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RESEARCH ARTICLE

The Effect of Sustainability Education Integrated with the e-Book on the Environmental Attitudes of Preschool Children

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Abstract

The goal of this study was to ascertain the influence of a sustainability education program combined with picture e-books created in a digital environment in accordance with the literature on environmental sustainability on the environmental attitudes of 57–72 (on average 63 months) preschool children. The sample of the study was determined as 24 children, 10 of whom were in the experimental group and 14 of them were in the control group, between 57 and 72 months old, attending an official preschool education institution affiliated with the Ministry of National Education in the Cukurova district of Adana province. The study's data collection method was the "Attitude Toward Environment Scale: Environmental Attitude Scale toward Children (Preschool Version)." For 8 weeks, the experimental group received e-book "Integrated Sustainability Education as part of the study. After the three picture ebooks prepared by the researcher were shared interactively with the children, supportive activities were implemented. The Mann–Whitney *U*-test and Wilcoxon signed-rank test were used to examine the study's data. In the research, it was concluded that sustainability education integrated with e-Book is effective in developing positive attitudes towards the environment.

Keywords: Environmental sustainability, picture e-books, preschool education, sustainability education

Introduction

The concept of sustainability, which started to be used in the 1970s, was officially included and defined in the "Our Common Future" report published by the United Nations World Commission on Environment and Development in 1987 (Onder & Ozkan, 2013). In the report Our Common Future, sustainability is defined as "meeting the needs of the present without compromising the ability of future generations to meet their own needs" (WCED, 1987). The basis of sustainability is the efficient use of natural resources, reduction of consumption and recycling of consumed waste, protection of natural resources to meet the needs of future generations, and measures for this (Onder & Ozkan, 2013). Sustainable development includes targeting and creating a road map for a more just and equal world in terms of living rights, where sustainable production and consumption are common, where individuals take precautions against the climatic changes experienced, and are aware of the situations that threaten biological diversity (Bulut & Polat, 2019). Societies are responsible for leaving a legacy of sustainable living conditions to future generations while using their present assets effectively. The understanding of sustainable development that emerged with this obligation includes environmental, economic, and social sustainability subdimensions. The society subdimension includes the decisive roles of social institutions in development, the determination of governments in a free and democratic environment, and democratic practices that support the resolution of differences. The environment subdimension includes

awareness of the limited resources of the physical environment, its depletion, and the effect of people on it. The economy subdimension includes awareness of the effects of economic development on society and the environment (UNESCO, 2005).

In order to transfer sustainable living conditions to future generations, sustainability education aims to raise individuals who are aware of environmental changes and can take an active role in society, by protecting natural resources, by realizing sustainable production and consumption, and recycling. The process of teaching sustainability begins at home and continues in the classroom. If the family does not provide an educational opportunity in this regard, the environmental sustainability education that will be offered to the child at school becomes even more important. Teachers and students should be made aware of environmental sustainability in the best possible way (Unal, 2011). If environmental sustainability is tried to be realized through education starting from preschool, it is possible to raise awareness of individuals about sustainability and the environment throughout their entire lives (Onder & Ozkan, 2013). Sustainability themes of the Early Childhood World Organization can be used to raise awareness about sustainability in education (Kahriman-Ozturk et al., 2012). According to Duncan (as cited in Kahriman-Ozturk et al., 2012), these themes, also known as 7R's, are Reduce (reduce), Reuse (reuse), Respect (respect), Reflect (express what you think), Recycle (recycling), and Redistribute (sharing resources equally). The theme "Reduce" is to maintain the same living conditions by reducing consumption; explaining, Rethink

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(inquiring) carrying out its actions by considering all living things in nature, Recycling (recycling) taking responsibility for the sorting and recycling of wastes, Redistribute (sharing resources equally) as sharing limited resources by considering disadvantaged situations.

Preschool is a time of strong curiosity and interest in the world around them, as well as a time of quick learning and development. With positive experiences in the preschool period, awareness can be created in children about the sustainability of biological diversity and natural resources, and the evaluation of environmental problems and solutions (Bulut & Polat, 2019). In their study, Samuelsson and Park (2017) emphasized the necessity of education for environmental sustainability in the preschool period. They said that it should be the duty of teachers to help every child understand that they are a part of a wider world and to seek out a more sustainable environment for the future. Children need to be actively trained to promote sustainability and solutions in partnership with adults since they are a part of social reality. Teachers must guarantee that the next generation is interested in establishing a sustainable future by laying the groundwork for young children's sustainable learning (Samuelsson & Park, 2017). Children who pay attention to environmental problems and recycling from an early age will have a high tendency to maintain these attitudes and behaviors for life. Considering that children can think about environmental problems in the first years of education, it is known that the sooner children are aware of the sustainability of the environment, the more effective sustainability will be in the society (Siraj-Blatchford et al., 2010). This training will be more effective if it can be started at an early age. Because the value judgments and attitudes that the child acquires in the preschool period are very important for him to develop empathy in his relations with the environment and to approach the environment with love. The development of empathy and love for the environment will also bring environmentally friendly behavior toward environmental problems. Learning in the affective domain will be effective in the development of environmentally conscious behaviors in individuals (Kahriman Ozturk & Guler Yildiz, 2018, p. 279). The importance of education on environmental problems and the sustainability of the environment in the preschool period will ensure that environmental problems are prevented before they occur, and it will be a protective measure against environmental problems (Gulay & Oznacar, 2010).

Children's picture books are an effective tool for preschool children to gain awareness about the target subject. Children's picture books, with their interesting pictures, not only attract children's attention to the subject but also enable them to gain awareness about it. After reading children's books about environmental sustainability, talking about the book, listening to children's ideas, enlivening the plot, and completing the process with supporting activities will help children acquire positive attitudes and behaviors toward environmental sustainability.

Preschool period e-books, which emerged with the new developments in children's literature, visual and audio effects prepared in an electronic environment or transferred to the electronic environment for children aged 3–6, allowing interaction with multimedia elements, displayed with an electronic device, are resources that aim to support the development of the child (Bozkurt Yukcu et al., 2019). One of the most striking features of picture e-books offered to children in the digital environment is the way readers interact with the elements of the application. Digital picture e-books now offer standard page-turning and indexing features, as well as screen features where readers can tap and swipe the screen to produce sound (Serafini et al., 2016). In e-books in digital media prepared for children, the writing varies according to age group. Picture e-books, which are expected to have the same features as traditional children's books, also have the feature of vocalizing the content (Bozkurt Yukcu et al., 2019). It is recommended that the background vocalizations used in e-books be presented in harmony with the visual content, and if they are supported by music, soft music should be preferred (Sari, 2018). In addition to the audio content, the visual

effects in e-books support children's ability to understand the plot and learn new words (Sari, 2018). In addition, e-books increase children's phonological awareness, as they provide the opportunity to listen again and again (Kucukoglu, 2020). Reich et al. (2019) stated in their studies that e-books should also meet the criteria of suitability for education, like printed books, and suggested that innovations that will improve understanding of e-books should be realized. In addition to encouraging children's individual learning, e-books need adult support for the effective and correct use of these materials and the management of time spent with the material (Kucukoglu, 2020).

When the literature is examined, it is seen that the studies on e-books have increased in recent years. These studies have shown that digital media stories support children's digital literacy skills, mathematics achievement, auditory processing skills, learning and renewal skills, and listening skills (Åberg et al., 2013; Aydin, 2019; Karademir, 2020; Kiriscigil Dogan, 2012; Kucukoglu, 2020; Mikelic Preradovic et al., 2013; Ture Kose, 2019). Richter and Courage (2017) aimed to evaluate the tendencies of preschool children in attention, participation, communication, and remembering the content of the story during the stories they listen to from e-books and printed books. According to the study's findings, children took twice as long to finish the electronic book as adults did. However, children engaged with the e-books more actively. Additionally, it was claimed that there was little difference between the application of an e-book and a printed book in terms of recalling the story's content. Ture Kose (2019) stated that the impact of digital storytelling is favorable for preschool children's discriminating, selective, empathetic, creative, critical, and active listening skills. In addition, digital stories are seen as an alternative material that can be used in preschool science activities (Yilmaz & Sigtirtmac, 2020).

In recent years, due to changing environmental conditions and future concerns, the importance given to the environment and the studies prepared on this subject have increased. According to these studies, children's environmental awareness may be made more favorable (Alan, 2014; Alparslan, 2019; Borg & Prambling-Samuelsson, 2019; Cengizoglu, 2013; Ferreira et al., 2016; Guzelyurt & Ozkan, 2019; Kahriman Ozturk, 2010; Karahan Aydin, 2019; Karimzadegan & Meiboudi, 2013; Korkmaz, 2014; Mahat et al., 2018; Ozkan et al., 2019; Ozcelik Akay, 2022; Salonen & Tast, 2013; Uslucan, 2016; Yurttas, 2023). There are limited studies showing that picture books are useful in fostering environmental consciousness among children (Bicer, 2020; Polat, 2021). However, these studies also focused on the story method and printed books. There was no study on how e-books affect kids' views about the environment in the pertinent literature evaluation. This study is significant since there are not many studies on the topic of sustainability in early childhood education, environmental sustainability, and e-books in the literature. In addition, the suspension of face-to-face education in some periods due to the pandemic in preschool education institutions has brought digital resources to the fore. For this reason, it is thought that e-books that can be used actively in the digital environment will be effective in the efficient realization of preschool education. This research is important because it is a study that evaluates the effect of e-books on sustainability education. It is predicted that the results of this research will be a source for sustainability skills, contribute to the awareness of teachers about the education to be given to children with the aim of environmental sustainability, and raise awareness of parents about environmental sustainability.

The research's problem is, "Is there an effect of sustainability education integrated with e-books on the environmental attitudes of children aged 57–72 months (average 63 months) attending preschool education?"

Objective

The aim of this research is to determine the effect of the sustainability education program integrated with picture e-books on

environmental sustainability on the environmental attitudes of 57–72 (average 63 months) preschool children.

Subtargets

- Are there any appreciable differences in the pretest scores of children in the experimental and control groups who range in age from 57 to 72 months (on average 63 months) regarding their views toward the environment?
- Are there any appreciable differences in the posttest scores of children in the experimental and control groups who range in age from 57 to 72 months (on average 63 months) regarding their views toward the environment?
- Are there any appreciable differences in the pretest–posttest scores of children in the experimental and control groups who range in age from 57 to 72 months (on average 63 months) regarding their views toward the environment?

Methods

The pretest–posttest unequalized control group model, one of the semitrial models, was used in this study to investigate the impact of the sustainability education program integrated with picture e-books created in the digital environment in accordance with the literature on environmental sustainability on the attitudes of preschool children toward the environment. By methodically adjusting the independent variable or variables, the cause-and-effect relationship between the independent variable and the dependent variable is examined in experimental research. Quasi-trial models are research designs in which random assignment to the experimental and control groups cannot be made in educational environments where it is difficult to disrupt the classroom routine and reorganize it. In the pretest–posttest unequalized control group model, the existing groups are randomly determined as the experimental and control groups (Sen & Yildirim, 2019).

Ethics and Permissions in Research

Research permissions were obtained with the letter numbered 43362 dated March 1, 2021, from the Directorate of Social Sciences Institute of Cukurova University. In addition, within the scope of the research, the approval of Adana Governorship with the number 23579472, the letter from the Adana Provincial Directorate of National Education with the number 23623628, the letter numbered 23698153 from the Cukurova District Directorate of National Education, and the permissions for the implementation of the research were obtained. Before the application, the researcher informed the parents about the research and obtained permission from the parents with the Parent Consent Form.

Universe and Sample

Children between the ages of 57 and 72 months (average 63 months) who were enrolled in preschool educational facilities in the central districts of the province of Adana during the spring semester of the academic year 2020–2021 are included in the study.

The sample of the study was determined as a control group and an experimental group of 57–72 months (average 63 months) attending an official preschool education institution affiliated with the Ministry of National Education in the Cukurova district of Adana province. The study's sample comprises 24 children, of whom 10 children (6 boys and 4 girls) are in the experimental group and 14 children (9 boys and 5 girls) are in the control group. It was established that the experimental and control groups in the study were unbiased. Experiment and control groups were selected from different periods of kindergarten, morning and afternoon, in order not to affect the parents and children related to the education given during the application process of the research.

In order to be able to easily implement the education program, which is appropriate for both in-person and online learning, the possibility of

schools to switch to distance education during the application process of the research and the participation rates of the children in the school selected in the previous term were taken into consideration in school selection. Due to the options provided by the kindergarten, a convenient sampling approach was used to identify the research sample, the large number of classes, the interest of school administrators and teachers in scientific research, and the low number of children attending school in other preschool education institutions due to the pandemic.

Data Collection Tools

As a research tool for gathering data, “Attitude Scale Toward Environment (CATES-PV): Environmental Attitude Scale Toward Children (Preschool Version),” it was created by Musser and Diamond in 1999, Turkish translation provided by Kahrman Ozturk in 2010, and customized for use with children in accordance with the original work by the same authors. In addition, a form collecting personal data that was created by the researcher was used to collect demographic information about children and their parents (Kahrman Ozturk, 2010).

The Environmental Attitude Scale (CATES-PV), developed by Musser and Markus (1996) to measure children's attitudes toward the environment, consists of 25 items. This scale was adapted to preschool children with 15 questions by Musser and Diamond (1999), excluding 10 questions that were not suitable for preschool children. The scale has an acceptable reliability with a Cronbach Alpha value of 0.68 (Kahrman Ozturk, 2010).

The scale, which Kahrman Ozturk (2010) translated into Turkish, consists of 15 image questions broken down into 4 subdimensions. Scale questions were prepared by using appropriate pictures in the subdimensions of consumption patterns (water, paper, and electricity consumption), environmental protection (plants, animals, and environmental pollution), recycling-reuse, and living habits (playground and housing preferences) (Kahrman-Ozturk et al., 2012). The child is shown each picture in the scale by the researcher. “Which of these children do you look like the most?” he would ask. After the child shows his answer, “Do you always act like this or only occasionally?” he would ask. If the child responds positively and states that he would always behave like this, 4 points can be obtained; a maximum of 60 points and a minimum of 15 points can be obtained from the scale.

Sustainability Training Integrated with e-Book

The study's findings revealed that Turkish e-books for preschoolers are uncommon in the area of environmental sustainability. For this reason, the story and pictures of the three picture e-books were created by the researcher in line with both the environmental sustainability literature and the smaller variations of the Children's Attitudes Toward the Environment Scale—Preschool Version (CATES-PV). The e-book “The Seed of What?” supports the environmental protection subdimension of the scale, the e-book “We're All Satisfied!” supports the recycling-reuse, living habits subdimension, and the e-book “Isn't There Another Way?” supports the consumption patterns subdimension. Using the insights of subject-matter specialists, the books were edited and voiced by the researcher.

In the 8-week educational program of the research, after three picture e-books were shared interactively with the children, supportive activities were implemented. The education program has been prepared in accordance with the environmental sustainability literature, in a way that will enable children to gain awareness about environmental sustainability. The activities included in this program are presented in Table 1.

In the context of the study, while the MNE (2013) Pre-School Education Program as well as Sustainability Education, integrated with the e-book, was carried out for the experimental group, only the

Table 1.
Sustainability Training Integrated with e-Book

	Event Name	Event Type
Week 1	The Seed of What? (Day 1)	Integrated Turkish, Science Activity
	What's in Our School Yard? (Day 2)	Field Trip
Week 2	How Do Plants Germinate? (Day 1)	Science Activity
	We Are Making a Seed Ball (Day 2)	Science Activity
Week 3	We Are All Satisfied! (Day 1)	Integrated Turkish, Science Activity
	Enough for All of Us (Day 2)	Integrated Turkish, Science Activity
Week 4	We Prepare Bird Food (Day 1)	Integrated Science and Art Activity
	Let's Compost (Day 2)	Integrated Science and Mathematics Activity
Week 5	Is There Another Way? (Day 1)	Integrated Turkish, Science Activity
	How Is Electricity Produced? (Day 2)	Integrated Science, Drama Activity
Week 6	Inexhaustible Energy (Day 1)	Integrated Science, Literacy Preparation Activity
	Separating Waste (Day 2)	Integrated Science, Play Activity
Week 7	Let's Make Paper Pulp from Waste Paper	Science Activity
	Art by Upcycling	Integrated Science, Art Activity
Week 8	Art in Our Drying Waste Papers	Integrated Science, Art Activity
	Let's Wear Our Environmental Badges	Integrated Science, Turkish Activity

MNE (2013) Pre-School Education Program was applied for the control group.

Data Collection

Necessary permissions were obtained from the governorship prior to this research. It was conducted in an Adana preschool education institution connected to the Ministry of National Education. The school's administrative management and teachers to be implemented were interviewed, and necessary information was given about the implementation process. After discussing the implementation process with the teacher and the school administrative management, it was planned to be 2 days a week in accordance with the school activity hours, so as not to disrupt the school's education program. Before the application, the "Parent Consent Form" was used to gain the appropriate approvals from the parents after informing the families of both the experimental and control groups of children about the application's content. The experimental study's execution phase took place between March 1, 2021 and May 21, 2021. Before the data collection process, the researcher was involved in the daily education flow as an observer in the experimental and control group classes and spent a day each to get to know the children and to have an idea about the group characteristics.

In the pretest application, the researcher carried out the application of the scale in a quiet environment in rooms with the least distractions. While applying the scale, care was taken not to conflict with the activities that the group enjoyed very much, and the children were given the choice of whether or not to participate in this application. At the beginning of the application, the researcher had a conversation with the child; he stated that his aim when starting the application was to get to know him, that he wondered what he thought about the pictures to be shown, that there were no right or wrong answers to the questions, and

that they could take a break whenever they wanted. During the pretest application, a voice recording was taken, and the instructions of the scale were applied sequentially. Pretest applications lasted an average of 25–30 minutes for each child.

As for the Integrated Sustainability Education e-book, the researcher gave the experimental group training for 8 weeks, 2 days a week. This application was carried out in the children's own classrooms and school gardens. Before each application, the researcher completed the necessary preparations for the activity and planned the activity process. Within the scope of the flexibility basic feature of the Pre-School Education Program, which allows the teacher to make necessary changes according to daily and instant changes, instant solutions and arrangements were made in some applications in respect to the interests and questions of the children in the activity applications. Practices for activities typically lasted 40–50 minutes. At the end of the day when the activity was implemented, the parent information note prepared by the researcher was delivered to the parents. In this parent information note, information was given about the activity held that day within the scope of the program, and suggestions were made for supportive activities that families can implement with their children at home in the field of environmental sustainability. In this interaction with the parents, the parents gave positive feedback on the implementation process.

The posttest was administered to both the experimental and control groups after the e-book Integrated Sustainability Education, which was applied to the experimental group for 8 weeks.

Analysis of Data

Data analysis was done statistically using the Statistical Package for the Social Sciences Statistics 22.0 (IBM SPSS Corp.; Armonk, NY, USA) software. The results of the experimental and control groups' performance on the Attitudes Toward Environment Scale underwent both descriptive and inferential statistical analyses.

Since neither the experimental group nor the control group had more than 30 individuals, nonparametric tests were utilized, despite the fact that the study's data were distributed normally. The Mann–Whitney *U*-test was used to compare the pretest outcomes of the experimental and control groups in order to determine whether there was a significant difference. To see if the posttest scores varied between the experimental and control group variables, the Mann–Whitney *U*-test was utilized. The Attitudes Toward Environment Scale pretest and posttest scores for the experimental and control groups were compared using the Wilcoxon signed-rank test.

Results

In this part of the research, according to the subobjectives of the research, information on the pretest and posttest results of the experimental group, which implemented the e-book Integrated Sustainability Education in addition to the Ministry of National Education (MEB; 2013) Pre-School Education Program, and the control group, which implemented only the MEB (2013) Pre-School Education Program, is presented in tables.

According to the findings in Table 2, when the pretest mean scores obtained from the Environmental Attitude Scale were examined, the mean score of the children in the experimental group was 38.80; it is seen that the pretest mean score of the children in the control group is 42.57. When the table is examined, it is seen that while the posttest mean score of the children in the control group was 44.64, the posttest mean score of the children in the experimental group increased to 51.90.

Table 2.
Pretest–Posttest Mean Scores and Standard Deviations of Children in the Sample Group from the Attitudes Toward Environment Scale

Group	N	Pretest		Final Test	
		\bar{x}	S	\bar{x}	S
Experiment	10	38.80	5.53	51.90	3.92
Control	14	42.57	5.80	44.64	6.51

According to the findings in Table 3, when the Mann–Whitney U-test was used to assess if there was a significant difference between the experimental and control group variables in terms of the pretest scores from the Environmental Attitude Scale, it is seen that there is no significant difference between the groups ($z = -1.382$; $p > .05$).

According to the findings in Table 4, when the Mann–Whitney U-test was used to assess if there was a significant difference between the experimental and control group variables in terms of the posttest scores from the Environmental Attitude Scale, it is seen that there is a significant difference between the groups ($z = -2.676$; $p < .05$). This difference was in favor of the experimental group.

Wilcoxon signed-rank test was used to determine whether the pretest and posttest scores of the control group differed from the Environmental Attitude Scale. The results of this test are given in Table 5. When Table 5 is examined, it is seen that there is no significant difference between the pretest and posttest scores of the children in the control group ($z = -1.420$; $p > .05$).

Wilcoxon signed-rank test was used to determine whether the pretest and posttest scores of the experimental group differed from the Environmental Attitude Scale. The results of this test are given in Table 6. When Table 6 is examined, it is seen that there is a significant

Table 3.
Results of Mann–Whitney U-Test Conducted to Determine Whether Pretest Scores Differ According to Experimental and Control Groups' Variables

Groups	N	SR	MR	U	z	p	
Environmental Attitude Scale (CATES-PV)	Experiment	10	101.50	10.15	46.50	-1.382	.167
	Control	14	198.50	14.18			

Note: * $p < .05$, ** $p < .01$.

N: Number, SR: Sum of Ranks, MR: Mean Rank.

Table 4.
The Results of Mann–Whitney U-Test Performed to Determine Whether Posttest Scores Differed According to Experimental and Control Groups' Variables

Groups	N	SR	MR	U	z	p	
Environmental Attitude Scale (CATES-PV)	Experiment	10	170.50	17.05	24.500	-2.676	.007
	Control	14	129.50	9.25			

Note: * $p < .05$.

** $p < .01$. N: Number, SR: Sum of Ranks, MR: Mean Rank

Table 5.
Wilcoxon Signed-Rank Test Results Conducted to Determine Whether the Pretest and Posttest Scores of the Control Group from the Environmental Attitude Scale Differed

Groups	N	SR	MR	z	p	
Environmental Attitude Scale (CATES-PV)	Experiment	10	21.00	5.25	-1.420	.156
	Control	14	57.00	7.13		

Note: * $p < .05$. ** $p < .01$. N: Number, SR: Sum of Ranks, MR: Mean Rank

Table 6.
Wilcoxon Signed-Rank Test Results to Determine Whether the Pretest and Posttest Scores of the Experimental Group from the Environmental Attitude Scale Differed

Groups	N	SR	MR	z	p	
Environmental Attitude Scale (CATES-PV)	Experiment	10	0.00	0.00	-2.805	.005
	Control	14	55.00	5.50		

N: Number, SR: Sum of Ranks, MR: Mean Rank.

difference between the pretest and posttest scores of the children in the experimental group ($z = -2.805$; $p < .05$).

Discussion

In the research findings, the pretest mean scores of the experimental group and the control group did not significantly differ from one another, but when the posttest mean scores were compared, there was a significant difference in favor of the experimental group. This finding shows that the e-book Integrated Sustainability Education has a favorable impact on the environmental sustainability knowledge of preschool children. According to the conclusions of this study, activities integrated with children's books affect attitudes and environmental awareness. This is supported by a review of the pertinent literature. In his study, Polat (2021) concluded that the Environmental Education Program Based on Picture Books was successful in influencing children's environmental views and increased their ecocentric views. Similarly, Bicer (2020) discovered that the educational program based on the story method was effective in attitudes and awareness of children toward the environment, particularly in regard to consumerism, environmental conservation, recycling, and lifestyle choices. Hadzigeorgiou and Judson (2017) stated in their studies that story activities increase environmental awareness in children. The findings of this research agree with those of the current studies.

There are many studies in the literature on the effectiveness of e-books and digital stories in different age groups. For example, similar results were obtained in the experimentation of storytelling practice with early childhood children in the digital environment by Kocaman-Koroglu (2008). In the results of the study, which was planned to evaluate the effectiveness of stories in the digital environment in preschool education, it was revealed that preschool children better understand the content of digital media stories. Similarly, in the study of Aydin (2019) in which he examined the levels of understanding of classical and digital media stories of preschool children, the average total score obtained by children on the test of understanding digital media stories was 9.72, while 7.92 in classical stories. The effectiveness of digital stories and e-book materials can be seen when the studies on digital stories conducted at different educational levels are examined. Shamir and Korat (2007) concluded that the e-book materials they developed support the literacy skills of preschool children. In the study of Bal Cetinkaya (2015), in which he studied how arithmetic instruction aided by electronic textbooks affected fifth-graders' academic progress, a significant difference was observed in the group's favor in which the e-textbook was applied in terms of the permanence of the achievements gained by the students at the end of the unit. Similarly, Bilaloglu (2019) concluded in his study that digital storytelling has an advantageous impact on the improvement of primary school fourth-grade students' reading comprehension skills and reading motivation. In his research, Kardes (2020) concluded that enriched e-books create a positive perception of the lesson, provide the lesson's motivation and aid in the topics' learning. The results of the research carried out at different education levels in the literature also support the result of the current research. As a result of this research, it was concluded that e-books presented in the digital environment are effective in children's understanding

of the subject and their acquisition of knowledge (Aydin, 2019; Bal Cetinkaya, 2015; Bilaloglu, 2019; Karademir, 2020; Kardes, 2020; Kocaman-Karoglu, 2008). In addition to the studies that overlap with the findings of this study, some studies reach different findings. In the study of Kiriscigil Dogan (2012) in which the group to which the humanistic technique was applied was more successful in grasping the narrative than the group to which the e-book method was applied, according to research that examined the efficiency of humanistic and technical (e-book) methods in teaching tales to 5-year-old children.

Conclusion and Recommendations

The goal of this study was to ascertain the impact of a sustainability education program combined with e-books created in a digital environment on the environmental attitudes of preschoolers between the ages of 57 and 72 (on average 63 months). As a result of the research, the pretest scores of the children in the experimental group and the control group did not differ significantly. Still, there was a significant difference in the groups' posttest scores, favoring the experimental group. Comparing the experimental group to the control group, who received the e-book Integrated Sustainability Education, experienced a significant increase in their positive attitude toward the environment after the intervention. This situation revealed that the implemented e-book Integrated Sustainability Education was effective. The findings of this study demonstrated how using e-books together with sustainability activities helped children form favorable environmental views. This demonstrates how using e-book resources may help children understand the environment and sustainability and form positive attitudes. It also supports research that reveals that individuals should be supported from early childhood in order to develop positive attitudes and behaviors on environmental and sustainability issues.

Considering the results of the research, it has been understood that picture e-books are efficient in the attitudes of preschool children toward the environment. In this respect, it is recommended to encourage more effective use of picture e-books on both environmental sustainability and other subjects within the scope of preschool education. Preschool teachers can facilitate children's access to picture e-books prepared in a digital environment. In future studies, the effects of different methods (drama, games, projects, etc.) on children's sustainable attitudes toward the environment can be investigated. In addition, picture e-books' effect on children's knowledge, attitudes, and skills (problem-solving, creative thinking, etc.) on different subjects can be investigated. On the subject of environmental sustainability, digital story creation practices can be done with preschool children as a group or individually.

Limitations

There are several restrictions on this study. This research was executed in a kindergarten in Adana. Due to the increase in the coronavirus disease 2019 epidemic, there was a decrease in the number of children attending kindergarten during the research process. This situation also negatively affected the sample size of the study. This research was limited to 24 children who attended the preschool education institution continuously throughout the research process. Different results can be seen in other similar studies to be executed with different age and sample groups.

Ethics Committee Approval: Ethical committee approval was received from the Ethics Committee of Cukurova University (Approval no: E-96820157-044-86306, Date: 27/04/2021).

Informed Consent: Written informed consent was obtained from the participants who agreed to take part in the study.

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References

- Åberg, E. S., Lantz-Andersson, A., & Pramling, N. (2013). 'Once upon a time there was a mouse': Children's technology-mediated storytelling in pre-school class. *Early Child Development and Care*, 184(11), 1583–1598.
- Alan, U. (2014). *Investigating kindergarteners' views of nature of science* [Unpublished master's thesis]. Anadolu University.
- Alparslan, C. G. (2019). *The effect of different preschool education models on environmental attitudes and productivity of 54–66 months old children*. Bahcesehir University.
- Aydin, M. S. (2019). *An investigation on the level of understanding the classical and digital stories that preschool students aged 5–6 years listen to individually and in groups* [Master's thesis]. Recep Tayyip Erdogan University.
- Bal Cetinkaya, K. (2015). *Investigation of the effect of e-book assisted mathematics teaching on the academic success, permanence, and textbook perception of 5th grade students* [Master's thesis]. Yildiz Technical University.
- Bicer, M. (2020). *The effect of story-based environmental education program on environmental awareness and attitudes of 48–72 months old children* [Master's thesis]. Bolu Abant Izzet Baysal University.
- Bilaloglu, F. (2019). *The effect of digital storytelling on primary school fourth grade students' reading comprehension skills and reading motivation* [Master's thesis]. Bolu Abant Izzet Baysal University.
- Borg, F., & Pramling Samuelsson, I. (2019). *Education for sustainability in the new preschool curriculum in Sweden*. ECER 2019 Conference, Environmental and Sustainability Education Research.
- Bozkurt Yukcu, S., Izoglu Tok, A., & Bencik Kangal, S. (2019). The current situation of children's literature: A developmental overview of the preschool picture e-books. *Journal of Early Childhood Studies*, 3(1), 139–164.
- Bulut, Y., & Polat, O. (2019). Examination of the concept of sustainability in early childhood education. *Firat University FEAS International Journal of Economics and Administrative Sciences*, 3(2), 35–55.
- Cengizoglu, S. (2013). *Investigating potential of education for sustainable development program on preschool children's perceptions about human-environment interrelationship* [Unpublished master's thesis]. Middle East Technical University.
- Ferreira, M. E., Cruz, C., & Pitarma, R. (2016). Teaching ecology to children of preschool education to instill environmentally friendly behaviour. *International Journal of Environmental and Science Education*, 11(12), 5619–5632.
- Gulay, H., & Oznacar, M. D. (2010). *Environmental education activities for preschool children*. Pegem Publications.
- Guzelyurt, T., & Ozkan, O. (2019). Environmental education in pre-school period: A review of children's books. *Elementary Education Online*, 18(1), 20–30. [CrossRef]
- Hadzigeorgiou, Y., & Judson, G. (2017). Toward more effective storytelling for raising environmental awareness in young students. *Journal of Advances in Education Research*, 2(1), 12–18.
- Kahrman Ozturk, D. (2010). *Preschool children's attitudes towards selected environmental issues* [Master's thesis]. Middle East Technical University.
- Kahrman, D., & Guler Yildiz, T. (2018). Education for sustainability in early childhood. In B. Akman, G. Uyanik Balat, & T. Guler Yildiz (Eds.), *Science education in early childhood* (pp. 245–279). Memoir Publishing.
- Kahrman-Ozturk, D., Olgan, R., & Guler, T. (2012). Preschool children's ideas on sustainable development: How preschool children perceive three pillars of sustainability with the regard to 7R. *Educational Sciences: Theory and Practice*, 9, 2987–2995.
- Karademir, E. (2020). *Digital storytelling applications in the development of 21st century skills: Learning and renewal skills in a sample of gifted primary school students* [Master's thesis]. Anadolu University.

- Karahan Aydin, B. (2019). *Perceptions of preschool teachers towards sustainable environmental education* [Master's thesis]. Kocaeli University.
- Kardes, A. (2020). *Developing an enriched e-book for robotic coding teaching* [Master's thesis]. Afyon Kocatepe University.
- Karimzadegan, H., & Meiboudi, H. (2014). Effectiveness of environmental education on environmental knowledge of kindergarten children in Rasht city. *Journal of Environmentally Friendly Processes*, 1(4), 2326. [CrossRef]
- Kiriscigil Dogan, F. (2012). *Comparison of humanistic and technological methods in fairy tale teaching in preschool period* [Master's thesis]. Necmettin Erbakan University.
- Kocaman-Karoglu, A. (2008). *A digital storytelling implementation experience with early childhood students*. AACE.
- Korkmaz, A. (2014). *Evaluation of preschool educational institutions using eco-school program for education for sustainable development* [Unpublished master's thesis]. Hacettepe University.
- Kucukoglu, E. (2020). *Development of preschool auditory processing test (PAP) and investigation of the effect of e-book materials on the auditory processing skills of 60–72 months old children* [Doctoral thesis]. Marmara University.
- Mahat, H., Hashim, M., Saleh, Y., Nayan, N., & Norkhaidi, S. B. (2019). Environmental sustainability knowledge, attitude and practices among pre-school students. International geography seminar IOP Conf. series. *IOP Conference Series: Earth and Environmental Science*, 286(1). [CrossRef]
- Mikelic Preradovic, N., Lesin, G., & Boras, D. (2013). Introduction of digital storytelling in preschool education: A case study from Croatia. *Digital Education Review*, 30, 94–105.
- MNE. (2013). *Preschool Education Program*. Minister of National Education Publishing House.
- Onder, A., & Ozkan, B. (2013). *Environmental education with activities in sustainable child development preschool period*. Memoir Publishing.
- Ozcelik Akay, C. (2022). *Investigation of the effect of using web 2.0 tools in environmental education on the environmental attitudes of pre-school children* [Unpublished master's thesis]. Ankara University.
- Özkan, B., Tuğluk, M. N., & Yiğitalp, N. (2019). Environmental sustainability scale for children 60–72 months old: A validity and reliability study. *Journal of Education and Training Studies*, 8(1), 32–41. [CrossRef]
- Polat, P. (2021). *The effect of the environmental education program based on picture books on the environmental attitudes and views of preschool children* [Doctoral thesis]. Cukurova University.
- Prambling Samuelsson, I., & Park, E. (2017). How to educate children for sustainable learning and for a sustainable world. *International Journal of Electronic Commerce*, 49, 273–285. [CrossRef]
- Richter, A., & Courage, M. L. (2017). Comparing electronic and paper storybooks for preschoolers: Attention, engagement, and recall. *Journal of Applied Developmental Psychology*, 48, 92–102. [CrossRef]
- Salonen, A. O., & Tast, S. (2013). Finnish early childhood educators and sustainable development. *Journal of Sustainable Development*, 6(2), 70–85. [CrossRef]
- Sari, B. (2018). *The effects of electronic storybooks on meaningful word acquisition of 4–6 years old children from different socio-economic status* [Doctoral thesis]. Uludag University.
- Sen, Y., & Yildirim, I. (2019). *Research methods in education*. Nobel Publishing.
- Serafini, F., Kachorsky, D., & Aguilera, E. (2016). Picture books in the digital age. *Reading Teacher*, 69(5), 509–512. [CrossRef]
- Shamir, A., & Korat, O. (2008). Developing an educational e-book for fostering kindergarten children's emergent literacy. *Interdisciplinary Journal of Practice, Theory, and Applied Research*, 24, 125–143.
- Siraj-Blatchford, J., Smith, K. C., & Samuelsson, I. P. (2010). Education for sustainable development in the early years. [https://scholar.google.com.tr/scholar?hl=tr&as_sdt=0,5&q=\(Siraj-Blatchford,+Smith+and+Prambling+Samuelsson,+2010\)](https://scholar.google.com.tr/scholar?hl=tr&as_sdt=0,5&q=(Siraj-Blatchford,+Smith+and+Prambling+Samuelsson,+2010))
- Ture Kose, H. B. (2019). *The effect of digital storytelling on listening skills in preschool children* [Unpublished master's thesis]. Kültürya Dumlupınar University.
- Unal, F. (2011). The place of water in sustainable environmental education in primary education. *Science and Education in the Light of Reason*, 132, 68–73.
- UNESCO. (2005). UN Decade of education for sustainable development 2005–2014: the DESD at a glance. <https://unesdoc.unesco.org/ark:/48223/pf0000141629>
- Uslucan, S. (2016). *The effect of environmental education program on the attitudes of pre-school children (60–72 months) towards the environment (Çanakkale province sample)* [Unpublished master's thesis]. Canakkale Onsekiz Mart University.
- WCED. (1987). Report of the world commission on environment and development our common Future. https://www.are.admin.ch/are/en/home/sustainable-development/international-cooperation/2030agenda/un_-milestones-in-sustainable-development
- Yilmaz, M. M., & Sığirtmac, A. (2023). A material for education process and the Teacher: The use of digital storytelling in preschool science education. *Research in Science and Technological Education*, 41(1), 61–88. [CrossRef]
- Yurttas, A. (2023). Perceptions of preschool five-year-old children about environmental problems. *Trakya Journal of Education*, 13(1), 695–710.