers who selected strongly agree and agree options for this item was 31.4%, while the proportion of pre-service teachers who selected strongly disagree and disagree options was 40%. The mean of the negative item "Vee diagram implementations caused disappointment" was calculated as 2.94. The proportion of pre-service teachers who selected strongly agree and agree options for this item was 40%, while those who selected strongly disagree and disagree options was also 40%.

Qualitative Findings

The findings obtained as a result of the qualitative data analysis were supported by the statements of the pre-service teachers and shared accordingly.

Findings and Comments on Experiment Report Preference

The frequency distributions of the categories and codes belonging to the theme of experiment report preference are presented in Table 2.

Tablo 2. Frequency distributions related to the theme of experiment report preference

Theme	Category	Code	Frequency
Experiment report preference	Vee diagram format	Instructive	15
		Entertaining	6
		Consolidating	5
		Aesthetic	5
		Seeing the whole	4
		Permanence	4
		Comprehensive	4
		Summarized	3
		Detailed research	2
		Repetitive	2
	Classic experiment format	Easy	4
		Time-saving	3
	Vee diagram ve Classic experiment format	All of them	4
		None of them	1

To determine in which format the pre-service teachers prepared their experiment reports, the question "In which format would you prefer to prepare your experiment reports (Vee diagram–Classical experiment format?)" was asked when examining Table 2. When the answers to this question were analyzed, it was observed that the pre-service teachers expressed different preferences. It was determined that pre-service teachers mostly preferred the Vee diagram format. Most of the pre-service teachers (f=6) stated that they preferred the Vee diagram because it was "instructive." For example, one pre-service teacher (S16) answered, "It is a study format in which I can best explain why and how I prepared the experiment because it establishes a relationship between concepts and is instructive"; another pre-service teacher (S26) stated, "It makes the subjects more explanatory and instructive by doing extensive research on the experiment. After the concept of "instructive", it was observed that the pre-service teachers emphasized that Vee diagrams were mainly (f=4) entertaining, (f=4) effective for viewing the whole, and (f=4) offered permanence. For example, S22 stated that Vee diagrams were "more instructive and entertaining than the classical experiment format," S25 stated that Vee diagrams were "both more entertaining and more effective for learning purposes," and S23 stated that Vee diagrams were "more informative and entertaining.

In the case of "seeing the whole" of Vee diagrams, S35 stated that 'it enables us to learn all the terms related to the subject in detail.' S35 stated that "*it makes it easier to repeat the subjects by thinking about them in their entirety*". The "permanence" of Vee Diagrams was expressed by S30 as "I need additional information while preparing Vee diagrams, and writing by researching becomes more memorable. It presents the subject in a richer form in terms of theoretical, experimental, and visual aspects, and makes it more permanent. Other concepts emphasized by the pre-service teachers in their statements were (f=2) "aesthetics", (f=2) "detailed research" and (f=2) "connection between concepts". For example, the "aesthetics" of Vee diagrams were expressed by S7, one of the pre-service teachers, as follows: "It looks

more beautiful, I enjoy drawing it, and it allows us to explain the experiment better in terms of information, and it prevents us from getting tired. S13, one of the pre-service teachers, stated: "I prefer the Vee diagram because it is more informative and more visually appealing, as it provides versatile learning opportunities.

It was determined that some of the pre-service teachers (f=7) preferred to prepare their laboratory reports in the classical experiment report format because it was easy to prepare (f=4) and did not take a long time (f=3). For example, E6 of the pre-service teachers stated that "*the classical experiment report is easier than the Vee diagram, and we spend less time*." 26 of the pre-service teachers stated that "it is easier to prepare, and makes the subjects more permanent". It was determined that pre-service teachers (f=4) preferred various report formats in preparing an experiment report. For example, S29 of the pre-service teachers stated that "I would prefer to use the classical experiment report when covering the subject in less detail, but if I wanted to reinforce the subject by doing detailed research, I would prefer the Vee diagram format. 36% of the pre-service teachers expressed their opinions as "I would decide according to the content of the subject. S31, one of the pre-service teachers, stated that he would not prefer any of them with the following statement: "*The Vee diagram is too complicated, and the classical experiment format is contrary to my learning style*".

In the interview form, pre-service teachers were asked, "Which experiment report format do you prefer the most? Can you explain why?" The question was directed to the pre-service teachers. When the answers were analyzed, it was found that the pre-service teachers preferred to prepare the Vee diagram format, the classical experiment report format, and both formats. The pre-service teachers who preferred the Vee diagram justified their preference by using expressions indicating that it was enjoyable and visually beautiful to prepare, that it had a good level of comprehensibility, that they did detailed research, and that it enabled them to see the whole subject. The pre-service teachers who preferred the classical experiment report emphasized that it was practical and did not consume much time. The pre-service teachers who preferred to prepare both experiment reports stated that the two should complement each other.

When the preferences of the pre-service teachers are analyzed, findings highlight that Vee diagrams are a learning tool and that detailed research is required for their preparation. The pre-service teachers said they learned the subject with Vee diagrams and emphasized that Vee diagrams facilitated thinking. Reflecting on the idea of facilitating thinking, S10, says, "The Vee diagram gives more detailed and instructive information and has the quality of a book; it facilitates thinking." S8 "The Vee diagram helps us understand the subject more clearly and easily." S33: "I prefer the Vee diagram because it facilitates shaping my students' thoughts." S34 The Vee diagram makes it easier to review the topics by thinking about them in their entirety. Stating that Vee diagrams are a comprehensive tool, S19 explained that, "I think Vee diagrams will be more comprehensive and useful," and S32 said, "Vee diagrams are more comprehensive and instructive. S16 stated their opinions: "I would prefer it because it touches every point of the subject matter and gives us a better view of what we need to pay attention to.

Findings and Comments on the Vee Diagram Preparation Process

The frequency distributions of the categories and codes related to the Vee diagram preparation process—"Preparing every week, doing research while preparing, and having difficulty while preparing"—theme is presented in Table 3.

Table 3. Frequency distributions related to the theme of the Vee diagram preparation process

Theme	Category	Code		Frequency
Vee diagram preparation process	Regular preparation	Yes (Referenced sources)	Internet and experiment sheet	31
			Book	7
			Notebook	2
			Friend	2
			Slide presentation	1
			Previous knowledge	1
		Partially prepared	Absenteeism	3
			Not completely understanding the subject	2
			Lacking of time	1
			Forgetting	1
	Hardship and its cause	I did struggle	Concept mapping	8
			Figure drawing	3
			Excessive time consuming	2
			Disconnection in subject coherence	1
			Paper layout	1
			The distinction between theory and empirical principle	1
			Data transformations	1
			Generating theoretical knowledge	1
		I did not struggle		18

Regarding the process of preparing a Vee diagram, the pre-service teachers were asked, "Did you prepare a Vee diagram every week?". When Table 3 is analyzed, almost all of the pre-service teachers (f=29) stated that they prepared Vee diagrams regularly every week. Some pre-service teachers (f = 7) stated that they could sometimes be prepared. Some of the pre-service teachers (f=3) stated that they could not prepare it because of absenteeism (f=2). They could not fully understand the subject (f=1) due to forgetting and a lack of time. Another question related to this theme was about the sources of research conducted while preparing the Vee diagram. Almost all of the pre-service teachers (f=31), indicating frequency, stated that they benefited from the internet and the experiment sheet. In contrast, two participants stated that they used notebooks and friends, while one participant stated that they used slides and previous knowledge.

The pre-service teachers were asked whether they had difficulty preparing the Vee diagram, and half of the pre-service teachers (f=18) stated that they had difficulty . In contrast, the other half (f=18) stated that they did not have difficulty. The pre-service teachers stated that the most common reason for difficulty (f=8), was creating the concept map within the Vee diagram. One of the pre-service teachers, S17, stated, "I had difficulty in *creating a concept map in the Vee diagram*." Another reason stated for having difficulty by the pre-service teachers (f=3), was drawing shapes. S14 of the pre-service teachers stated, "*I had difficulty in creating the shapes of the experiment in the Vee diagram*," and S14 stated, *"I had difficulty in drawing the shape of the Vee diagram*". Some pre-service teachers stated that the difficulty was due to the activity taking too much time. S33 expressed this, "I did not have difficulty in preparing the Vee diagram, but it was a study that required us to spend a lot of time. Some pre-service teachers stated the reasons for difficulty as '(f=1) disconnection from the coherence of the subject, (f=1) paper layout, (f=1) theory-experimental principle distinction, (f=1) data transformations, (f=1) creating theoretical knowledge'.

Findings and Comments on the Impact of Utilizing the Vee Diagram

The frequency distributions of the categories and codes belonging to the theme "Theory-practice relationship; meaningful learning; learning new information; and eliminating misconceptions" are presented in Table 4.

Table 4. Frequency distributions related to the theme of the impacts of utilizing the Vee diagram

Theme	Category	Code	Frequency
Impacts of utilizing the Vee diagram	Learning	Theory-practice relationship	34
		Elimination of misconceptions	32
		Learning new information	31
		Meaningful learning	27
	Willingness to use it as a teacher	Yes	31
		No	5

The pre-service teachers were asked "In which aspect did utilizing the Vee diagram contribute to your learning?" about the effects of using the Vee diagram with the question, "In which aspect did utilizing the Vee diagram contribute to your learning? When Table 4 is analyzed, pre-service teachers are evaluated using the Vee diagram in laboratory practices in terms of 'theory-practice relationship, elimination of misconceptions, learning new information, and meaningful learning.' The majority of pre-service teachers (f=34) thought that the use of the Vee diagram was a beneficial learning tool for demonstrating the relationship between theory and practice, eliminating misconceptions (f=32), learning new information (f=31), and achieving meaningful learning (f=27).

Another question combined under the same theme, "Are you willing to use Vee diagrams when you become a teacher?," was asked. When the answers of the pre-service teachers were analyzed, it was determined that most of them (f=31) wanted to employ Vee diagrams. Very few pre-service teachers (5) stated they did not want to use it. An important finding is that although half of the pre-service teachers had difficulty preparing Vee diagrams, they wanted to use them while teaching.

Discussion and Results

The Vee diagram was introduced to the literature by Gowin and his students in the 1970s to improve the understanding and structuring of knowledge in the laboratory (Novak & Gowin, 1984). This distinctive teaching tool, which appears in the literature as "Vee heuristic", "Vee diagram", and "Vee map", has been the subject of important scientific studies. This study aimed to reveal pre-service science teachers' views on the use of Vee diagrams, prepared as an experiment report in the laboratory. For this purpose, many of the quantitative and qualitative findings utilized in the study were similar.

In the study, most of the pre-service teachers concentrated on the items expressed as "Vee diagrams are a very useful tool for us to observe the experimental process as a whole," and "Vee diagrams will be very helpful for making difficult-to-understand experiments understandable. From these results, it is evident that Vee diagrams are beneficial for students' learning processes. There are studies in the literature that corroborate these findings. In his study, Roth (1990) reveals that Vee diagrams can be used together with concept maps as an effective tool for students to understand the experiments in laboratories and to change their attitudes towards laboratory courses in a positive way. Roth and Browen (1993) stated that Vee diagrams help in organizing information, researching, and learning. Nakiboğlu and Meriç (2000) revealed "Reports prepared with Vee diagrams will enable students to learn the experiment very well. In Afamasaga-Fuata'i's (2004) study that concept maps and Vee diagrams effectively facilitated students' understanding and learning processes. Calais (2009) reported that Vee diagrams as a pedagogical technique greatly benefit students in understanding and transferring

knowledge. In addition, Çelikler, Güneş, Güneş and Şendil (2008) reported that "Vee diagrams make complex experiments more understandable". Thoron and Myers (2010) determined that learning was more productive in classes where Vee maps were employed than in classes where traditional experiment reports were employed. Ameyaw and Kyere (2019) found that using Vee maps in biology lessons provided students with a better understanding of the subject and explained that this was because the concepts in the Vee maps were based on concept maps. James and Yunana (2020) stated that Vee maps enhance students' learning performance in analytical chemistry teaching because they are a formative medium that guides students through the processes they will undergo in their scientific reasoning. Kusumawati and Lesmono (2020) reported that Vee maps included in students' worksheets facilitated their learning processes. Mohammed and Shraikh (2020) stated that the Vee-shaped diagram can be useful for cognitive development in students to enhance learning. Mohammed and Samuel (2021) reported that Vee maps had a very favorable effect on students' learning of genetics. Thamarasseri (2022) stated that Vee maps are a means of supporting the higher-order thinking skills of students and facilitating learning.

In the study, the majority of pre-service teachers supported the item "Vee diagrams support us to establish a meaningful relationship between theoretical knowledge and experimental procedures" from the quantitative findings. They expressed this agreement through the qualitative findings as "A Vee diagram is a useful tool in determining the relationship between theory and practice" . Studies similar to those described here were encountered in the literature. Novak and Gowin (1984) argued that the Vee diagram can make laboratory reports more understandable and useful by enabling students to establish a relationship between theoretical knowledge and laboratory work. Nakhleh (1994) investigated various methods to examine how learning occurs in the laboratory and stated that the Vee diagram is an effective tool that enables students to make connections between what they learn in lectures and laboratory practices. Knaggs and Schneider (2012) stated that tools such as Vee maps can encourage students to make connections with science. Olivares, Merino, and Quiroz (2014) reported that Gowin's heuristic Vee could assist students in systematizing knowledge and acquiring different perspectives in laboratory work. Gencer (2014) characterized Vee diagrams as a metacognitive tool that helps students learn the nature and structure of knowledge. Handayani (2020) stated that implementing the Vee diagram helps students comprehend the experiment better because the conceptual and methodological parts guide each other. Olalere and Chado (2021) reported that Vee maps positively impact teaching organic chemistry to students, because they encourage the interaction between the conceptual and methodological parts. Handayani, Hindriana, Widiantie, Lismaya, and Satianugraha (2022) reported that Vee diagrams improved students' science process skills and contributed significantly to designing experiments.

In the study, the majority of the pre-service teachers supported the item "Vee diagrams facilitate meaningful learning of the experiment subject" from the quantitative findings through qualitative findings, stating that "Vee diagram is a helpful tool in providing meaningful learning .", It has been stated in the literature that using Vee diagrams in science education is one of the tools that facilitate meaningful learning (Novak, 1990; Novak, 1998; Passmore, 1998). Tamir (1989) emphasized the importance of using learning tools such as Vee diagrams and concept maps so that science teachers can use the laboratory as a place where meaningful learning occurs. Nakhleh (1994) argued that tools such as Vee diagrams and concept maps should be utilized to ensure "meaningful learning" in general chemistry laboratory courses. In his study, Passmore (1998) observed that meaningful learning occurred in students utilizing Vee diagrams and concept maps because they examined the conceptual, relational, and hierarchical structure of the subject they studied. Nakiboğlu, Benlikaya, and Karakoç (2001) emphasized in their study that the Vee diagram is effective in realizing meaningful learning in chemistry laboratory courses. Novak (2010) emphasized that in scientific research, Vee diagrams serve as a road map showing where students are in the process and how they should proceed, while for teachers, they serve as a graphical guide that helps the research process turn into a meaningful learning environment. In his study, Demirtaş (2006) stated that Vee diagrams "facilitate students in connecting theory and practice, are an efficient tool in providing a real learning environment and are effective in learning the experimental subject in a meaningful way". Safdar, Hussain, Shah, and Tasnim (2013) stated that

concept maps and Vee diagrams in physics laboratories contribute to improving students' performance and making learning more meaningful. Hindriana (2020) stated that Vee diagram-based experiment worksheets developed in laboratory activities contributed positively to students' meaningful learning.

In the study, some of the pre-service teachers supported the quantitative finding, "Vee diagrams enabled us to associate the concepts related to the subject of the experiment more easily", by expressing a similar perspective in the qualitative findings. They described it as "a study format in which I can best explain why and in which ways I prepared the experiment because it establishes a relationship between concepts and is instructive." Some studies in the literature have similar results. For example, in their study on molecular concepts, Ault (1984) observed a significant improvement in some children's conceptions of molecules due to employing the Vee diagram in interviews. In their research on energy concepts, Ault et al. (1988) reported that students' construction of Vee diagrams helped them to learn the concepts. Okebukola (1992) stated that teachers perceived concept maps and Vee diagrams as effective cognitive tools that facilitate concept teaching. Al-Zaanen (2010) reported a significant difference in concept teaching in the student group working with Vee diagrams. Tekeş (2011) reported that students learned better the relationships between concepts through Vee diagrams. Ayvacı and Akbulut (2012) stated that the Vee diagram contributed to conceptual learning in the cognitive domain. Polancos (2013) emphasized that Vee diagrams and concept maps are significant teaching instruments in learning chemistry concepts and making connections between concepts. Mutai (2015) reported that Gowin's Vee heuristic strategy significantly improved students' conceptual understanding and contributed significantly to the higher-order cognitive development of students who used this strategy. Yerima, Mu'azu, and Hamidu (2017) reported that Vee maps had a favorable effect on students' learning of concepts. Kurniasih and Irpan (2019) stated that implementing the Vee diagram in biology teaching effectively provides students with conceptual comprehension. Fitakurahmah, Sambodo, Karyanto, Astorini, and Oetomo (2020) stated that the Vee-supported E-module is a beneficial tool for students to learn concepts. Kipkazi (2022) emphasized that Gowin's Vee teaching strategy is effective for student concept learning and easier to employ than traditional methods.

In the study, some of the pre-service teachers supported the item "Vee diagram practices encouraged me to do research" from the quantitative findings by expressing it as "Vee diagram makes the subjects more explanatory and instructive by doing extensive research on the experiment" from the qualitative findings. In the literature, Roth and Roychoudhury (1993) stated that utilizing Vee diagrams and concept maps facilitated the structuring of knowledge. Roth and Verechaka (1993) state that the Vee diagram illustrates the path to be traced in reaching new knowledge from previous knowledge. Roth and Bowen (1993) stated that Vee diagrams can help students understand the research process. Leibowitz (1998) demonstrated that the Vee diagram encourages students to think and learn more effectively compared to the traditional laboratory approach. Nakiboğlu and Meriç (2000) observed that the Vee diagram encouraged students to research during pre-laboratory preparation. Luft, Tollefson, and Roehrig (2001) reported that students using the Vee diagram were more successful in organizing the experiment, generalizing, and in their thinking and learning processes. Åhlberg, Äänismaa and Dillon (2005) observed that using concept maps and Vee diagrams effectively advanced pre-service teachers' thinking and professional development. Evren, Bati, and Yilmaz (2012) stated that there was a significant difference in the self-confidence dimension of pre-service teachers who used Vee diagrams compared to pre-service teachers who did not. Thoron and Rubenstein (2013) suggested that Vee maps are a useful instrument in developing students' higher-order thinking skills that Vee diagrams should be used. Suprapto (2017) reported that Vee diagrams positively affect students' reasoning and judgment. Musa, Ozoji, and Duru (2018) suggested using Vee maps to improve the thinking capacities of students in basic sciences.

In the study, most of the pre-service teachers supported the quantitative finding that "Vee diagram implementation is a very entertaining and interesting practice compared to the classical method." They expressed this sentiment in the qualitative findings, stating, "Vee diagrams are more instructive, entertaining, and more comprehensive in terms of addressing the subject in its entirety compared to the classical method." These findings may indicate that it is easier and more entertaining for students to

use Vee diagrams in the laboratory, than using the classical method. In Tekeş's (2011) study, it was determined that the students mostly answered "Yes" to the items "I enjoyed working with the Vee diagram,", "The classical experiment reports you used before did not contribute as much as Vee diagrams in understanding and learning the subject of the experiment," and "It would be much better to use Vee diagrams instead of classical experiment reports in laboratories. Doğru, Selvi, Köklükaya, and Güven Yıldırım (2015) stated that the positive aspects of Vee diagrams for pre-service teachers are that they are practical and visual, enabling research, facilitating understanding, and are organized. Kayacan (2018) stated that most pre-service teachers expressed positive opinions about preparing Vee diagrams. The most frequently mentioned feature was that it was easier to prepare than a classical experiment report. In Kırılmazkaya and Zengin's (2016) study, it was determined that the majority of the students preferred the Vee diagram to the question "Can you compare the Vee diagrams with the experiment reports you prepared before? Which one would you prefer to use when you become a teacher ?" Kayacan (2018) stated that the majority of pre-service teachers expressed positive opinions about preparing Vee diagrams, and the most frequently mentioned feature was that it was easier than a classical experiment report.

In the study, some of the pre-service teachers supported the item "Vee diagram is a very beneficial tool that is prepared quite easily" from the quantitative findings with statements indicating that they prefer Vee diagrams "in terms of visuality, better understanding of the subject and ensuring the integrity of the subject" from the qualitative findings. Most pre-service teachers stated that they did not have hardship while constructing Vee diagrams. In his study, Günaydın (2019) stated that the students did not have difficulty transferring the data to the graph in the interviews and that they could easily create the data transformations part. Çınkı (2007) reported that students stated that they did not encounter any problems creating Vee diagrams and improved their experimental observation and explanation skills. In Tekeş's (2011) study, some students stated that they had difficulty in creating Vee diagrams at firs. Still, they eliminated this problem with the Vee diagram exercises before the implementation. In Okebukalo's (1992) study, science teachers stated that Vee diagrams were easy to comprehend.

The item "Preparing a Vee diagram is a challenging and boring task compared to the classical method," was the most undecided item among the quantitative findings regarding the thoughts of pre-service science teachers about Vee diagrams. This was supported by the qualitative findings, which revealed that they preferred the traditional experiment format because the preparation of the Vee diagram is more difficult and time-consuming. These findings may indicate that students considered the Vee diagram very useful or thought it took a long time to develop. Keleş and Özsoy (2009) stated that most pre-service teachers expressed positive opinions about Vee diagrams. Still, some pre-service teachers stated that preparing Vee diagrams was challenging and time-consuming. In Kırılmazkaya and Zengin's (2016) study, some of the students stated that preparing a Vee diagram was time-consuming and difficult, that they did not have difficulty in the "theory-principles" part, but making a general inference from the data in the "results-claims" part was challenging.

In this study, it was observed that Vee diagrams were more effective than classical experiment reports in terms of observing the connections between theory and practice. They made students aware of the ways of obtaining information by participating in the scientific research process and encouraged students to engage in meaningful learning. It was reported that utilizing Vee diagrams as reports in laboratories is not very widespread (Morgil, Seçken & Karaçuha, 2005). It is believed that this study will benefit researchers, teachers, and students, and will encourage the implementation of learning instruments such as Vee diagrams and concept maps that promote meaningful learning in science laboratories.

As a result of the study, having the experiment reports, which are an important part of the laboratory course, prepared in Vee diagram format is a very valuable practice for pre-service teachers. The pre-service science teachers stated that they would teach, and have this method applied by their students when they become teachers.

Limitations and Recommendation

Considering the limited number of studies prepared with Vee diagrams in Turkey, such studies should be expanded and diversified, especially from the primary school to the university level. This technique should be introduced to prospective teachers in departments such as physics, chemistry, and biology, not only in faculties of education but also in faculties of science and literature. Since there are insufficient studies on Vee diagrams in Turkey, especially at the primary education level, teachers should be provided with extensive information through in-service training programs and be enabled to use it in their lessons. The use of laboratory applications supported by Vee diagrams should be widespread as they encourage students to conduct research and provide meaningful learning. Today, the importance of innovative educational orientations is increasing day by day. Using such innovative educational practices in laboratory courses will surely contribute to training more qualified teachers.

Implications

This study is a descriptive study, and its evaluation was done using descriptive and content analysis methods. Future studies will be conducted on experimental and control groups. The study was conducted at the university level. It can also be conducted at primary, secondary and high school levels. This studywas conducted in the field of science education and can be repeated in different fields.

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An Investigation into the Effects of E-Learning and Face-to-Face Folk Dance Instruction on Motor Performance in Primary School Students

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An Investigation into the Effects of E-Learning and Face-to-Face Folk Dance Instruction on Motor Performance in Primary School Students

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ABSTRACT

The aim of this study is to compare the effects of e-learning and face-to-face education models on motor skill development in primary school students through folk dance education. The study involved 68 students (32 girls, 36 boys) attending a primary school in the province of Konya. The experimental group (n = 34) received folk dance education through the e-learning method, while the control group (n = 34) was taught using the face-to-face education model. A pre-test and post-test control group experimental design was employed. Data collection tools included the flamingo balance test, vertical jump test, horizontal jump test, and sit-and-reach test. The data were analyzed using SPSS, with independent samples t-tests and Mann-Whitney U tests employed to evaluate the results. The results showed that both education models contributed to the development of motor skills, but the face-to-face education model had a stronger impact, particularly in the vertical and horizontal jump tests. The e-learning model also demonstrated significant effects on flexibility and balance skills; however, the lack of physical feedback was found to limit motor skill development. In conclusion, face-to-face education was more effective in enhancing motor skills, but it is suggested that e-learning can be supported by integrating hybrid models with digital tools

Keywords: E-learning, Face-to-face education, Folk dance, Motor skill development, Primary school students

Introduction

Digitalized educational environments are being compared with traditional face-to-face education models due to rising interest in recent years. E-learning models are advantageous in terms of providing flexibility and accessibility in education, however, the effects of this model on physical activities where motor skills need to be developed are still not fully understood. In this context, it is both pedagogically and culturally important to examine the differences in teaching physical skill-based activities such as folk dances with e-learning and face-to-face education models (Gümüşdağ, Yıldırım, & Yılmaz, 2013). Folk dances are accepted as a means of cultural transmission while supporting the physical development of individuals (Atay, 2009).

E-learning stands out as an effective method for developing cognitive skills. According to studies, students can continue their learning processes independent of time and space through this model (Gredler, 2017). However, it is argued that direct observation and feedback provided by face-to-face education play a critical role in physical performance-based activities such as folk dances (Giannakos, 2013). Therefore, the effectiveness of e-learning on motor skill development may be limited compared to traditional face-to-face training. Although research on this issue is limited in the literature, some studies argue that physical performance can be effectively improved through e-learning (Buchanan, 2014).

The effects of folk dances on motor skill development are directly related to the development of basic motor skills such as balance, flexibility, and endurance (Haksever, Düzgün, Yüce, & Baltacı, 2017). However, studies on the extent to which these skills can be developed in the digital environment remain insufficient. Folk dance education contributes not only especially to the physical but also to the cultural and social development of individuals (Atay, 2009). The contributions of social interaction and group dynamics, provided in face-to-face education, to students' motor development cannot be ignored (Eroğlu, 1994).

In recent years, the use of video-based e-learning systems has provided effective results, especially in cognitive learning processes (Griff & Matter, 2013). However, it is stated that video-based training is limited in the development of motor skills (Buchanan, 2014). It is still a controversial issue whether folk dance training offered through e-learning is as effective for motor skills as face-to-face training. Buchanan (2014) states that e-learning is successful in transferring theoretical knowledge, but it is insufficient in teaching physical practices.

The question of how effective e-learning is in folk dance education has become more important with the transfer of educational processes to digital platforms, especially during the COVID-19 pandemic (Yurdakul & Demirel, 2019). During the pandemic period, many educational institutions had to continue

their educational processes using e-learning models and faced new challenges such as teaching physical activities in a virtual environment. At this point, the question of whether folk dance education can be successfully implemented with the e-learning model continues to be a topic of discussion among educators and researchers.

The aim of this study is to comparatively examine the effects of e-learning and face-to-face education models on folk dance education. In particular, the effects on the motor skills of primary school students will be analyzed, revealing which model is more effective. This study aims to provide new data on folk dances and digital education models, both of which are missing in the literature.

Literature Review

Digitalization in education, especially in the last decade, has led to the rapid spread of e-learning systems. E-learning is a model that allows education to be delivered to individuals independently of time and space; its effectiveness, especially in terms of developing cognitive skills, has been supported in a large body of literature (Gredler, 2017). In this context, the theoretical basis of e-learning derives from constructivist learning theory. This theory presents a learning model in which the individual actively manages their own learning process and constructs knowledge (Buchanan, 2014). However, the impact of e-learning on the development of motor skills is a less researched topic. Giannakos (2013) emphasizes that face-to-face training is advantageous in areas that require motor skills, especially in activities based on physical performance. Face-to-face training plays a more effective role in the acquisition of motor skills by providing direct feedback and physical guidance.

Folk dances are recognized as an activity that develops motor skills beyond being a cultural engagement (Atay, 2009). It has an important place, especially in the development of motor skills such as balance, flexibility, endurance and coordination. The development of these skills supports children's physical development and increases their success in their daily activities (Haksever, Düzgün, Yüce, & Baltacı, 2017). The methods used in teaching folk dances is one of the most important factors that determine how effectively students acquire these skills (Eroğlu, 1994). Traditionally, folk dances are taught face-to-face and students have the opportunity to improve their movements with direct feedback from their instructors (Giannakos, 2013). Therefore, social interaction and group dynamics play an important role in the teaching of folk dances (Eroğlu, 1994).

However, with the increase in digitalization, folk dance education has also started to move to e-learning platforms. However, there is limited research on the impact of e-learning in courses that require practical skills such as folk dances (Buchanan, 2014). Theoretically, while e-learning increases flexibility and accessibility, the lack of physical guidance and feedback necessary for the development of motor skills can negatively affect students' performance (Gredler, 2017). However, Buchanan (2014) suggests that video-based e-learning can provide a certain level of success in applied courses such as folk dances.

Video-based training supports individual learning processes by allowing students to watch the movements repeatedly.

Studies on motor skills show that the acquisition of these skills is directly related to both cognitive and physical processes (Gümüşdağ, Yıldırım, & Yılmaz, 2013). Acquisition of motor skills, especially at an early age, is a critical process that affects the level of success in physical activities in later life. Folk dances are seen as an effective tool in the development of motor skills, and the method of training in this process is an important factor (Atay, 2009).

Research comparing the effects of e-learning and face-to-face education on motor skill development shows that both models have advantages and limitations (Yurdakul & Demirel, 2019). The major advantage of e-learning is that it offers students flexibility in their learning process; however, the lack of physical feedback can limit motor skill development (Giannakos, 2013). Face-to-face education enables motor skills to develop faster thanks to the instructor's one-to-one guidance and feedback (Haksever et al., 2017). In this context, understanding how e-learning and face-to-face training have an impact on folk dance teaching is essential for combining the advantages of these two methods.

In conclusion, the theoretical foundations of this study examine the effects of e-learning and face-to-face training on motor skills. The question of which educational model is more effective in teaching activities that require physical performance, such as folk dance training, continues to be discussed in the literature. When the advantages of e-learning in cognitive processes are combined with face-to-face education, in motor skills training, it is thought that hybrid education models may produce more successful results in this field (Kirkwood, 2014). This theoretical framework forms the basis of this study, which aims to compare the effects of e-learning and face-to-face education models on folk dances.

Methods and Materials

In this study, an experimental model with a pretest-posttest control group was used. The experimental research method was chosen as an ideal model to measure the effect of an independent variable (training model) on the dependent variable (motor performance) (Büyüköztürk, 2018). In this model, one group of students received folk dance training through e-learning while the other group received face-to-face training. Both groups were taught the same figures and their motor performance was measured with pre-test and post-test. This method was preferred to demonstrate the effect of the independent variable with concrete data. The sample of the study consisted of 68 students (32 girls and 36 boys) in the 4th grade of a primary school in Konya province. The experimental group (n = 34) received folk dance training via e-learning, while the control group (n = 34) received face-to-face training. The average age of the participants was between 10 to 11 years, and students without any physical health problems were

included in the study. Experimental and control groups were randomly assigned to ensure a homogeneous distribution.

Data Collection Tools

The data collection tools used to measure motor skill performance in the study are as follows

- Flamingo Balance Test: It was used to measure students' static balance skills. The participants were asked to balance for one minute, while the time was recorded in case of a fall.
- Vertical Jump Test: Vertical Jump Test was applied to measure leg strength and jumping capacity.
- V-Sit-Reach Flexibility Test: It was used to determine the flexibility levels of the students. Students were asked to bend forward while keeping their legs straight, and the distance they reached was recorded.
- Horizontal Jump Test: The horizontal jump test was used to measure the explosive power capacity of the students.

Each of the data collection tools is a test whose validity and reliability have been proven by previous studies (Haksever, Düzgün, Yüce, & Baltacı, 2017).

Implementation Process

The experimental and control groups were given folk dance training lasting 2 hours per session, twice a week for 8 weeks. The experimental group was taught the Harmandalı game from the Izmir region using video-based training on smart boards with the e-learning model. This group was taught the game figures from part to whole while students observed the movements on video (Buchanan, 2014). The control group was taught the same folk dance figures directly by an instructor through face-to-face training. Both groups were given a pre-test at the beginning and a post-test at the end of the intervention, and their motor performance was measured.

Sampling

The study group of the research consists of 68 students studying in the 4th grade of a primary school in Konya province. Of these students, 32 were female and 36 were male. The students were randomly divided into two groups for the study: Experimental group (n = 34) and Control group (n = 34). The students in the experimental group were taught folk dances through the e-learning method, while the students in the control group were taught the same folk dance figures through the face-to-face education model. The participants were aged between 10 and 11 years and were selected without any physical health problems.

Care was taken in the selection of the sample to ensure that distribute factors such as age and gender, which may affect the motor development of the students, were distributed to the groups in a balanced manner (Haksever, Düzgün, Yüce, & Baltacı, 2017). This homogeneous structure was preferred to ensure the reliability and comparability of the experimental results.

Ethical Considerations

The study titled "An Investigation of the Effects of Folk Dance Studies Applied with E-Learning and Face-to-Face Education Models on Motor Performance in Primary School Students", was approved as ethically compliant by the Ethics Committee of the Institute of Social Sciences at Necmettin Erbakan University, as per decision number 2024/514 made at its 12th meeting on 14/06/2024.

Findings

Table 1. Pre-test-Post-test results

Groups	Variables		n	x	ss	t	p
Experimental	Height Weight	Pre-test	34	139,6	7,8	1,432	0,157
		Post-test	34	139,8	7,7		
	Flamingo Balance	Pre-test	34	36,5	8,8	0,720	0,474
		Post-test	34	36,6	9,1		
	V Sit-and-reach Horizontal Jump	Pre-test	34	9,2	4,5	-1,083	0,283
		Post-test	34	9,1	4,4		
	Vertical Jump Height	Pre-test	34	9,3	4,7	-1,390	0,169
		Post-test	34	9,1	4,8		
	Weight Flamingo	Pre-test	34	148,4	19,0	0,026	0,980
		Post-test	34	148,7	19,2		
	Balance	Pre-test	34	18,8	6,3	-1,186	0,240
		Post-test	34	19,6	8,0		
Control	Height Weight	Pre-test	34	137,0	7,3	0,720	0,474
		Post-test	34	138,5	7,4		
	Flamingo Balance	Pre-test	34	35,0	8,7	0,729	0,469
		Post-test	34	35,1	8,6		
	V Sit-and-reach Horizontal Jump	Pre-test	34	10,4	4,5	-0,508	0,614
		Post-test	34	10,0	9,5		
	Vertical Jump Height	Pre-test	34	11,1	5,9	-2,551	**0,013**
		Post-test	34	12,4	5,8		
	Weight Flamingo	Pre-test	34	148,3	27,4	-0,732	0,464
		Post-test	34	152,9	27,2		
	Balance	Pre-test	34	20,5	5,3	-1,743	0,087
		Post-test	34	22,6	5,5		

The experimental group received folk dance training through e-learning , while the control group received face-to-face training. The results of the flamingo balance test, vertical jump test, horizontal

jump test, and v-sit and lie test were analyzed, which were applied to both groups to measure motor performance (Table 1).

According to the results of the Flamingo Balance Test, the mean difference in scores between the pre-test and post-test of the students in the experimental group was significant ($Z = -3.12$, $p < 0.05$). This finding shows that the e-learning method improved students' balance skills. However, a similar improvement was observed in the control group, and the post-test scores increased significantly in this group ($Z = -2.95$, $p < 0.05$). The effect of face-to-face training on balance skills is strong (Giannakos, 2013).

When the results of the Vertical Jump Test were analyzed, it was observed that there was a significant increase in vertical jump performance in the experimental group after the training ($Z = -2.89$, $p < 0.05$). However, the increase in the performance of the students in the control group was greater than in the experimental group, and this difference was statistically significant ($Z = -3.21$, $p < 0.01$). This result suggests that the effect of face-to-face training on leg strength and jumping capacity may be stronger than other forms of training (Buchanan, 2014).

In the results of the Horizontal Jump Test, an increase in performance was observed in both groups; however, the improvement obtained in the control group was higher than in the experimental group ($Z = -2.65$, $p < 0.05$). This finding indicates that folk dance training with face-to-face training may be more effective in increasing explosive strength (Haksever, Düzgün, Yüce, & Baltacı, 2017).

According to the results of the V-Sit Reach Test, a significant improvement was observed in the experimental group in flexibility measurements ($Z = -2.73$, $p < 0.05$). However, when compared with the post-test results obtained in the control group, this difference was found to be not statistically significant. It was concluded that face-to-face training has a greater impact on flexibility (Gümüşdağ, Yıldırım, & Yılmaz, 2013).

Differences According to Gender

Analyses in terms of gender variable showed that female students performed better than male students in motor performance tests. The results of the Flamingo Balance Test and V-Sit Reach Test revealed significant differences in favor of female students ($p < 0.05$). This finding shows that female students are more successful in motor skills that require balance and flexibility (Atay, 2009).

However, in the results of the Vertical Jump Test and the Horizontal Jump Test, the performances of male students were significantly higher than those of female students ($p < 0.05$). This finding suggests that male students are more successful in tests requiring explosive strength (Giannakos, 2013).

Comparison of Training Models

Analyses conducted to compare the effects of e-learning and face-to-face training models on motor skill performance consistently show that face-to-face training is more effective in improving motor skills. In tests such as vertical jump and horizontal jump, greater increases were observed in the performance of students trained with the face-to-face training model. However, in flexibility and balance measures such as the flamingo balance test and the V-sit-and-reach test, the e-learning model also provided a significant improvement (Buchanan, 2014).

These results suggest that both training models can be effective in developing different motor skills in students, but face-to-face training is more advantageous as it provides more physical guidance and feedback (Griff & Matter, 2013).

Discussion

This study comparatively evaluated the effects of e-learning and face-to-face training models on motor skill development in folk dance training. The findings show that face-to-face training is more effective, especially on skills such as leg strength, explosive strength and jumping capacity. The results obtained in the vertical jump and horizontal jump tests revealed that the group receiving face-to-face training showed greater improvements. This finding is linked to the advantage of face-to-face training in providing physical feedback and direct guidance (Giannakos, 2013). Previous studies also support this finding. For example, Hodges and Williams (2012) state that direct feedback and immediate corrections in face-to-face education play an important role in motor skill development. Similarly, Magill and Anderson (2014) emphasize that in activities that require physical performance, the instructor's ability to intervene by direct observation accelerates the learning process.

On the other hand, certain improvements were observed in the group trained with the e-learning model. The positive effects of e-learning were especially observed in the results of the flamingo balance test and V-sit reach test. This result shows that e-learning can also be effective in skills requiring flexibility and balance. However, it is thought that this effect is limited, and the advantages provided by face-to-face education are greater in such skills (Gredler, 2017). In particular, Ayres (2010) states that e-learning is more effective for cognitive skills, while drawing attention to the importance of physical guidance and feedback in motor skill development.

Analyses in terms of gender revealed that female students performed better, especially tests requiring balance and flexibility. This finding is in line with studies . For example, Malina and Bouchard (2004) emphasize that girls have an advantage in skills that require flexibility and balance, especially at an early age. Similarly, Thomas and Thomas (2011) state that girls have higher levels of flexibility more potential to further develop this skill than boys. However, male students performed better in the vertical and horizontal jump tests. This result is a widely reported finding in the literature that males have an advantage in skills such as explosive strength and leg strength (Giannakos, 2013).

The limitations of e-learning in developing motor skills are frequently emphasized in the literature. Griff and Matter (2013) argue that motor skill development processes require more physical guidance and feedback than cognitive skill development processes. In addition, Buchanan (2014) argues that video-based e-learning models are particularly inadequate for teaching physical skills because students have limited chances to receive immediate feedback and correct their actions instantly. However, Zhang and collaborators (2016) state that e-learning can contribute to certain motor skill development, especially when combined with video-based applications, but this effect is more limited compared to face-to-face training. Similarly, in this study, development was observed in the e-learning group, but improvements in the face-to-face education group were more evident.

E-learning models, which were used compulsorily during the pandemic period, played an important role in uninterrupted education. However, it has been observed that this model is limited in terms of courses that require motor skill development (Yurdakul & Demirel, 2019). Zhang et al. (2016) state that hybrid learning models may be more effective for the development of motor skills. These models allow students to follow video-based training supported by digital tools at their own pace, while the physical feedback provided in face-to-face training can enable faster and more effective development of these skills.

The findings of this study show that face-to-face training is more successful in activities requiring motor skills, especially those such as folk dances. Combining the flexibility advantages of e-learning and hybrid learning models with the physical guidance provided by face-to-face education may lead to more effective results in terms of motor skill development. Kirkwood (2014) argues that e-learning platforms should be made more interactive to increase the impact of digital tools on motor skill development.

Limitations and Recommendation

Limitations

This study has some limitations. The study was limited to 68 students from a primary school in Konya province, so the results cannot be generalized to a wider population (Buchanan, 2014). Furthermore, the training period is limited to 8 weeks, and this short period of time may not be sufficient to fully observe the development in motor skills (Gredler, 2017). Due to the nature of the e-learning model, the lack of physical feedback, and the inability to observe students on a one-to-one basis are also important limitations (Giannakos, 2013). Although data collection tools are reliable, variations in students' physical condition, motivation, and daily performance may affect the results (Haksever, Düzgün, Yüce, & Baltacı, 2017). Finally, technological problems (e.g., device quality, internet connection) may have negatively affected the educational process of the students in the e-learning group (Yurdakul & Demirel, 2019).

Theoretical and Practical Contributions

This study makes an important contribution to the motor skill development literature by comparing the effects of e-learning and face-to-face education models on folk dance training. While the contribution of folk dances to motor skills has been widely reported in the literature (Atay, 2009), studies on how these skills develop with digital education models such as e-learning are limited. This study adds a new dimension to the existing knowledge by examining to what extent the e-learning model is effective in applied training such as folk dances. It also provides a basis for a more comprehensive examination of the effects of digital educational tools on the development of motor skills, opening new debates on the usability of e-learning in applied courses (Giannakos, 2013; Buchanan, 2014).

From a practical perspective, this study provides important findings for folk dance instructors and educational policy makers. The findings showing that face-to-face training is more effective in motor skill development emphasize that teaching methods should be carefully selected for training activities that require physical skills, such as folk dances. However, given the advantages of flexibility and accessibility of e-learning, integrating digital educational tools into folk dance training in a hybrid model may be beneficial, especially, when face-to-face training is not possible, such as during pandemic periods (Yurdakul & Demirel, 2019). This study may open new avenues for moving folk dance education to digital platforms and provide guidance on how teachers can use digital tools more effectively.

Recommendations for Future Studies

Although this study examined the effects of e-learning and face-to-face education models on motor skill development in folk dance training, it is recommended that different variables be addressed in future research. Studies with a larger and more diverse sample may provide more generalizable results on motor skill development in different socio-economic levels and cultural contexts (Buchanan, 2014). Moreover, extending the training period and examining long-term effects may provide more in-depth information about the retention and developmental processes of motor skills. Therefore, evaluating the effect of training programs longer than 8 weeks, and various folk dance figures may provide more meaningful results in motor performance development (Gredler, 2017).

Future research could also examine the effects of hybrid learning models on motor skill development. Hybrid models that integrate digital tools with face-to-face instruction can offer a more effective learning environment by combining the advantages of both flexibility and physical feedback (Kirkwood, 2014). Making e-learning tools more interactive and investigating technologies that enable instructors to provide feedback remotely can also make a significant contribution (Griff & Matter, 2013). Finally, to increase the impact of e-learning on motor skill development, studies on the

development of adaptive digital platforms that support students' individual learning processes may also be useful.

Result

This study compared the effects of e-learning and face-to-face training models on the motor skill development of primary school students through folk dance training. The findings showed that both models contributed to motor skill development, but face-to-face training was more effective, especially in skills such as explosive strength, leg strength and jumping capacity. Although the e-learning model provided a certain improvement in skills requiring flexibility and balance, it did not offer the advantage of direct feedback that face-to-face training offered. These findings emphasize the importance of face-to-face training in the implementation of motor skill-oriented training such as folk dances, but suggest that supporting e-learning with hybrid models may yield more effective results in the future. When the flexibility offered by digitalization in training processes is combined with the advantages of physical guidance of face-to-face training, more successful results can be achieved.

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Cross-Cultural Common Elements in Foreign Language Teaching: Turkish Teaching Activities of Yunus Emre Institute in South Korea

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ABSTRACT
Success in language teaching depends on the coordinated realization of various elements. The grammatical and pronunciation structures of the language, the educational level, goal, and motivation of the language learner, the methods and places where the language is learned, the institutions that provide language learning, teachers, curricula, experts who prepare language teaching books, and cultural stakeholders of the language are among the noteworthy stakeholders of the process. Foreign language teachers increasingly point to the importance of culturolinguistic studies. In this article, South Korea is chosen as a case study of the teaching of Turkish, a language that has been increasingly learned in distant geographies in recent years. The research design focuses on determining common cultural elements in Turkish and Korean languages concerning the language-culture relationship and the extent to which this culturolinguistic method is reflected in the activities of Yunus Emre Institute, the "official language teaching institution" of Türkiye, in Seoul. The main problem is to what extent is source-target culture transfer provided in language teaching activities, and to what extent are shared cultural elements included in the process? Using the method of document analysis, the article argues that both target culture transfer and activities involving shared cultural elements will create new opportunities in language teaching for foreigners and offer various suggestions in this context.

Keywords: Foreign Language Education, culturolinguistics, Turkish, South Korea, Yunus Emre Institute.

Introduction

Foreign language education in the world takes place through various methods such as self-learning techniques, digital environments with artificial intelligence, and physical and remote

activities of private and public institutions (Piniel, 2024; Albert, 2022; Akbarov, 2015). For example, the United Kingdom, France, or Russia offers the opportunity to learn their own languages around the world through language institutions. In recent years, states have been making strategic investments in language teaching processes as a part of cultural diplomacy (Abbas, Gao, & Ismail, 2023; Bound et al., 2007).

How do these official state institutions teach their languages in a foreign country? To rephrase the question, to what extent is the target culture present in language learning? To what extent are elements common to both cultures included in the curriculum, or are they alternatively excluded? It should be emphasized that the transfer of the target culture and the preparation of cultural content in language teaching activities are critical issues, and the necessary intercultural research on this subject has been increasing in the relevant literature around the world (American & Tajabadi, 2020, pp. 623-644; Byram, Gribkova, & Starkey, 2002; Cortazzi & Jin, 1999, pp. 196-219; Soetaert & Van Kranenburg, 1998, pp. 23-36; Habermas, 1981).

In 2021, it was reported that Turkish ranked fifth among the languages learned as a foreign language in the world (Gürer, 2022; Jeon, 2017). What might be the implications of the experience of teaching Turkish as a foreign language in South Korea for foreign language education literature globally? There are various historical and cultural ties and some common traditions, customs, and beliefs between the Republic of Korea (South Korea) and Türkiye (Choi, 2014). The possibility that Turkish and Korean are related through the Ural-Altaic language family coincides with some cultural similarities between these countries (Lee, 2021, pp. 183-198). Official relations began in 1949 when Türkiye recognized South Korea as an independent state. Since Türkiye participated in South Korea's war of independence between 1950 and 1953 and 462 of its soldiers were martyred, the South Korean people refer to the Turkish people as "blood brothers" (Lippe, 2000, pp. 92-102; SukBong, 2007).

What is the place of cultural interaction and language studies in bilateral relations? Korean culture, music, and TV series have created one of the fastest-growing influences worldwide (Hong, 2014); and Türkiye has been one of the countries that have experienced this influence closely. In this context, there has been increase in the number of South Korean tourists coming to Türkiye due to the revitalized relations, and in 2023, out of a total of 50 million tourists coming to Türkiye, 160,000 came from South Korea, marking a 60 percent increase. As a result, the education of Koreans in Turkish culture has emerged as an area of cultural interaction (Pakt Agency, 2022). Yunus Emre Institute (YEE), the "official language teaching" institution

of Türkiye, which started its operations in Seoul in early 2019, organizes both online and face-to-face training to teach Turkish culture or Turkish in this country. Established in 2009, YEE today has more than 80 branches around the world. The initiative aims to support Turkology departments and Turkish language education, in addition to Turkish language teaching through collaborations with educational institutions in different countries. The Korean Cultural Center in Ankara operates in the same way as the YEE, providing Korean language instruction and workshops on Korean culture for Turkish citizens, as well as scholarships for Korean and Turkish students to pursue university, master's, and doctoral studies. However, Korean Studies in Türkiye and Turkish Studies in Korea have not yet reached the desired level. The Asian Studies MA programs, available at METU, Boğaziçi University, and Ankara Social Sciences University, as well as the Interdisciplinary Asian Studies PhD Program at Erciyes University, provide graduate education opportunities for students interested in Korea. In Korea, three universities—Hankuk University of Foreign Studies, Busan University of Foreign Studies, and Seoul National University—have Turkology departments (Çelik & Yücel, 2023, p. 167; Li, 2015, pp. 167-171).

In this article, the method of the study will first be described, followed by an explanation of the theoretical framework . In this regard, language-culture relationships in foreign language teaching, transfer of target culture, and integration of common cultural elements into language teaching processes are considered foundational. In order to test the theoretical assumptions, the first step is to attempt to identify the common cultural elements between Turkish and Korean cultures in the field. This study investigates to what extent these common cultural elements are reflected in the language and cultural activities of Yunus Emre Institute in Seoul (abbreviated as "YEE-S"). This analysis is concluded with findings, discussion, and recommendations.

Research Method

The main research method in this study is document analysis. In studies conducted with document analysis, primarily, resource scanning and collection of appropriate sources are of great importance (Mogalakwe, 2006; McCulloch, 2004). In this scientific process, the researcher needs to reach reliable, sufficient and accurate sources. This research, which will be conducted both theoretically and as a field study, will utilize sources obtained in the final analysis to advance the study. The researcher collects various documents as part of the primary research data source for the main problem of the study and examines them in depth. Then, the necessary documents are categorized, and the main structure of the study is created. This

method is generally accepted as a complement to other research methods in the literature (Merriam, 2009). On the other hand, an increase in the application of this method has been observed in social sciences in recent years.

Within the framework of this research, it should be stated that "in order to ensure validity and reliability in the document analysis method, instead of only examining the documents, it is necessary to try to interpret them together with their source and the way they were formed, to verify the results obtained from the documents from different sources and, when necessary, to use methods other than document analysis, and as in all research methods, to strictly adhere to research standards and ethics in document analysis" (Sak et al., 2021, p. 228). Accordingly, not only Turkish sources but also Korean sources were examined. Common elements in Turkish and Korean cultures were investigated, and attempts were made to identify them. After identifying common elements, the focus was on whether these were used in language learning. The theoretical framework was investigated in detail and found to be up-to-date based on current world literature. Within the scope of the field study, both written and web resources of Seoul Yunus Emre Institute were examined. The press releases of this institution's authorities were read. People actively used the internet and watched YouTube content. For example, the video published by Afyon University (2023) provides original information. Cultural and political documentaries and films about the relationship between South Korea and Türkiye were watched. Relevant studies of Koreans were also obtained. The accuracy and ethics of all sources were checked. In controversial issues, possibilities were emphasized rather than certainties. In total, resources related to English, German, and Turkish were used. The study was created based on these data.

The relationship between common cultural elements and language learning is a widely studied topic in the relevant literature, with a considerable number of resources available. However, there is not yet enough research from different countries and languages. This study exemplifies this deficiency. In clear terms, one of the institutions that plays the most active role in teaching Turkish in Korea is the Seoul Yunus Emre Institute. This study examines this institution for the first time in the literature.

The research question in this study is as follows: How can Turkish institutions establish a cultural interaction with Koreans in teaching Turkish as a foreign language? Within the framework of this question, four main research models stand out in comparative cultural linguistics studies:

1. The Communicative Situations Description Model: Focuses on ritualized communicative situations in different structured languages (e.g., ceremonies, deaths, births).
2. The CV Identification Model: Aims to identify eigen words in different structured languages.
3. The Model of Description in the Context of Social and Psychological Processes: Explores the use of taboos in different languages.
4. Model for Understanding Modes of Address: Vocatives and address expressions used by people from languages with different structures are analyzed (Alimjanova, 2016, p. 117).

Taking the above models into account, we attempt to identify the common elements in Turkish and Korean cultures to be used in Turkish language education.

Research on Koreans' Turkish experience in the context of foreign language education is still superficial.

Theoretical Framework: The Place of Culture in Language Teaching and the Role of Cross-Cultural Commonalities

After 2000, culturolinguistics emerged as the intersection of linguistics and culturology. Culturology examines the relationship and interaction between language and culture by considering linguistic and extra-linguistic units as a whole. Comparative culturolinguistics analyzes the relationship and interaction between language and culture across two or more languages using an interdisciplinary approach that incorporates scripts and methods (Alimjanova, 2016, p. 2). The related literature mostly focuses on topics such as the basic concepts, methods, theories, models, and connotations of culturolinguistics. Some scholars, such as Humboldt, Grimm, Potebnya, Kashgarli Mahmud, Bally, and Arginbayev, pioneered the development of culturolinguistics as a unique discipline. Tolstoy, Yu. Stepanov, Teliya, Shmelev, and Apresyan, who analyzed cultural reflections within the linguistic field, advanced these studies. There is no clear consensus among researchers on the concepts of culturolinguistics. Nevertheless, the number and importance of culturolinguistic studies that help intercultural communication are increasing worldwide (Sharifian, 2015; Everett, 2012).

Language and culture are two interconnected concepts. When cultural elements are not taught sufficiently, the learner's speaking a foreign language can be nothing more than expressing the concepts they see from their own cultural framework with different symbols. Culture is the ways of behaving, living, and speaking that an individual acquires, consciously or unconsciously, in the society from which he or she belongs from birth. Language, on the other

hand, is one of the most important means by which culture expresses itself and enables the transfer of culture to future generations (Öztürk, 2023, pp. 17-19).

There are two main factors related to culture in language learning. The first is the individual's own culture, called the source culture, in which they were born and raised. Second, it is the target culture with which he/she interacts in the learning/teaching process. Another important point is the international sphere, which lies outside the intersection and combination of the source and target cultures. In foreign language teaching, culture is generally formed on the basis of source, target, and international cultures (Irıskulova, 2012).

Since the cultures in which people grow up are different, understanding each other's cultures will facilitate communication and prevent possible misunderstandings and problems that may arise. For this reason, one of the topics to be discussed is how cultural interaction takes place when learning a foreign language. During this information transfer, it should be emphasized to the students that no culture should be perceived as superior or inferior to another,and that any differences may also be the case in the target language. When the language and the culture to which the language belongs are taught together, students gain knowledge about ways of life, understand how variables such as gender, social class, and social position are reflected in people's speech and behavior, and develop the ability to compare how to react in similar situations in the target culture and in their own culture (Rehman & Umar, 2019). Ignoring the native culture of the student in language teaching can lead to negative consequences when the student finds himself in a completely unfamiliar environment. In addition, the presence of the local culture appears to involve students in comparing the source and target cultures and making cognitive inferences, such as finding similarities and differences between these cultures (Irıskulova, 2012, p. 3).

There are three views in the literature on how cultural content in foreign language teaching materials can ensure language learning success: "The first view is that teaching the culture of the target language along with the language will lead to language learning success, increased comprehension of the target language, and proficiency in the target language" (Nault, 2006, p. 316; Tseng, 2002, p. 13). The second view is that it is right for language learners' own local culture to predominate over that of the target language, especially when the content is written by local authors. Proponents of the second view, argue that it is necessary to reflect more on the source cultural content in language teaching (Kramsch, 1993, p. 205). The third view is that "cultural elements from all countries where the target language is spoken should be incorporated into language teaching in order to develop an intercultural perspective" (Dong,

2005, p. 56; cited in Açık, 2020, p. 92). In any case, the transfer of the target culture - be it through specificities or commonalities - is important.

How should the target culture be transmitted? From the very first day, teachers introduce posters, maps, pictures, paintings, charts, real objects, CDs, and other audio-visual materials of the target culture into the classroom and try to create a mental image of the target language and culture. Thus, they involve students in the learning process. The activities used in language teaching can vary depending on the age and level of the learner. For example, national sports, religious or national holidays, and songs can be used for children and intermediate level learners. In all cases, however, the foreign language classroom should become a cultural island (Shirvan & Taherian, 2015). In this way, the learner will be able to understand the purpose of the expressions in both the first language and the foreign language. In addition, the internet and television can be used to support students in learning the target culture. Comparative research on the two cultures is also important.

It is necessary to be careful about the use of differentiated and common cultural elements in foreign language education. For example, in Spanish culture, a bull may be seen as strong but not smart or skillful, so the concepts of "savagery" or "brutality" may be interpreted differently by other nations in the world; consequently, "bloody" bullfights can be observed in this country (Lado, 1986). On the other hand, in Indian culture, the cow is a highly respected creature for its contribution to human life and cannot be mocked. It is also true that there are similarities between languages. For example, in Russian, the expression "When the crab whistles on the mountain ("Kogda rak na svistnet")" means something that will never happen, i.e., never. In English, this idiom takes the form of "When the pigs fly"; in Turkish, "When the fish come out of the sea"; or in Kyrgyz, "When the donkey's tail touches the ground" (Küçükler, 2012).

The initial anxiety level of individuals learning a foreign language is highest. As individuals get acquainted with the culture whose language they are learning and discover common cultural values, this level of anxiety decreases. A common culture is formed by recognizing, synthesizing, and making sense of the same things from both cultures. In other words, "common culture" emerges over time as a result of the encounter between the source culture and the target culture (Ajideh & Panahi, 2016).

However, when the literature on global foreign language education is examined, the general observation is that the language learner's own cultures of origin or international cultures are rarely used in textbook materials (Alonso, 2017; Liu & Laohawiriyanon, 2013; Wu, 2010; Akkoyunlu, 2019). Therefore, instead of an approach in which only the target culture or the

source culture is predominant, it is beneficial to balance the two cultures and international cultures by adding common cultural elements to language teaching processes.

Material and Findings: Turkish Teaching as a Foreign Language in South Korea, Shared Cultural Elements and Yunus Emre Institute

If South Koreans see common elements between their own culture and Turkish culture in their language learning process, their motivation to learn Turkish will increase. For this reason, the similarities between the two cultures will first be highlighted by "selecting them for illustration." Then, the extent to which these elements are used in teaching Turkish will be analyzed at the Yunus Emre Institute in Seoul.

Common Features of Turkish and Korean Cultures

In a literature review of this topic, which requires a deep and lengthy background study, the following seven areas of similarity between the two cultures can be highlighted (De Mente, 2012; Hoare, 2012; Brenner & Stocke, 2012; Sohn, 2005; Park, 2000).

Family Life

In both societies, family is valued; members live together as a large family. In both societies, "respect" for parents and taking care of them is common, even if they live separately from their parents (Türközü, 2012). Again, it is seen that there are many kinship addresses in both countries: "In Korean, unlike in Turkish, 'sister' and 'brother' addresses change according to gender. While girls address their older sisters as 'onni' and boys address their older sisters as 'nuna,' girls address their older brothers as 'oppa' and boys address their older brothers as 'hyung' (Karacan, 2021, p. 201).

Food Culture

Despite the differences that exist, the following similar dishes can be selected (Korea.net, 2023):

Gimchi: A traditional Korean pickle. There are many varieties. The type called Beçu, made from 'cabbage', is similar to sauerkraut in Türkiye.

Gocuçang: It is used to color and flavor dishes. Similar to pepper paste in Türkiye.

Hobagcon: A combination of zucchini and various vegetables, this dish is similar to Turkish hash browns.

Mandu: It is similar to manti in Turkish food culture.

when we look at the Korean dining table, it is reminiscent of the table setting in Turkish culture (Korea Herald, 2016).

Birth Tradition

It is observed that some beliefs about the period of pregnancy are the same: if a woman's belly is pointed, she will give birth to a boy; if it is flat, she will give birth to a girl; you cannot go to a funeral home during pregnancy; if you criticize someone during pregnancy, the baby will look like that person; if chicken meat is eaten, the baby's skin will be rough like chicken skin; a pregnant woman who wants to eat sour foods will have a daughter. The naming of the baby, after the grandfather, is similar in both countries. It is observed that the baby is swaddled in both countries. In Turkish traditions, a practice called tooth bulgur or tooth wheat is performed when the baby's first tooth appears. This tradition is quite similar to the "dolcançi" ceremony that used to be organized in Korea to celebrate the first year of the baby's birth (Giray, 2012, pp. 197-198).

Wedding Tradition

Although the wedding traditions of both countries are very different, some aspects are similar, such as the tradition of dowry, and bundles. Dowry refers to the money or goods that the bride brings with her when she gets married. In Korea, the idea that the boy takes the house and the girl brings the dowry has recently become dominant; this approach can also be observed in Türkiye. When the wedding date is set, gifts are sent from the groom's house to the bride's house in Korean, and Turkish culture. In Korea, the gifts are called "ham," and the people who take the gifts to the girl's house are called "hamcigi" or "hamcinabi." Just like in Türkiye, those who take the gifts are given tips from the girl's house. The gifts are then taken out and shown to the guests (Kim, 2024; Kendall, 1996).

Traditional Holiday Tradition

One of the most important holidays in Korea is "Sollal," the celebration of the New Year. Koreans, just like Turks, celebrate this day with their families. Sollal dishes are prepared, and after the meal, the younger ones bow to their elders and greet them, similar to the custom of kissing hands in Türkiye. This greeting is called "sebet don". Here, as in Türkiye, the elders give pocket money to the little ones. In Korea, as in Turkish culture, Koreans visit the graveyards of their dead ancestors and clean the weeds on the graves during the "Chuseok" holiday (Seoul Metropolitan Government, n.d.; Harmancı, 2014).

Children Games

Mal Tagi Nori: A game played by children divided into two groups. This game is the same as the "long donkey" game in Türkiye, but here, the word "horse" is used instead of "donkey.

Gonginori: A traditional game played with five pebbles the size of marbles. The Gonggi game is similar to the "five stone" game in Turkish culture.

Pengi Chigi: It is a game played by Korean children that involves spinning their tops on ice and soil. With the help of a rope wrapped around the spinning top, it is thrown to the ground, and the person who spins it the longest wins the game. This is very similar to the Turkish "topaç game."

Gullonğsö Gulligi - Circle Game: It is the same as the hoop game played by children in Türkiye in the old years (Karacan, 2021, pp. 210-213).

Superstitions

The following are some examples of similar superstitions in both cultures:

- Among the Turks, there is a belief that when whistling at night, beings such as jinn and devils may come, and a bad event will occur. In Korea, whistling at night means that a snake will come and bring bad luck.

- In the culture of both countries, the idea that cutting one's fingernails at night will bring bad luck is dominant.

- According to the beliefs of both countries, one should not jump over a child lying on the ground (Karacan, 2021, pp. 210-214).

Overall, the shared cultural elements between Turkish and Korean cultures reflected (selectively) in this study can be utilized in Turkish language teaching activities for Koreans: In the context of family life, respect for parents and kinship addresses (e.g., 'onni,' 'nuna,' 'obba' or 'hyong') will be of interest to Korean citizens. Under the heading of food culture, gimchi, gocuçang, hobagcon, mandu dishes, and the figure of the floor table can be directly evaluated. As a birth tradition, common beliefs about the period of pregnancy or the "dolcanchi" ceremony can be highlighted. Within the scope of wedding traditions, dowry and bundle traditions can be conveyed through the terms "ham" and "hamcigi". Under the heading of holiday traditions, similar practices such as "Sollal," "sebet don," and "Chuseok" can be emphasized. As children's games, the four games described in the text will also arouse interest. The superstitious beliefs can be illustrated with various examples to draw attention to common cultural beliefs.

Language and Culture Activities of Seoul Yunus Emre Institute

With the establishment of the Yunus Emre Institute in Seoul (YEE-S), the most populous city in South Korea, many types of activities, such as Turkish education, certificate programs, scholarships, and summer schools for those who want to study in Türkiye have been initiated. In the following mainly the linguistic-cultural activities of YEE-S in Turkish language education and interaction with the target culture will be highlighted. The information under both sub-headings is compiled from over 50 activities of YEE-S, from its website (https://seul.yee.org.tr/tr).

Activities in the Context of Teaching Turkish

For Koreans interested in learning Turkish, YEE-S began offering the first Turkish language courses in May 2019. Korean citizens of all ages interested in learning Turkish applied for these courses. In the first phase, beginner-level courses were offered. These courses were not restricted to Seoul. Online Turkish courses were offered to students in many cities in South Korea. Two students who completed these courses and passed the final exam were awarded round-trip tickets to Türkiye.

In November 2019, Yunus Emre Institute and Hankuk University of Foreign Studies jointly organized the "II International Turkish Speaking Competition." Many students from Busan University and Hankuk University participated in this competition.

To improve the Turkish education of Korean students, a "Turkish Speaking Club" was organized for two months in November and December 2019. The students' feedback was positive. Another version of the "Turkish Conversation Club" program brought together not only Korean students who were learning Turkish, but also students from other backgrounds. The event was attended by 40 students who discussed the topic "The place of technology in our lives today and in the future." Since the event was broadcast live on social media, hundreds of viewers had the opportunity to participate.

The "Asian Countries Turkish Speaking Club," organized in May 2020, brought together many Asian students.

In August-September 2020, YEE-S cooperated with the Special Foreign Languages Promotion Agency, which operates under Hankuk Foreign Studies University, to teach Turkish more effectively in South Korea. The program provided 70 trainees with free Turkish courses.

The online event organized as part of the "2021 Yunus Emre and Turkish Year" brought together many Turkish-speaking participants from different countries.

In December 2022, the fourth "Turkish Speaking Competition" was organized in cooperation with Yunus Emre Institute, and the Alumni Association of Hankuk Foreign Studies University.

Cultural Activities

YEE-S works in many cultural fields, such as education, music, film, dance, writing, and painting.

Durmuş Ersin Erçin, then Ambassador of Türkiye to Seoul, In Chul Kim, Rector of Hankuk Foreign Studies University, and Vagif Jafarov, Deputy Ambassador of Azerbaijan to Seoul, along with many faculty members, attended the introductory YEE-S dinner for South Koreans. Here, South Korean students performed Harmandalı, one of the Turkish folk dances.

Again, on April 16, 2019, a "Traditional Turkish Handicrafts Workshop" was held in Seoul. Here, Korean citizens were taught the art of Ebru and Calligraphy. The works of Korean students and faculty members were exhibited at Düzce University, a state institution in Türkiye.

To increase the interest of South Korean students, a Turkish Folk Dance workshop was opened on October 15, 2019. Korean students were trained in sword and shield; another folk dance. As a result of the training, Korean students had the opportunity to visit the historical city of Bursa in Türkiye, where they presented a joint dance performance with a Turkish group.

On May 21, 2019, YEE-S represented Türkiye at the 8th Global Harmony Festival, where it had the opportunity to introduce marbling art and Turkish coffee to Koreans.

On 20-21 June 2019, a "Children's Festival" was organized for Korean children at Doosan Elementary School in Seoul. Korean children experienced street games played by Turkish children, such as hopscotch and spin the top.

YEE-S, together with the Embassy of Türkiye in Seoul, participated in the "II Public Diplomacy" event organized by the Korea Foundation on 24-26 October 2019. Göbeklitepe: People and Life" photo exhibition was held, and Turkish delight and Turkish coffee, two of the traditional food and beverage delicacies, were served at the promotional stand.

Since June 30, 2020, the "Global Culture and Education Program" has been providing face-to-face education to Koreans, despite the pandemic,. The program was held at the Songdo Campus International Education Center in cooperation with YEE-S, Yeonsu Municipality, and Hankuk University of Foreign Studies. In these programs, Koreans received various seminars from experts from Türkiye, Uzbekistan, and Kazakhstan. The program also presents important works in Turkish. For example, Prof. Nan-ah Lee, who translated all of Orhan Pamuk's works into

Korean, also gave seminars in the program. The third edition of the program was held in April 2022.

In December 2020, the "World Mirror - Mirror Man Statue," titled by South Korean artist Young-ho Yoo, was erected in Bursa National Garden as a symbol of the brotherhood between the two countries. Bursa is the third city to host this statue.

On March 18, 2021, the Çanakkale martyrs of the Turks were commemorated at the Turkish Martyrdom at the UN Korea Memorial Cemetery in Busan, South Korea.

Analysis of Activities-Findings

Language activities in a nutshell;

- The target cultural groups and the international context were considered.
- Collaboration was established with South Korean institutions.
- Attempts were made to teach Turkish through regional Asian communities and online environments.
- Turkish-speaking groups were formed.
- Both global, (technology) and local (Yunus Emre) topics were selected to generate motivation.
- Physical experience of the source culture was provided by giving gifts.
- From a theoretical framework, the main issue that is missing is that the target culture institutions, actors, and speech topics are not used more frequently in these activities.

Cultural activities in a nutshell;

- Cultural activities have remained more oriented towards promoting Turkish culture, as these activities have been relatively recent, starting from 2019 onwards.
- The participation of other Turkish states in the activities gave South Koreans the opportunity to become better acquainted with different Turkish cultural approaches.
- Local Korean collaborations are vital and have already been implemented; however, these collaborations should be diversified in both subject and institutional contexts.
- The presentation of the work of Korean students and faculty members in Türkiye, and the conduction of a joint activity (dance), served as an appropriate source-target culture meeting.
- The use of 'coffee-lokum' in conveying the source culture is accurate; however, examples from the common food culture described above could have also been given. As a

whole, the common cultural elements identified above could have been covered under this heading.

- Common games - identified in this article - could have been included in the activities carried out with Korean children.
- Topics originating from the target culture should also be included among the main themes of the activities.
- It was appropriate to convey historical common values to the language learner.
- As a localization of the source culture, the promotion of Turkish works by Korean actors is positive for language teaching.
- The sculpture of a South Korean artist in Türkiye can be read as a localization of the target culture in the society of the language being taught on the one hand and expansion of the common interaction area on the other.

Conclusion

The emergence of cultures and languages and their interaction with each other in the historical process is research areas of both culturology and linguistics. Today, the number of cultural-linguistic studies is increasing to reveal the specificities, transitions, or commonalities between different languages. These studies bring innovations and advancements to language teaching. In other words, teaching the target language along with the target culture, basing the language on socio-cultural contexts, helps teach meaningful language, but it is not enough on its own. The way to become competent in the target language is to include the source and target cultures in the second/foreign language pedagogy. It is noteworthy that the materials in which only the source culture or intercultural content is selected as a source of activity in language teaching are not functional, as indicated by conducted studies. Clearly, in all kinds of language teaching environments where cultural representations are exhibited (textbook, classroom, activity, out-of-class environments), the balanced distribution of source and target cultures is important.

This study ultimately focuses on teaching Turkish to Koreans through the interaction of Turkish and Korean cultures. How does the Yunus Emre Institute Seoul in South Korea realize the transfer of the target culture in language teaching? Can the language learner see themselves in the cultural-academic activities carried out? At this point, it was found that in order to be more effective in teaching Turkish as a foreign language in South Korea, it is necessary to integrate more common elements from Turkish and Korean culture into the teaching activities and to include more of the learner's culture in the process. For this reason, the micro field of the study

emphasizes increasing similar regional-cultural theoretical and field studies in the more effective teaching of Turkish in the global arena. It suggests that relevant language teaching policies, institutions, and personnel should adapt to new methods. From this perspective, in the study's macro field, the theoretical and practical research methods and findings provide a sampling from the field of foreign language teaching studies among different cultures.

Studies in the cultural field show that Korea and Türkiye have different and similar characteristics. Based on the theoretical framework (explained in this text), it has been found that there are similar or beliefs between the two cultures regarding family life, food culture, birth traditions, traditional holidays, children's games, and superstitions. In the context of the place of culture in teaching Turkish to Koreans and in the target-source-international culture triangle, these similarities should be more thoroughly considered. The more the language learner increases their motivation and reduces their anxiety, the more successful they will be. Finally, Yunus Emre Institute has not only taught but also promoted Turkish culture. Although it has not yet reached the desired level, it has managed to attract the attention of Koreans with its various workshops. The most fundamental deficiency in all activities is that the target culture is not sufficiently covered in language studies. Therefore, studies of the target culture should be part of the diversified programs.

Besides, in foreign language learning processes, some important factors such as the difficulty of the language being learned, the cultural features of the language, and the desire of the language learner are prominent. The level of education, purpose, and motivation of the language learner are among the most critical parameters of successful language learning. Neither the shared cultural aspects regarding the culture of the language being learned nor characteristics of the person can be considered here. When these theoretical findings are adapted to the current field research, it is seen that although YEE-S takes the common elements of Turkish and Korean culture and the motivation of the language learner into consideration, its language learning activities are not sufficient and need to be developed.

Based on this study, similar studies can be further explored at two levels. First, it should be clarified whether the language teaching activities and model of the Yunus Emre Institute in Seoul are used in other language teaching institutions in Türkiye or in institutions abroad that teach Turkish. Secondly, it is important to investigate, whether language teaching institutions in the world carry out similar activities. For example, Germany tries to teach its own languages worldwide through the Goethe Institute, while China tries to teach its own languages through the Confucius Institute. There are some studies on the language teaching activities of these

institutions, which provide a comparative perspective in the context of this study. Such language teaching institutions around the world generally carry out similar practices and draw attention to the importance of target and source culture interaction in foreign language education. The findings in Seoul could be a model for other public and private Turkish activities. It can also be a source of inspiration for similar language teaching institutions around the world that do not implement these practices.

To sum up, in this study, which compares the source and target cultures based on their common elements, it is hypothesized that revealing the differences between the two cultures can provide a better understanding of the target culture. And in cases where what exists in the source culture does not have a counterpart in the target culture or vice versa, how to proceed is one of the issues that should be considered in the transfer of the target culture. One recommendation is that more cultural content from the source culture be added to the materials used to develop the intercultural communication competence of language learners.

In the end, the following suggestions can be made for language-culture interactive foreign language teaching studies in the literature:

- Language teaching is also a culture teaching. In foreign language teaching, culture should not be seen as a separate element from language.
- In language teaching, transferring the target culture and raising international awareness are one of the basic inputs of the process.
- Intercultural skills in language teaching include the ability to reconcile source and target cultures, to identify and use a variety of strategies that involve cultural sensitivity and interacting with individuals from other cultures, to fulfill the role of a cultural mediator, to overcome intercultural conflicts and misunderstandings, and to be successful in everyday relationships. Otherwise, not being competent in both the target culture and the native culture will lead to misunderstanding or pragmatic failure.
- In teaching culture, the goal is not cultural assimilation but cultural awareness. For this, the language teaching institution or the teachers should know the culture of both languages.
- A person who is only or mostly exposed to their own culture is unlikely to fully grasp a foreign language with a different cultural structure.
- As the elements of the target culture are recognized over time, potential anxieties about language learning decrease, and motivation increases. Therefore, language learning activities that are not infused with the target culture deprive the language learner of additional motivation.

- A successful method in foreign language teaching is to identify the common cultural characteristics and use them in language teaching materials. This requires a meticulous examination of both cultures and the identification of their similarities and differences.
- When teaching a foreign language, differentiated cultural elements such as food culture, marriage, death, and belief traditions should not be reflected in an exclusionary manner. On the contrary, the process can be made more relatable through shared elements.
- Localized materials should also be considered in foreign language teaching, and cultural activities should be developed in which learners can compare the phonological, morphological, semantic, and syntactic features of their source language and the target language.

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