Journal of Theoretical Educational Science, 17(1), 202-235, January 2024
Kuramsal Eğitimbilim Dergisi, 17(1), 202-235, Ocak 2024
[Online]: http://dergipark.org.tr/akukeg
DOI number: http://doi.org/10.30831/akukeg.1358837

The Effect of Digital Game-Based and Different Education Programs on Phonological Awareness Skills of 60-72 Months-Old Children*

Dijital Oyun Tabanlı ve Farklı Eğitim Programlarının 60-72 Aylık Çocukların Ses Bilgisel Farkındalık Becerilerine Etkisi

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Received: 12 September 2023 **Research Article** **Accepted:** 30 October 2023

ABSTRACT: This study examines the effects of digital game-based and different educational programs on the phonological awareness skills of 60-72-month-old children. The study group of the research consists of 60-72-month-old children studying in kindergartens affiliated with primary schools. The study group was divided into three experimental groups and one control group. There were 22 children in experimental group 1, 16 in experimental group 2, 17 in experimental group 3, and 17 in the control group, totaling 72 children. In the study, a phonological awareness education program was applied to experimental group 1, a digital game-supported phonological awareness education program was applied to experimental group 2, a digital game-based phonological awareness education program was applied to experimental group 3, and no intervention was applied to the control group. A quasi-experimental design was used as the research model. The Study used the Early Literacy Skills Assessment Tool (ELSA) and the Early Literacy Test for Preschoolers (ELTKC) as data collection tools. A pre-test was administered to the study and control groups, and after the pre-test, educational programs were applied to the experimental groups for ten weeks. After the educational programs were implemented, a post-test was administered to the experimental and control groups, and a retention test was administered to the experimental groups. According to the results of the study, it was determined that there was a significant difference between the experimental groups and between the experimental groups and the control group.

Keywords: Phonological awareness, digital game, educational program, preschool education.

ÖZ: Bu araştırmanın amacı dijital oyun tabanlı ve farklı eğitim programlarının 60-72 aylık çocukların ses bilgisel farkındalık becerilerine etkisinin incelenmesidir. Araştırmanın çalışma grubunu ilkokula bağlı anasınıflarında eğitim alan 60-72 aylık çocuklar oluşturmaktadır. Araştırmada çalışma grubu üç deney ve bir kontrol grubu olmak üzere dört farklı gruba ayrılmıştır. Deney grubu 1'de 22, deney grubu 2'de 16, deney grubu 3'de 17 ve kontrol grubunda 17 çocuk olmak üzere toplam 72 çocuk bulunmaktadır. Araştırmada deney 1 grubuna; ses bilgisel farkındalık eğitim programı uygulanmış, deney 2 grubuna dijital oyun destekli ses bilgisel farkındalık eğitim programı uygulanmış, deney 3 grubuna dijital oyun tabanlı ses bilgisel farkındalık eğitim programı uygulanmış, kontrol grubuna ise hiçbir müdahalede bulunulmamıştır. Araştırmanın modeli olarak yarı deneysel desen kullanılmıştır. Araştırmada veri toplama araçları olarak Erken Okuryazarlık Becerilerini Değerlendirme Aracı (EOBDA) ve Anasınıflarına Yönelik Erken Okuryazarlık Testi (EROT) kullanılmıştır. Çalışma gruplarına ve kontrol gruplarına ön test uygulanmış ve ön test sonrasında deney gruplarına on hafta süreyle eğitim programları uygulanmıştır. Eğitim programları uygulandıktan sonra deney gruplarına ve kontrol grubuna son test, deney gruplarına kalıcılık testi yapılmıştır. Araştırmanın sonuçlarına göre deney grupları arasında ve deney grupları ile kontrol grubu arasında anlamlı farklılık olduğu tespit edilmiştir.

Anahtar kelimeler: Ses bilgisel farkındalık, dijital oyun, eğitim program, okul öncesi eğitim.

* It was produced from the doctoral dissertation titled "Digital Game-Based, Supported Training Programs for Phonological Awareness Skills and the Effect of Phonological Awareness Training Program on the Phonological Awareness Skills of 60-72 Month-Old Children".

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Citation Information
Göle, M. O., & Temel, Z. F. (2024). The effect of digital game-based and different education programs on phonological awareness skills of 60-72 months-old children. *Kuramsal Eğitimbilim Dergisi [Journal of Theoretical Educational Science]*, *17*(1), 202-235.

ISSN: 1308-1659

Quality preschool education affects children's school success in primary school and further education levels. The most important factors affecting literacy success in primary school are quality early literacy education and phonological awareness education given in the preschool period (Bentin et al., 1991; Castles & Coltheart, 2004; Goswami, 2003; Justice & Vukelich, 2008; Kostelnik et al. al., 2019; Kozminsky & Kozminsky, 1995). Phonological awareness is defined as an individual's implicit and explicit sensitivity to the sounds in the structure of spoken language (Pullen & Justice, 2003). Phonological awareness is a starting point for understanding the relationship between a sound and the letters in the alphabet that represent it. It starts at about age three and develops gradually over the years. This skill begins with word and syllable awareness and continues with phoneme awareness, progressing toward the smallest phoneme in the word. It is also stated that phonological awareness occurs when children can hear and notice the boundaries of words (Christie et al., 2011; Morrison & Wilcox, 2012). Phonological awareness skills: realizing that the sentence consists of words, noticing rhyming words and producing rhyming words, separating the word into syllables, determining and matching the first/last sound of the word, determining the word formed by adding sound and syllable to the word, determining the word formed when the sound and syllable are removed from the word, the sounds forming the word and syllable speaking skills form phonological awareness skills (Hempenstall, 2003; National Reading Panel, 2000; Phillips et al., 2008; Yopp & Yopp, 2000).

Phonological awareness studies contribute to separating and combining sounds, spelling, decoding, and reading during the reading process. Writing affects skills such as understanding the principle of the alphabet, coding, understanding the relationship between letters and sounds, and writing in accordance with the letters represented by sounds (Busink, 1997; Cardoso-Martins et al., 2011; Castles & Coltheart, 2004; De Jong, 2007; Martins & Silva, 2001; Schuele & Boudreau, 2008; Torgesen & Mathes, 1998). High-quality phonological awareness education, which includes quality educational environments, methods, and techniques and the implementation process that children are exposed to in the preschool period, enables children to be successful in reading and writing skills in the future, and the effect of this success continues in the first and second grades of primary school (Casalis & Colé, 2009; Hogan et al., 2005). In the studies, it has been determined that enriching the educational environment and learning centers with visual stimuli related to phonological awareness, using visual and audio-sensory cards, and authentic materials supports the development of phonological awareness skills (Chambers et al., 2016; Franc & Subotic, 2015; Sucena et al., 2023). The studies determined that children's rhyme, syllable, and sound awareness skills were supported by the use of children's books that comply with content standards and interactive book reading methods (Elmonayer, 2013; Lefebvre et al., 2011; Lenhart et al., 2022; Mihai et al., 2015; Stadler & McEvoy, 2003; Symmonds, 2020). As a different method in phonological awareness education, poetry-based education programs in which poems are used for children have also been found to improve phonological awareness positively (Lennox, 2014; Lim & Chew, 2018; Nichols et al., 2018). It has been determined that word games played by changing the sounds and syllables in the word, visual cards, and games played using different materials positively affect phonological awareness (Arias, 2023; Luna, 2021). In phonological awareness studies using rhymes and finger games, rhyme awareness provides the development of

skills to combine sounds and syllables (Bolduc & Lefebvre, 2012; Harper, 2011; Incognito & Pinto, 2023; Redig, 2018). Singing children's songs, writing songs with children, and practicing rhythm improves syllable awareness, rhyme, sound awareness, and sound combining skills (Degé & Schwarzer, 2011; Del Egido, 2023; Moritz et al., 2013; Patria, 2023; Rowe et al., 2023).

Many different materials are used in the learning environment for children's phonological awareness skills. Nowadays, tablets and smartphones are essential to children's daily lives, and digital games are among children's game preferences and attract attention (Mertala & Meriläinen, 2019; Rideout, 2011; Shuler, 2012). Therefore, it is seen that digital games are essential in the education process in terms of increasing the diversity of materials and a qualified phonological awareness educational environment for children (Bennett & Parise, 2014; Saracho & Spodek, 2002; Selwyn, 2016; Sheridan et al., 2011; Zevenbergen, 2007). Digital game-based learning has emerged by incorporating digital games into the educational process. Digital game-based learning refers to learning that takes place through digital games. It encompasses learning through playing games or developing games (Becker, 2017). Using digital games in the educational process; critical thinking, problem-solving, knowledge construction (Moyer et al., 2002), using digital games in the educational process; critical thinking, problem-solving, knowledge construction (Moyer et al., 2002), matching, classifying, sorting, counting and coding (Pila et al., 2019; Stephen & Plowman, 2014), cognitive skills such as discovery, creativity, as well as acting autonomously, cooperation, intrinsic motivation (Arnott, 2013; Ferrari & Addessi, 2014; Lennon et al., 2022; McClarty et al., 2012; Ryan et al., 2006; Xiong et al., 2022), it also supports phonological awareness skills, one of the early literacy skills, as well as social skills such as. Studies conducted using digital games have shown contributions to the development of subdimensions of phonological awareness, such as syllable awareness, segmentation of words into syllables (Da Silva et al., 2022; Elimelech & Aram, 2020), syllable merging, syllable deletion from words (Amorim et al., 2020), rhyme detection, and rhyme matching (Goffredo et al., 2016; Puolakanaho et al., 2003; Van Goch et al., 2017), initial sound identification, matching words with the same initial sounds, sound deletion from words, blending sounds and syllables (Arnold et al., 2021; Cameron, 2023; Li et al., 2020; Sá et al., 2022), word segmentation into sounds, and letter knowledge (Kartal & Terziyan, 2016), as well as coding skills (Weiss et al., 2022).

Research has identified various methods, techniques, applications, and educational programs implemented to enhance children's phonological awareness skills. These studies have found that educational programs utilizing poetry, nursery rhymes, children's songs, and books, as well as gamified activities, support children's phonological awareness skills (Arias, 2023; Bayraktar & Temel, 2014; Del Egido, 2023; Incognito & Pinto, 2023; Rowe et al., 2023). Furthermore, research conducted on phonological awareness has concluded that digital games have the potential to enhance children's syllable, rhyme, and phonological awareness skills (Arnold et al., 2021; Kartal & Terziyan, 2016; Oliva-Maza et al., 2021; Vinter et al., 2022). When we look at the research above, the effectiveness of digital game-based, digital game-supported, and phonological awareness studies implemented with different methods was compared with the control group. However, few studies compare the effectiveness of various educational programs among themselves and the control group. The research conducted

is essential in terms of being comprehensive and trying to determine the effectiveness of various educational programs for phonological awareness (digital game-based, digital game-supported, educational programs where different methods are applied) by comparing them between the programs and the control group. It is also thought to be a guide in determining and selecting phonological awareness educational programs for children.

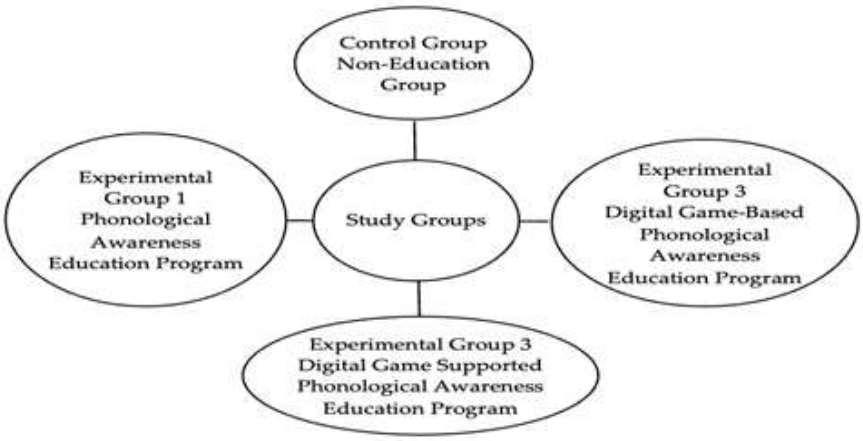
This study examines the effects of different education programs (phonological awareness education program, digital game-supported phonological awareness education program, and digital game-based phonological awareness education program) on the phonological awareness skills of 60-72-month-old children. For this general purpose, Is there a difference between the different education programs applied to the experimental groups in improving the phonological awareness skills of 60-72 children? Is there a difference between the experimental and control groups, in which different educational programs were applied to improve the phonological awareness skills of 60-72 children? Do the education programs applied to the experimental groups increase/improve retention? Answers to these questions were sought.

Method

A quasi-experimental design was used in this research to examine the effects of digital game-based and different educational programs on the phonological awareness skills of 60-72-month-old children. Cohen et al. (2017) state that it is only sometimes possible and challenging to determine the experimental and control groups by random assignment in empirical studies conducted in educational settings. Quasi-experimental designs are studies conducted without random assignment of participants to groups. In this model, the researcher does not assign impartially to the experimental and control groups, and the effect of the applied intervention on the experimental group is examined (Mertens, 2019). Since this research was conducted in an educational institution, a quasi-experimental design was used. Research-ready groups were matched in terms of phonological awareness skills without random assignment. Experimental and control groups were equally unbiased regarding phonological awareness skills. The research consists of three experimental groups and one control group. These groups are shown in Figure 1 below.

Figure 1

Study Groups and Applied Programs of the Research



When examining Figure 1, it can be observed that the research study consists of four groups in the study group: experimental group 1, experimental group 2, experimental group 3, and the control group. The phonological awareness education program was applied to experimental group 1, the phonological awareness education program supported by digital games was applied to experimental group 2, and the digital game-based phonological awareness education program was applied to experimental group 3. The Control group did not receive any specific education and continued with the implementation of the 2013 Preschool Education Program in the classroom. Ministry of National Education [MoNE] (2013) Preschool Education Program is a national preschool education program applied to the control group. However, the program offers flexibility to the teacher regarding which methods will be used to help children achieve the objectives. Therefore, it is at the teacher's discretion which methods the teacher teaching the control group will use for phonological awareness skills. In addition, although there is no technology center in the classroom where the control group receives educational, there is a smart board. However, it was determined that there was no digital game application on the smart board. Pre-test, post-tests, and retention tests were conducted to measure and compare the effectiveness of the programs. Retention testing can be done at least two weeks after educational programs are implemented (Haynie, 1997). In the study, the permanence test was performed three weeks after the last test was applied.

Study Group

In this research, criterion sampling, one of the purposeful sampling methods, was used. Purposive sampling is a sampling technique chosen due to its alignment with the specific purpose of the research and is preferred because of the unique characteristics of the sample elements (Check & Schutt, 2012; Newby, 2010). In this context, it was determined through discussions with school principals and preschool teachers whether educational programs aimed at supporting phonological awareness skills had been previously implemented in nursery schools and preschool classes affiliated with the Ministry of National Education. This approach identified preschool classes where no phonological awareness education program had been participated in, and voluntary participation was sought. The study group of the research consists of a total of 72 children in the 60-72 month age group who received education in preschool classes where a phonological awareness skill-supporting educational program had not been previously implemented within an elementary school affiliated with the Ministry of National Education in Afyonkarahisar city center. Among these are 22 children in experimental group 1, 16 in experimental group 2, 17 in Experimental group 3, and 17 in the Control Group.

In quasi-experimental studies, no precise rule for determining the appropriate sample size exists. However, it is mentioned that conducting a study with groups of 30-40 individuals may provide researchers with various advantages in terms of the generalizability of research results and the availability of robust statistics (Büyüköztürk et al., 2014). The research sample was formed using a cluster sampling technique. Cluster sampling is a method where groups are selected randomly rather than individual individuals. All members of the selected groups have similar characteristics. Any group

with similar characteristics and no inference made is called a cluster (Özen & Gül, 2007). Information about the study group of the research is provided in Table 1.

Table 1

Participant Demographic Information

		Experiment Group 1		Experiment Group 2		Experiment Group 3		Control Group		Total	
		n	*%*	*n*	*%*	*n*	*%*	*n*	*%*	*n*	*%*
Age	60-66 Month	8	36.4	6	37.5	11	64.7	10	58.8	35	48.6
	67-72 Month	14	63.6	10	62.5	6	35.3	7	41.2	37	51.4
Gender	Girl	14	63.6	9	56.3	12	70.6	9	52.9	44	61.1
	Boy	8	36.4	7	43.8	5	29.4	8	47.1	28	38.9
Birth Order	Firstborn	4	18.2	4	25	5	29.4	2	11.8	15	20.8
	Middle Child	8	36.4	8	50	6	35.3	3	17.6	25	34.7
	Last Child	10	45.5	4	25	6	35.3	12	70.6	32	44.4
Number of Children in the Family	One	3	13.6	0	0	2	11.8	1	5.9	6	8.3
	Two	14	63.6	11	68.8	10	58.8	8	47.1	43	59.7
	Three	5	22.7	5	31.3	5	29.4	8	47.1	23	31.9
Attending a Preschool Institution	0-6	1	4.5	2	12.5	2	11.8	1	5.9	6	8.3
	7-12	13	59.1	13	81.3	8	47.1	15	88.2	49	68.1
	13-18	4	18.2	0	0	3	17.6	1	5.9	8	11.1
	19-24	2	9.1	1	6.3	2	11.8	0	0	5	6.9
	25 and over	2	9.1	0	0	2	11.8	0	0	4	5.6

When Table 1 is examined, it is seen that there are 22 children in experimental group 1, 16 children in experimental group 2, 17 children in experimental group 3, and 17 children in the control group. When the ages of the children are examined, in experimental group 1, 60-66 month-old children are 8 (36.4%), 67-72 month-old children are 14 (63.6%), in experimental group 2, 60-66 months old 6 (37.5), 10 (62.5%) if 67-72 months old, 11 (64.7%) 60-66 months old, 6 (35.3%) 67-72 months old, 60-66 months old when the control group is examined It is seen that the children are in the age range of 10 (58.8%) and 7 (41.2%) between 67-72 months. When the children are examined in terms of gender, it is seen that the number of girls is 44 (61.1%) and the number of boys is 28 (38.9%). When examined in order of birth, the children participating in the study were the last child at most, 32 (44.4%) and the least the firstborn was 15 (20.8%). Considering the number of children in the family, there are at most 2 (63.6%) and at least 6 (8.3%) single children in the families of the children participating in the study. Considering the pre-school education status of the children participating in the research, it is seen that 49 (68.1%) children attend school between 7 and 12 months and continue for at least 25 months and above (5.6%).

Data Collection Tools

In the study, the Early Literacy Assessment Tool (ELST) and the Early Literacy Test for Kindergarten Children (ELTKC) were used to evaluate the phonological awareness skills of the experimental and control groups.

Early Literacy Skills Assessment Tool (ELST)

The measure used to examine early literacy skills in preschool children was developed by Karaman and Aytar (2016). It applies to children between the ages of 48 and 77 months. The scale consists of 5 subtests: phonological awareness, story narration, matching pictures, writing awareness, and pre-writing skills. This study used the phonological awareness subtest as the research objectiveIn the phonological awareness skills subtest, there are five factors, which include matching rhyming words (9 items), matching words with the same initial sound (6 items), identifying initial sounds (21 items), blending sounds (7 items), and segmenting syllables and sounds (10 items). The reliability of the Phonological Awareness Skills Assessment subtest is indicated by a KR20 reliability coefficient of .91, and the test-retest reliability value is .92. The test's scoring is as follows: incorrect responses receive 0 points, correct responses receive 1 point. In the case of no response, the question item is repeated three times, and if there is still no response, 0 points are given. The test is administered individually and takes approximately 45-60 minutes. The evaluation of the test involves calculating the average score obtained by the children in the group, and then each child's score is assessed concerning the average score.

Early Literacy Test for Kindergarten Children (ELTKC)

The measurement tool used to assess early literacy skills in preschool children was developed by Kargın et al. (2017). It consists of subtests for expressive language, fluent language, functional knowledge, general naming, listening comprehension, phonological awareness, and letter knowledge. In this study, the phonological awareness subtest of the test was used. The phonological awareness subtest also comprises eight subtests, which include segmenting sentences into words, syllable segmentation, rhyme awareness, matching initial sounds, matching final sounds, syllable blending, deleting final sounds, and deleting initial sounds. Each subtest contains four items. The overall reliability coefficient of the scale is .94. The Spearman-Brown two-half reliability value is .79. The reliability of the phonological awareness subtest is indicated by a KR20 value of .87, the test-retest reliability coefficient of .70, and a Spearman-Brown two-half reliability value of .67. The scale can be administered to children in the age group of 60-72 months. Scoring for the test involves assigning 0 points for incorrect answers and 1 point for correct answers. Assessment is conducted based on the cutoff point, and the cutoff point for the phonological awareness subtest is .50.

When examining the assessment tools used in the research, it is observed that the sub-factors within phonological awareness tests differ. Different assessment tools have been used to comprehensively investigate the effectiveness of the applied educational programs in the research.

Analysis of Data

Since the number of participants in the experimental and control groups is less than thirty, non-parametric analysis methods can be employed for data analysis (Büyüköztürk, 2013). Consequently, the Mann-Whitney U test has been used to compare the pre-test data. Additionally, the Wilcoxon Signed-Rank Test has been utilized to compare the pre-test to the post-test and the post-test to retention test scores.

Preparation and Implementation of Education Programs

Within the scope of the research, a phonological awareness education program, a digital game-based phonological awareness education program, and a digital game-supported phonological awareness education program were developed. During the preparation process of the program, the aim was to create a comprehensive program focusing on phonological awareness skills. Therefore, a review of the relevant literature and scales related to phonological awareness skills was conducted. As a result of these reviews, decisions were made regarding which phonological awareness skills would be covered in the program. It was then compared with the achievements and indicators for phonological awareness in the currently implemented Preschool Education Program for 36-72 72-month-old children (MoNE, 2013). As a result of the comparisons, it was seen that there were differences between the phonological awareness gains in the program and the phonological awareness skills determined for the research. Due to these differences, skills such as word awareness, syllable segmentation, determining the number of syllables in a word, syllable deletion, blending syllables, deleting the first/last sound in a word, and sound blending were added to the outcomes and indicators of the educational programs implemented in the research. After determining the outcomes and indicators, the educational programs were prepared. The prepared educational programs were child-centered, spiral, gamified, actively participatory, and interactive and aimed to transition from the known to the unknown, avoiding didactic approaches. Furthermore, the digital game was prepared following Gestalt theory, Gagne's instructional conditions model, and cognitive load theory. After the educational programs were developed, they were sent to three academics specializing in program development for evaluation. The academics stated that the programs were appropriate regarding outcomes, indicators, the learning process, assessment, and materials. Subsequently, the programs were implemented with the experimental groups. The first researcher carried out the implementation of the educational programs prepared for the experimental groups. In the spring semester of the 2021-2022 academic year, practices were carried out in the classrooms where children were educated on Tuesdays and Wednesdays of the week. The researcher attended the children's education for three days so that the children could get to know the researcher and establish interaction between them. Then, the pre-test and implementation phase started. A phonological awareness educational program was applied to the Experiment 1 group. In this educational program, various activities were carried out using different methods in Turkish, drama, mathematics, music, games and pre-literacy preparation activity types and activity types. For example, methods and techniques such as shared reading and drama were used in the Turkish activity, and problem solving in the music activity. Natural objects, toys or object images, game cards, puppets and similar materials were used in these activities. The activities were carried out in the form of individual, large and small studies. Care was taken to ensure a diverse array of materials in the activities, providing with the opportunity to choose materials, reflect on their own thoughts, and have their preferences implemented. For example, by allowing children to create poems as a group and stories individually, add different words to songs, use different materials in the classroom, and add rules to games (which will not affect the acquisition of phonological awareness skills), the education process was designed to be flexible, ensuring active participation from the children. Additionally, a listening and writing

center was established in the educational environment for both Experimental group 1 and Experimental group 2, and adjustments were made in other centers according to the activities included in the program. The centers were updated with different materials every week. Experimental group 1 received the phonological awareness education program for ten weeks, with two weekly sessions, each lasting approximately 30 minutes.

Experimental group 3 received the digital game-based phonological awareness education program, administered for ten weeks with two sessions per week. The duration of each session ranged from approximately 20-25 minutes. The digital game reflects phonological awareness skills. First of all, sentences, words, and instructions to be presented to children reflecting each phonological awareness sub-skill were determined. In determining the sentences, words and instructions, Memoğlu-Süleymanoğlu's (2014a) Turkish Frequency Dictionary and Turkish Reverse Frequency Dictionary (2014b) studies were utilized (Gökmen, 2007; Görgün, 2020; Keklik, 2010, 2011; Şahin Kamışlı et al., 2015; Savaş & Turan, 2011; Topbaş, 1996; Topbaş, 2006). Then, it was sent to academics working in the field of curriculum to check the appropriateness of words, sentences, and instructions. In line with the feedback from the academics, words and sentences that were not suitable for children were removed, and the instructions were organized. For example, the word kaleidoscope was removed, considering that it is a word that children rarely encounter in their daily lives. Afterwards, a meeting was held with the Sekizdesekiz company, and a game was prepared using words, sentences, and instructions. Visuals suitable for the words, sentences and instructions were prepared and vocalized by Firma. This process continued with an exchange of views between the researchers and the company. For example, when it was thought that children could not make sense of the prepared visual, the visual was drawn differently. Or the necessary ideas were exchanged to ensure that the vocalization attracted children's attention and that the word or sentence was clearly understood. In this process, the visuals and vocalizations were transferred to the game application Sekizdesekiz used. The company's game application can be installed on smart boards, computers, and tablets. In the research, the application was installed on smart boards. In the process of playing digital games, the study was conducted as a large group so that each child could play the game at the same time. The tool for this was the remote controllers prepared by the company for large group work. A remote control was defined for each child, and children used their own remote controls during the application process. After the game application is opened, each child defines his/her own remote control. Next comes the interface of the game (visuals, the spelling of words, background, etc.), followed by the instructions for the sentences, words, and voiceover. This allows children to listen and see, appealing to multiple senses. After listening to the instructions and words, children tap the remote control button to give the correct answer.

Experimental group 2 received the digital game-supported phonological awareness education program. For this group, the phonological awareness education program was applied, which included activities using natural objects, toys or visuals of objects, game cards, puppets, and similar materials (Turkish, drama, mathematics, music, play, and pre-literacy preparation). After each application, a digital game explicitly prepared for that skill was played. For example, after participating in an

activity related to rhyme awareness, the children played a digital game related to the rhyme. The program applied to Experimental group 2 lasted for ten weeks, with two sessions per week, each lasting approximately 45-50 minutes.

The educational programs prepared for the experimental groups were structured sequentially according to the phonological awareness dimensions specified in the literature and included in the scales. For example, activities and digital games start with sentence awareness and then continue with word awareness. After spelling the words and determining the number of syllables in the word, studies are carried out on rhyme awareness. Additionally, every three weeks, different materials, activities, and words related to phonological awareness skills that had been previously covered were introduced. This process also applies to the digital game. In the digital game, the activities were arranged sequentially based on phonological awareness skills, and every three weeks, review games with different words and visuals were played.

Ethical Procedures

An application was made to the Ethics Committee of the University to conduct the research on 06.12.2021. The application to the ethics committee included a file containing information about the research's objectives, the measurement tools to be used in the research, and details about the researchers. The ethics committee members reviewed the file, and approval for the research was granted on 14.01.2022. The ethics committee approval bears the date and file number 14.01.2022-E.264744.

Results

This section presents the findings related to the pre-test, post-test, and retention test based on the ELTKC and ELST assessment tools for the experimental groups.

Comparison of Pre-test and Post-test Total Scores of Experimental Groups

In the research, to compare the effectiveness of the educational programs applied to the experimental groups on children's phonological awareness skills, a Kruskal-Wallis H test was conducted to determine whether there was a significant difference in the total scores of the pre-test and post-test based on the ELTKC assessment tool. The results are presented in Table 2.

Table 2

Kruskal-Wallis H Test Results for Pre-Test and Post-Test Total Scores of Experimental Groups based on ELTKC

	Experimental Groups	*n*	Mean Ranks	x^2	*df*	*p**	Significant Difference
ELTKC Pre-Test Total	Experimental Group 1	22	42.18	5.495	3	.139	-
	Experimental Group 2	16	40.84				
	Experimental Group 3	17	28.09				
	Control Group	17	33.47				
ELTKC Post-Test Total	Experimental Group 1	22	48.02	32.994	3	.000*	4<1 4<2 4<3
	Experimental Group 2	16	46.50				
	Experimental Group 3	17	36.21				
	Control Group	17	12.47				
	Total	72					

*p<.05

When examining the ELTKC post-test total scores, a notable difference is evident among experimental groups 1, 2, 3 when compared to the control group without education (x^2 (df=3, n=72)=5.495, p=.000, p>.05). However, when the relationship between experimental group 1, experimental group 2, and experimental group 3 is examined, no significant difference is observed among the groups. Therefore, the educational programs applied to experimental group 1, experimental group 2, and experimental group 3 were effective compared to the control group.

The ELTKC pre-test and post-test scores of experimental group 1, experimental group 2, experimental group 3, and the control group within the experimental group were examined in terms of their means relative to the cutoff point of ELTKC. The findings are presented in Table 3.

Tablo 3

Grouping of Pre-Test and Post-Test Scores According to ELTKC Cutoff Point

	Pre-test				Post-test			
	Below the Cutoff Point		Above the Cutoff Point		Below the Cutoff Point		Above the Cutoff Point	
Groups	*n*	%	*n*	%	*n*	%	*n*	%
Experimental Group 1	18	81.8	4	18.2	1	4.5	21	95.5
Experimental Group 2	12	75.0	4	25.0	2	12.5	14	87.5
Experimental Group 3	17	100.0	0	0.0	1	5.9	16	94.1
Control Group	16	94.1	1	5.9	10	58.8	7	41.2

When examining the values in Table 3, it can be observed that in Group 1 of the experimental group, there were 18 children below the cutoff point and four children above the cutoff point in the ELTKC pre-test. After implementing the phonological

awareness education program in Group 1, in the ELTKC post-test, 21 children in Group 1 were above the cutoff point, and one child was below the cutoff point. Looking at Group 2, according to the ELTKC pre-test results, there were 12 children below the cutoff point and four children above the cutoff point in Group 2. After applying the digital game-supported phonological awareness education program to Group 2, in the ELTKC post-test, there were two children below and 14 children above the cutoff point in Group 2. Analyzing the data for Group 3, all the children in Group 3 are below the cutoff point in the ELTKC pre-test. After playing the digital game, when the ELTKC post-test results were examined, there was one child below the cutoff point and 16 children above the cutoff point in Group 3. Finally, looking at the control group, according to the ELTKC pre-test results, there are 16 children below the cutoff point and one child above the cutoff point. When examining the post-test results of the control group, there were ten children below and seven above the cutoff point.

In the study, to compare the effects of the education programs applied to the experimental groups on children's phonological awareness skills, the total mean scores of the groups were calculated using the Kruskal-Wallis H test to determine if there was a significant difference in the ELST pre-test and post-test total scores. The results are presented in Table 4.

Table 4

Results of Kruskal-Wallis H Test for ELST Pre-Test and Post-Test Total Scores Between Experimental Groups

	Experimental Groups	*n*	Mean Ranks	x^2	*df*	*p**	Significant Difference
ELST Pre- Test Total	Exp. Group 1	22	40.41	2.724	3	.436	-
	Exp. Group 2	16	40.09				
	Exp. Group 3	17	33.29				
	Control Group	17	31.26				
ELST Post- Test Total	Exp. Group 1	22	50.50	38.017	3	.000*	3<1 4<1 3<2 4<2 4<3
	Exp. Group 2	16	48.19				
	Exp. Group 3	17	31.18				
	Control Group	17	12.71				
	Total	72					

*p<.05

Table 4 reveals that there was no significant difference among the experimental groups in terms of ELST pre-test total scores (x^2 (*df*=3, *n*=72)=2.724, *p*=.436, *p*>.05). Hence, the experimental groups had similar phonological awareness skills at the beginning. However, when examining the ELST post-test total scores, it can be observed that there was a significant difference between experimental groups 1, 2, and 3 compared to the control group, indicating an increase in phonological awareness skills in the experimental groups after the implementation of the education program. Moreover, a significant difference was observed when comparing the experimental

groups among themselves. This significant difference favors experimental group 1 when compared to experimental group 3. There was no significant difference between experimental group 1 and experimental group 2. Nevertheless, there was a more significant increase in scores for experimental group 1 compared to experimental group 2 after implementing the education programs. Additionally, when comparing experimental group 2 to experimental group 3, a significant difference was observed in favor of experimental group 2.

The Examination of the Pre-Test Scores of the Experimental Groups Based on Sub-dimensions

In the study, the Kruskal Wallis H test was conducted to determine whether there was a significant difference in the ELTKC pre-test scores of the experimental groups and the control group regarding phonological awareness skills, and the results are presented in Table 5.

Table 5

Results of Kruskal Wallis H Test for Group Differences in Pre-Test Score Averages by ELTKC Sub-dimensions

	Experimental Groups	*n*	Mean Rank	x^2	*df*	*p**
Rhyme Awareness	Experimental Group 1	22	36.68	4.019	3	.259
	Experimental Group 2	16	43.09			
	Experimental Group 3	17	37.26			
	Control Group	17	29.29			
Matching by Initial Sound	Experimental Group 1	22	38.95	2.713	3	.438
	Experimental Group 2	16	36.22			
	Experimental Group 3	17	30.00			
	Control Group	17	40.09			
Matching by Final Sound	Experimental Group 1	22	35.93	3.164	3	.367
	Experimental Group 2	16	37.66			
	Experimental Group 3	17	30.50			
	Control Group	17	42.15			
Segmenting Sentences into Words	Experimental Group 1	22	43.75	5.653	3	.130
	Experimental Group 2	16	34.56			
	Experimental Group 3	17	29.32			
	Control Group	17	36.12			
Segmenting Words into Syllables	Experimental Group 1	22	40.09	6.834	3	.077
	Experimental Group 2	16	34.56			
	Experimental Group 3	17	29.32			
	Control Group	17	36.12			
Blending Syllables	Experimental Group 1	22	43.00	3.986	3	.263
	Experimental Group 2	16	35.19			
	Experimental Group 3	17	32.32			

Delete the Initial Sound in Words	Control Group	17	33.50	4.766	3	.190
	Experimental Group 1	22	38.95			
	Experimental Group 2	16	38.44			
	Experimental Group 3	17	34.00			
Delete the Final Sound in Words	Control Group	17	34.00	4.176	3	.243
	Experimental Group 1	22	37.80			
	Experimental Group 2	16	40.03			
	Experimental Group 3	17	35.00			
	Control Group	17	33.00			
	Total	72				

*p<.05

When examining Table 5, it can be observed that there was no significant difference in the pre-test scores and total scores of the ELTKC sub-dimensions among the experimental groups and the control group (x^2 (df=3, n=72)=5.495, p>.05). Therefore, the phonological awareness skill levels of the control and experimental groups were similar concerning ELTKC sub-dimensions.

In the study, a Kruskal Wallis H test was conducted to determine whether there was a significant difference in the ELST pre-test scores among the experimental and control groups, and the results are shown in Table 6.

Table 6

Results of Kruskal Wallis H Test for Mean Pre-Test Scores by ELST Sub-Dimensions Among Groups

	Experimental Groups	n	Mean Rank	x^2	df	p
Matching Words Beginning with the Same Sound	Experimental Group 1	22	35.82	1.260	3	.739
	Experimental Group 2	16	41.31			
	Experimental Group 3	17	34.62			
	Control Group	17	34.74			
Matching Rhyming Words	Experimental Group 1	22	44.34	6.003	3	.111
	Experimental Group 2	16	35.34			
	Experimental Group 3	17	28.91			
	Control Group	17	35.03			
Finding the Beginning Sound of the Given Word	Experimental Group 1	22	37.64	3.487	3	.322
	Experimental Group 2	16	35.81			
	Experimental Group 3	17	40.29			
	Control Group	17	31.88			
Producing Words That Begin with a Stimulus Sound	Experimental Group 1	22	37.36	.757	3	.860
	Experimental Group 2	16	36.44			
	Experimental Group 3	17	33.09			
	Control Group	17	38.85			

Producing Words That Start With the Same Sound	Experimental Group 1	22	38.30	1.764	3	.623
	Experimental Group 2	16	40.38			
	Experimental Group 3	17	34.82			
	Control Group	17	32.21			
Delete Syllables and Sounds	Experimental Group 1	22	37.64	1.673	3	.643
	Experimental Group 2	16	41.06			
	Experimental Group 3	17	34.76			
	Control Group	17	32.47			
Merge Sounds	Experimental Group 1	22	38.41	4.439	3	.218
	Experimental Group 2	16	40.66			
	Experimental Group 3	17	27.74			
	Control Group	17	38.88			
	Total	72				

*p<.05

When Table 6 is examined, it can be observed that there was no significant difference in the mean ELST pre-test scores among the experimental groups and the control group (x^2 (df=3, n=72)=2.724, p>.05). Therefore, the phonological awareness skill levels of the control and experimental groups were similar according to ELST sub-dimensions.

Examination of Experimental Groups' Final Test Scores by Sub-Dimensions

In the study, in order to determine whether there was a significant difference in the phonological awareness skills of the experimental groups and the control group based on the ELTKC post-test scores, a Kruskal-Wallis H test was conducted, and the results are presented in Table 7.

Table 7

Results of Kruskal-Wallis H Test for Mean Scores on ELTKC Sub-Dimensions in Terms of Post-Test Scores by Groups

	Experimental Groups	n	Mean Rank	x^2	df	p	Significant Difference
Rhyme Awareness	Experimental Group 1	22	46.82	38.329	3	.000*	4<1 4<2 4<3
	Experimental Group 2	16	43.69				
	Experimental Group 3	17	40.65				
	Control Group	17	12.24				
Matching by Initial Sound	Experimental Group 1	22	42.18	28.700	3	.000*	4<1 3<2 4<2 4<3
	Experimental Group 2	16	50.88				
	Experimental Group 3	17	36.29				
	Control Group	17	15.82				
Matching by Final Sound	Experimental Group 1	22	43.86	33.093	3	.000*	4<1 3<2
	Experimental Group 2	16	49.69				

	Experimental Group 3	17	37.88				4<2
	Control Group	17	13.18				4<3
	Experimental Group 1	22	45.64				
Segmenting Sentences into Words	Experimental Group 2	16	39.84	36.541	3	.000*	4<1
	Experimental Group 3	17	42.97				4<2
	Control Group	17	15.06				4<3
	Experimental Group 1	22	41.41				
Segmenting Words into Syllables	Experimental Group 2	16	38.22	18.069	3	.000*	4<1
	Experimental Group 3	17	40.94				4<2
	Control Group	17	24.09				4<3
	Experimental Group 1	22	39.50				
Blending Syllables	Experimental Group 2	16	34.88	4.334	3	.228	4<1
	Experimental Group 3	17	37.41				
	Control Group	17	33.24				
	Experimental Group 1	22	45.98				
Delete the Initial Sound in Words	Experimental Group 2	16	38.16	10.325	3	.016*	2<1
	Experimental Group 3	17	30.06				4<1
	Control Group	17	29.12				
	Experimental Group 1	22	45.09				
Delete the Final Sound in Words	Experimental Group 2	16	43.91	22.088	3	.000*	4<1
	Experimental Group 3	17	37.91				4<2
	Control Group	17	17.00				4<3
	Total	72					

*p<.05

Table 7 indicates that there was a significant difference in the mean scores of the experimental groups and the control group in all sub-dimensions of ELTKC post-test scores except for the "syllable merging" sub-dimension (x^2 (n=72; df=3)=32.994, p<.05). According to the results of the Mann-Whitney U test conducted to determine which groups differ, it has been found that the experimental groups scored significantly higher than the control group in all areas except for the "syllable merging" and "producing words that start with the same sound" sub-dimensions. Specifically, only experimental group 1 had higher mean scores than the control group in all areas, and additionally, experimental group 2 had significantly higher mean scores than experimental group 3 in the "matching words beginning with the same sound" and "matching rhyming words" sub-dimensions.

In the research, a Kruskal Wallis H test was conducted to determine whether there was a significant difference in ELST post-test scores between the experimental and control groups, and the results are shown in Table 8.

Table 8

Results of the Kruskal Wallis H Test for Inter-Group Comparison of Mean Scores of ELST Sub-dimensions at Post-Test

	Experimental Groups	*n*	Mean Rank	x^2	*df*	*p*	Significant Difference
Matching Words Beginning with the Same Sound	Experimental Group 1	22	48.59	31.086	3	.000	3<1 4<1 4<2 4<3
	Experimental Group 2	16	45.50				
	Experimental Group 3	17	34.50				
	Control Group	17	14.38				
Matching Rhyming Words	Experimental Group 1	22	49.70	37.521	3	.000	3<1 4<1 3<2 4<2 4<3
	Experimental Group 2	16	48.41				
	Experimental Group 3	17	31.32				
	Control Group	17	13.38				
Finding the Beginning Sound of the Given Word	Experimental Group 1	22	43.18	19.419	3	.000	4<1 4<2 4<3
	Experimental Group 2	16	39.94				
	Experimental Group 3	17	38.85				
	Control Group	17	22.26				
Producing Words That Begin with a Stimulus Sound	Experimental Group 1	22	49.09	32.852	3	.000	3<1 4<1 3<2 4<2 4<3
	Experimental Group 2	16	45.66				
	Experimental Group 3	17	33.82				
	Control Group	17	14.26				
Producing Words That Start With the Same Sound	Experimental Group 1	22	44.82	27.514	3	.000	4<1 4<2 4<3
	Experimental Group 2	16	45.56				
	Experimental Group 3	17	39.50				
	Control Group	17	14.21				
Delete Syllables and Sounds	Experimental Group 1	22	48.57	33.211	3	.000	3<1 4<1 4<2 4<3
	Experimental Group 2	16	46.34				
	Experimental Group 3	17	35.12				
	Control Group	17	13.00				
Merge Sounds	Experimental Group 1	22	45.70	29.854	3	.000	4<1 4<2 4<3
	Experimental Group 2	16	47.72				
	Experimental Group 3	17	36.79				
	Control Group	17	13.74				
ELST Post-Test Total	Experimental Group 1	22	50.50	38.017	3	.000	3<1 4<1 3<2 4<2 4<3
	Experimental Group 2	16	48.19				
	Experimental Group 3	17	31.18				
	Control Group	17	12.71				
	Total	72					

*p<.05

Table 8 shows that there was a significant difference in the mean scores of ELST post-test sub-dimensions among the experimental groups and the control group (x^2 (n=72, df=3)=38.017, p<.05). According to the results of the Mann-Whitney U test conducted to determine which groups differ, it is observed that the experimental groups scored significantly higher than the control group in all dimensions. Additionally, in the sub-dimensions of matching words beginning with the same sound, syllables, and sounds dropping, both experimental groups 1 and 2 scored higher than experimental group 3, and in the sub-dimensions of matching rhyming words, noticing the initial sounds of words, and the total score, both experimental groups 1 and 2 scored higher than experimental group 3.

Examination of the Retention Test Scores of the Experimental Groups

The Wilcoxon Signed-Rank Test was conducted to examine the significant differences between the final test and retention test scores of Experimental group 1, Experimental group 2, and Experimental group 3 in terms of their auditory awareness skills in ELTKC and ELST. The results are displayed in Table 9 and Table 10.

The Wilcoxon Signed-Rank Test examined the significant differences between the final test and retention test scores of Experimental group 1, Experimental group 2, and Experimental group 3 regarding their auditory awareness skills in ELTKC and ELST. The results are displayed in Table 9 and Table 10. It was determined that the scores in the sub-dimensions of matching to the initial sound (Positive Rank Sum ST=28.00) and matching to the final sound (Positive Rank Sum ST=66.00) increased. At the same time, there was a decrease in the dimension of omitting the initial sound of words (Negative Rank Sum ST=70.00). It can be observed that the mean scores of the final test and retention test in Experimental group 1 are similar. A significant difference was observed between the ELTKC final test and retention test scores in Experimental group 2 (n=16; Z=-2.289; p<.05). However, when examining the sub-dimensions of ELTKC, no significant differences were found in any of the sub-dimensions (p<.05). Upon closer examination of the sub-dimensions of ELTKC, a decrease was observed in the sub-dimension matching the initial sound (Negative Rank Sum ST=10.00). At the same time, an increase was noted in the positive rank sums in other sub-dimensions and the total positive rank sum (Total Positive Rank Sum ST=68.00). Despite the observed decreases and increases in the sub-dimensions of ELTKC, these values did not show a significant decrease or increase. There is a difference between the final test and retention test scores, with an increase in Experimental group 2's ELTKC retention test score. On the other hand, there was no significant difference found between the ELTKC final test and retention test scores in Experimental group 3 (n=17; Z=-.595; p<.05). When examined according to the sub-dimensions of ELTKC, no significant differences were found in any of the sub-dimensions (p<.05). When looking at the total rank sum value of ELTKC, it can be observed that there is a slight increase in Experimental group 3 overall (Total Positive Rank Sum ST=153.00). However, it can be concluded that this increase is not statistically significant. There is also a slight increase in the ELTKC retention test results for Experimental group 3, but according to the analysis conducted, this increase does not reflect a significant difference.

When examining the findings in Table 10, it is evident that there is a significant difference between the ELST final test and retention test scores in Experimental group 1

(z=-2.112; p<.05). When looking at the sub-dimensions of ELST, a significant difference is observed in the sub-dimension of matching words that start with the same sound (p<.05), and there is a decrease in the correct answers given in this sub-dimension by Experimental group 1 (Negative Rank Sum ST=66.00). There is no significant difference found in the sub-dimensions other than matching words that start with the same sound (p<.05). However, it is observed that there is a decrease in the answers provided by Experimental group 1 (Total Negative Rank Sum ST=108.50). There is a difference between the final test and retention test scores, with a decrease in the ELST retention test score of Experimental group 1 compared to the final test score. Although this difference is slight, it is statistically significant, as seen in Table 10. In contrast, no significant difference was observed in the ELST final test and retention test scores in Experimental group 2 (n=16; Z=-.361; p<.05).

When looking at the sub-dimensions of ELST, it was found that there is no significant difference in any of the sub-dimensions of ELST (p<.05). However, when examining the sub-dimensions of ELST, there is a decrease in the sub-dimension of omitting syllables and sounds (Negative Rank Sum ST=57.00), and there is also a decrease in the total rank sum of ELST. There is a slight decrease in the average score of the retention test for experimental group 2 compared to the final test score. However, this decrease reflects a slight difference. A significant difference was found between the ELST final test and retention test scores in experimental group 3 (n=17; Z=-2.080; p<.05). When examined according to the sub-dimensions of ELST, there is a significant difference in the sub-dimension of matching words that start with the same sound. However, there is no significant difference in the other sub-dimensions. When examining ELST's total rank sum value, there is an increase in experimental group 3. When looking at the rank sum values of the sub-dimensions, there is an increase in the sub-dimensions of matching words that start with the same sound (Positive Rank Sum ST=7.00) and omitting syllables and sounds (Positive Rank Sum ST=45). There is a slight decrease in the sub-dimension of matching rhyming words (Negative Rank Sum ST=33.00). Experimental group 3 shows an increase in the average score of the ELST retention test compared to the final test score, which results in a significant difference.

Table 9

Groups ELTKC Retention Test Results

	Experimental Groups	Negative Rank (n)	Negative Rank (R.A)	Negative Rank (R.S)	Positive Rank (n)	Positive Rank (R.A)	Positive Rank (S.T)	Equal (n)	z	p*
Rhyme Awareness	Exp. Group 1	0	.00	.00	3	2.00	6.00	19	-1.732	.083
	Exp. Group 2	0	.00	.00	3	2.00	6.00	13	-1.732	.083
	Exp. Group 3	4	4.00	16.00	4	5.00	20.00	9	-.302	.763
Matching by Initial Sound	Exp. Group 1	0	.00	.00	7	4.00	28.00	15	-2.530	.011
	Exp. Group 2	3	3.33	10.00	2	2.50	5.00	11	-.707	.480
	Exp. Group 3	2	4.00	8.00	5	4.00	20.00	10	-1.134	.257
Matching by Final Sound	Exp. Group 1	0	.00	.00	11	6.00	66.00	11	-3.317	.001*
	Exp. Group 2	2	4.50	9.00	4	3.00	12.00	10	-.333	.739
	Exp. Group 3	2	4.00	8.00	5	4.00	20.00	10	-1.134	.257

Segmenting Sentences into Words	Exp. Group 1	2	2.00	4.00	1	2.00	2.00	19	-.577	.564
	Exp. Group 2	0	.00	.00	3	2.00	6.00	13	-1.604	.109
	Exp. Group 3	1	1.50	1.50	2	2.25	4.50	14	-.816	.414
Segmenting Words into Syllables	Exp. Group 1	2	1.50	3.00	0	.00	.00	20	-1.414	.157
	Exp. Group 2	0	.00	.00	2	1.50	3.00	14	-1.342	.180
	Exp. Group 3	1	1.00	1.00	0	.00	.00	16	-1.000	.317
Blending Syllables	Exp. Group 1	0	.00	.00	0	.00	.00	22	.000	1.000
	Exp. Group 2	0	.00	.00	1	1.00	1.00	15	-1.000	.317
	Exp. Group 3	1	2.00	2.00	1	1.00	1.00	15	-.447	.655
Delete the Initial Sound in Words	Exp. Group 1	11	6.36	70.00	1	8.00	8.00	10	-2.470	.014
	Exp. Group 2	0	.00	.00	4	2.50	10.00	12	-1.890	.059
	Exp. Group 3	4	3.13	12.50	1	2.50	2.50	12	-1.414	.157
Delete the Final Sound in Words	Exp. Group 1	3	5.00	15.00	8	6.38	51.00	11	-1.706	.088
	Exp. Group 2	2	6.00	12.00	8	5.38	43.00	6	-1.628	.103
	Exp. Group 3	1	2.00	2.00	3	2.67	8.00	13	-1.134	.257
Total	Exp. Group 1	6	7.42	44.50	9	8.39	75.50	7	-.887	.375
	Exp. Group 2	1	10.00	10.00	11	6.18	68.00	4	-2.289	.022*
	Exp. Group 3	4	6.63	26.50	7	5.64	39.50	6	-.595	.552

Table 10

Experimental Groups ELST Retention Test Results

	Experimental Groups	Negative Rank (n)	Negative Rank (R.A)	Negative Rank (R.S)	Positive Rank (n)	Positive Rank (R.A)	Positive Rank (S.T)	Equal (n)	z	p*
Matching Words Beginning with the Same Sound	Exp. Group 1	10	6.60	66.00	2	6.00	12.00	10	-2.324	.020*
	Exp. Group 2	5	3.50	17.50	2	5.25	10.50	9	-.632	.527
	Exp. Group 3	2	5.50	11.00	10	6.70	67.00	5	-2.352	.019
Matching Rhyming Words	Exp. Group 1	6	5.33	32.00	4	5.75	23.00	12	-.471	.638
	Exp. Group 2	4	3.50	14.00	3	4.67	14.00	9	.000	1.000
	Exp. Group 3	6	5.50	33.00	5	6.60	33.00	6	.000	1.000
Finding the Beginning Sound of the Given Word	Exp. Group 1	1	2.00	2.00	1	1.00	1.00	20	-.447	.655
	Exp. Group 2	0	.00	.00	1	1.00	1.00	15	-1.000	.317
	Exp. Group 3	3	2.00	6.00	0	.00	.00	14	-1.633	.102
Producing Words That Begin with a Stimulus Sound	Exp. Group 1	8	5.13	41.00	2	7.00	14.00	12	1.430	.153
	Exp. Group 2	2	2.00	4.00	2	3.00	6.00	12	-.378	.705
	Exp. Group 3	4	4.63	18.50	5	5.30	26.50	8	-.491	.623
Producing Words That Start With the Same Sound	Exp. Group 1	5	4.50	22.50	7	7.93	55.50	10	-1.344	.179
	Exp. Group 2	3	4.00	12.00	3	3.00	9.00	10	-.333	.739
	Exp. Group 3	5	5.50	27.50	5	5.50	27.50	7	.000	1.000
Delete Syllables and Sounds	Exp. Group 1	12	8.63	103.50	4	8.13	32.50	6	-1.866	.062
	Exp. Group 2	10	5.70	57.00	2	10.50	21.00	4	-1.446	.148
	Exp. Group 3	6	7.67	46.00	7	6.43	45.00	4	-.036	.971

Merge Sounds	Exp. Group 1	6	6.17	37.00	8	8.50	68.00	8	-1.008	.313
	Exp. Group 2	5	5.40	27.00	4	4.50	18.00	7	-.577	.564
	Exp. Group 3	1	5.50	5.50	5	3.10	15.50	11	-1.081	.279
ELST Post-Test Total	Exp. Group 1	13	8.35	108.50	3	9.17	27.50	6	-2.112	035*
	Exp. Group 2	7	6.21	43.50	5	6.90	34.50	4	-.361	.718
	Exp. Group 3	2	10.00	20.00	12	7.08	85.00	3	-2.080	038*

*p<.05

Discussion and Conclusion

Before proceeding to the results and discussion, it is recommended to revisit Figure 1 to understand better which educational programs were applied to the experimental groups.

When examining the total scores for ELTKC pre-tests and post-tests, the total scores for ELST pre-tests and post-tests, the number of children who scored below the cutoff point based on pre-test results, and also the pre-test data for ELTKC sub-dimensions six and the pre-test data for ELST sub-dimensions, it was determined that there were no significant differences among experimental group 1, experimental group 2, experimental group 3, and the control groups, both in total and sub-dimensions. The absence of significant differences may indicate that the levels of auditory awareness skills were similar among these groups. This situation may be suitable for evaluating and comparing the effect of the educational programs applied to the experimental groups on auditory awareness skills.

Comparison Among the Experimental Groups

Upon examination, it is determined that, based on the ELTKC final test total scores, the applied educational programs positively affected the auditory awareness skills of the experimental groups. However, based on the final test total scores, there is no significant difference between experimental group 1, experimental group 2, and experimental group 3. Therefore, a comparison regarding the applied educational programs cannot be made based on ELTKC pre-test and post-test total scores. According to this data, the educational programs applied to the experimental groups had similar effects.

When the number of children in experimental group 1 who scored above and below the cutoff score on the ELTKC final test was examined, it was found that 21 children in experimental group 1 scored above the cutoff score. In contrast, one child scored below the cutoff score. In experimental group 3, 16 children scored above the cutoff score, while one scored below the cutoff score. In experimental group 2, 14 children scored above the cutoff score, while two children scored below the cutoff score. In the control group where the educational program was not implemented, it was observed that seven children scored above the cutoff score, while ten children scored below the cutoff score. The applied educational programs contributed to the phonological awareness skills of the children in the experimental group. Additionally, it is observed that the number of children scoring below the cutoff point has decreased in the control group, where the educational program still needs to be implemented. The decrease in the number of children scoring below the cutoff point in the control group

can be attributed to the fact that the control group continued with the 2013 Preschool Education Program, which includes rhyme awareness and phonological awareness indicators in the language development domain. The presence of these skills in the education program received by the children in the control group may be the source of the meaningful difference.

When the ELST final test scores were examined, it was concluded that there was a significant difference between the experimental groups and the control groups. The educational programs applied to the experimental groups positively affected the children's phonological awareness skills. When the final test total scores of experimental group 1, experimental group 2, and experimental group 3 were compared, a significant difference in favor of experimental group 1 was observed compared to experimental group 3. When experimental group 2 was compared to experimental group 3, a significant difference was determined in favor of experimental group 2. It was determined that there is no significant difference between experimental group 1 and experimental group 2. However, when looking at the mean total scores in Figure 2, it was found that experimental group 1 scored higher than experimental group 2. The research results indicate that the phonological awaereness educaiton program is more effective than the digital game-based educaiton program. These findings are in line with relevant research in the leterature. The active participation of the children in the implementation process of the education program applied to experimental group 1, the flexibility of the education process, and the attempt to increase interaction with large and small group studies may have led to the emergence of this difference.

Shifflet et al. (2020) examined the effects of educational materials (traditional materials) and tablet-based applications on preschool children's phonological awareness skills. Traditional materials were used in the education given to one experimental group, while tablet-based applications were applied in the education given to the other experimental group. They found that the phonological awareness skills of children in both experimental groups improved. They also found that there was no significant difference between the experimental groups. In the study conducted by Shifflet et al. (2020), materials such as cubes, magnetic letters, and unifix were used. In the study, children's books, finger plays, rhymes, songs, natural objects, toys, and activities were prepared in a gamified way in the implementation of the phonological awareness educational program. The difference between the Shifflet et al. (2020) study and the study can be attributed to the materials used. Goffredo et al. (2016) developed a platform called 'En Plein' to support preschool children's phonological awareness skills, which includes activities related to rhyme awareness, initial/final syllable recognition, and syllable blending skills. The study consisted of an experimental group that used the platform and a control group that received regular phonological awareness education. The research found that the phonological awareness education program was more effective than the digital game-based education program, which can be considered a more conventional program than the digital game-based education program. There are differences in the research results. Goffredo et al. (2016) noted that boys and girls participating in their research were highly motivated. The ability of children to create their avatars and move simultaneously with the avatar may have increased their motivation, leading to more accurate answers. This could be a source of the differences in research results. Hillman and Marshall (2009) emphasized the importance of intrinsic

motivation for achieving desired results in skills targeted through digital use and for these results to be lasting.

According to the results, experimental group 1, which received the phonological awareness education program, scored higher in all ELST sub-dimensions than the control group. Experimental group 1 had a higher average score in rhyme word matching, initial sound recognition, and overall scores than experimental groups 3 and 2. Experimental group 2 was found to have higher scores in rhyme word matching, generating words starting with the prompting sound, and overall scores compared to experimental group 3. When the final test findings for all sub-dimensions of ELTKC and ELST are examined among the experimental groups, the phonological awareness education program applied to experimental group 1 is more effective.

In their study, Elimelech and Aram (2020) developed a digital syllable game for children aged 5-7 to support early literacy skills. The research was conducted with three different groups, including two experimental groups and a control group. According to the study results, the group provided with both visual and auditory support and the group provided with only auditory support performed better than the other groups in Word syllabication and phonological awareness areas. The group with visual and auditory support received higher letter knowledge, phonological awareness, and word spelling scores than the unsupported and control groups. Children in both experimental groups scored higher in letter knowledge than in the control group. In the syllabication of words, the groups receiving auditory and visual-auditory support related to word syllabication scored higher in the final test than those receiving only auditory support and the control group. When examining the research, there appears to be a similarity between the study and the implementation process. In the conducted research, there are three different experimental groups: a phonological awareness education program group, a digital game-based phonological awareness education program group, and a digital game-supported phonological awareness education program group. Looking at the stimuli provided to the experimental groups in the research, the group where the digital game-supported phonological awareness education program was implemented was exposed to more stimuli. In comparison, the other groups were exposed to fewer stimuli. In this regard, Elimelech and Aram (2020) concluded their research that the group with more stimuli (visual and auditory support) scored higher in all areas compared to the other groups. However, in the conducted research, it is observed that among the groups that received high scores, the group that underwent the phonological awareness education program performed better. Therefore, there is no similarity in the research results. However, in the study conducted by Elimelech and Aram (2020), when examining the group with auditory support and the group without support compared to the other groups, it was observed that the group with auditory support scored higher. These results are similar to the digital game-supported phonological awareness education program applied in experimental group 2 and the digital game-based phonological awareness education program applied in experimental group 3, which scored higher than the control group. Likewise, it is similar to the digital game-based phonological awareness education program received by experimental group 3, which scored higher than the control group. The digital game applied to experimental group 3 includes visual and auditory elements. Providing two different sensory supports during the education process may have resulted in similar research results. At the same time,

the fact that the education program applied to experimental group 2 included both digital games and activities using different method techniques, appealing to children's tactile, visual, and auditory senses and interacting directly with objects and peers may have caused similar results.

Comparison of the Experimental Groups with the Control Group

When comparing experimental group 1, which received the phonological awareness education program, with the control group based on the ELTKC and ELST final test results, a significant increase in the scores of experimental group 1 is observed. The results obtained are similar to the research results in the literature. The results obtained are similar to the research results in the literature. For example, In a study conducted by Bolduc (2009) examining the effect of a music education program on preschool children's phonological awareness skills, an experimental music education program was applied to the study group, while the control group followed the official curriculum of the ministry. The study results concluded that the experimental music education program was more effective in developing participant children's phonological awareness skills. On the other hand, in a study conducted by Bayraktar and Temel (2014), they found that the pre-literacy education program implemented with different activities and methods was influential on the reading comprehension, mechanical reading, and writing skills of children in the experimental group as they progressed to primary school education. Kelly et al. (2019), in their research examining the effect of a phonological awareness educational program with traditional materials on children aged 3.5 to 5.5 years, found that the word and alphabet awareness of the experimental group improved. The use of music as both an activity type and a method, starting from different activities and using materials children encounter in their daily lives, maybe the reason for the similarity with the research findings.

When comparing experimental group 2, which received the digital game-supported phonological awareness education program, with the control group based on the ELTKC and ELST final test results, it can be observed that experimental group 2 showed a better score increase than the control group. In a study conducted by Jadán-Guerrero et al. (2020), using both natural materials and a digital program with children aged 5-6 who had phonological awareness issues, it was concluded that the applied program had a positive impact on the development of children's phonological awareness skills. Weiss et al. (2022) prepared an online reading camp education program for five-year-old children. The research included five-year-old children from the experimental group, who participated in the online reading camp program, and the control group, who did not receive the education. The research results showed that children in the experimental group improved their phonological awareness and decoding skills compared to the control group. The study aligns with previous research findings, and it can be said that the implemented digital game-supported phonological awareness education program contributes to children's phonological awareness skills.

Again, when comparing experimental group 3, which received the digital game-based phonological awareness education program, with the control group based on the ELTKC and ELST final test results, it can be observed that experimental group 3 scored higher than the control group. The implemented digital game has contributed to the children's phonological awareness skills. While there may not have been specific

content related to syllable skills in the digital game used in the study by Li et al. (2020), the progress in syllable skills observed in children could be attributed to their age. However, the difference in the study could also be because the digital game content was prepared following the ranking of phonological awareness skills and the educational program was developed based on a spiral approach. In their research, Da Silva et al. (2022) examined the impact of digital games on literacy skills in groups of 4-year-old children consisting of four experimental groups and a control group. They found that the experimental groups scored higher than the control group in phonological, syllable, and rhyme awareness skills. Oliva-Maza et al. (2021) developed an adventure-themed digital game to support phonological awareness skills in four preschool-age children aged 5-6. During the game process, children were required to complete different tasks related to phonological awareness in each section. At the end of the process, it was concluded that the adventure-themed digital game supported children's phonological awareness skills. The research aligns with the findings of previous studies.

Examination of the Persistence of the Experimental Groups

When examining the ELTKC retention test results, it was concluded that the education programs applied to experimental group 1, 2, and 3 had a retention effect. Additionally, an increase in the scores of experimental group 2 was observed in the ELTKC retention test results. According to the ELST retention test findings, it was determined that the education programs applied to experimental group 2 and 3 had a retention effect. Furthermore, an increase in the ELST retention test results was observed in experimental group 3. According to the ELST retention test findings, it was concluded that there was a decrease in the scores of experimental group 1. However, it was also determined that there was no significant difference in the ELST subtests between the final test and the retention test for experimental group 1. Therefore, while the education program applied to experimental group 1 had a retention effect on the ELST subtests, it did not affect the overall results. The applied phonological awareness, digital game-supported phonological awareness, and digital game-based phonological awareness education programs had a retention effect. In their study, Çetin (2019) found that the early literacy program they implemented had a lasting effect on phonological awareness skills. Similarly, Dinler and Cevher Kalburan (2021) concluded that the poetry-supported education program had a lasting effect on word, rhyme, initial/final sound, and syllable awareness skills. Van der Kooy-Hofland et al. (2012) determined that a computer game focused on names and sounds had a lasting effect on children's phonological awareness skills. Sá et al. (2022) developed a digital game to support phonological awareness skills and found that the developed digital game had a lasting effect on children's phonological awareness skills. It is essential to review and repeat information and experiences periodically. Repeating with both new and previously learned words helps achieve lasting learning (Beers et al., 2010). The research findings and the existing literature in the field support the results of the conducted study.

Upon analyzing the data obtained from the research, it can be concluded that the phonological awareness education program (experimental group 1), the digital game-supported phonological awareness education program (experimental group 2), and the digital game-based phonological awareness education program (experimental group 3) are all effective programs. Additionally, the findings suggest that the most effective

among the implemented education programs is the phonological awareness education program (experimental group 1). Furthermore, it can be interpreted that the digital game-supported phonological awareness education program (experimental group 2) is more effective than the digital game-based phonological awareness education program (experimental group 3). In the education program applied to Experimental Group 1, the inclusion of materials from children's daily lives and the use of different materials, intensive interaction with peers and the educator, high participation in the education process with their thoughts and actions, and the use of different methods and techniques may have made this education program more effective. The lack of interaction with both the game and peers during the digital game process, the absence of an adventure element, and the fact that it was played on a smart board instead of a tablet may have caused experimental group 3 to be less effective than the other groups.

Implications

With the development of artificial intelligence and different digital applications, studies can be carried out by developing games for phonological awareness that can be played with individual tools, where children are more active, can make changes in the game, and interact more with their peers and the game. For digital games to support the education process, games that match the theme used in the education process and the game theme can be used. Family-based or family-participated interventions using digital games for phonological awareness development can also be investigated. The effect of phonological awareness skills on cognitive and social development can be investigated. Moreover, the research process for implementing various educational programs can explore children's participation, willingness, and motivation. During the education process, phonological awareness skills (combining sounds, making sounds, etc.) can be included, taking into account the developmental characteristics of children.

No financial support was received from any institution for this research. Technical support was obtained for developing the digital game created for the research. We want to express our gratitude to Sekizdesekiz Group for their contributions.

Statement of Responsibility

Both authors contributed to the work. The initial conceptualization and drafting of the original text were carried out by Göle. Methodological design was carried out by Göle and Temel and analysis by Göle. Data, Software and Visualization are carried out to the lake. Writing, Revision by Göle and Temel, and Editing by Temel and Göle.

Conflicts of Interest

There are no conflicts of interest among the authors in this research. Furthermore, there are no conflicts of interest with any institution.

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