International Research in Geographical and Environmental Education

ISSN: 1038-2046 (Print) 1747-7611 (Online) Journal homepage: www.tandfonline.com/journals/rgee20

Green futures begin early: a case study of preschool children's waste-related environmental knowledge and attitudes

Zeynep Aslı Ariman, Tuğba Abanoz, Ayşe Özgün Çelik, Sultan Irmak Hortoğlu & Nursena Kartal

To cite this article: Zeynep Aslı Ariman, Tuğba Abanoz, Ayşe Özgün Çelik, Sultan Irmak Hortoğlu & Nursena Kartal (23 Feb 2026): Green futures begin early: a case study of preschool children's waste-related environmental knowledge and attitudes, International Research in Geographical and Environmental Education, DOI: 10.1080/10382046.2026.2633149

To link to this article: https://doi.org/10.1080/10382046.2026.2633149

Published online: 23 Feb 2026.

Submit your article to this journal

View related articles

View Crossmark data

Full Terms & Conditions of access and use can be found at
https://www.tandfonline.com/action/journalInformation?journalCode=rgee20

INTERNATIONAL RESEARCH IN GEOGRAPHICAL AND ENVIRONMENTAL EDUCATION
https://doi.org/10.1080/10382046.2026.2633149

Routledge
Taylor & Francis Group

Check for updates

Green futures begin early: a case study of preschool children's waste-related environmental knowledge and attitudes

Zeynep Aslı Ariman, Tuğba Abanoz, Ayşe Özgün Çelik, Sultan Irmak Hortoğlu and Nursena Kartal

Faculty of Educational Sciences, Department of Early Childhood Education, Ankara University, Ankara, Turkiye

ABSTRACT

This study aimed to examine the how a teaching intervention implemented in a preschool setting influenced children's knowledge about the importance of protecting the environment, their awareness of recycling, and their active participation in environmental protection through specifically designed educational activities.To achieve this goal, 25 children aged 5–6 years (12 girls and 13 boys) participated in the study, which was designed as a case study within qualitative research methods. Over an eight-week implementation period, Environmental Education (EE) activities were conducted once a week at a preschool in Ankara, Turkey. To collect data, a semi-structured interview form was utilized, and the data was analyzed using content analysis. The research findings revealed that environmental education significantly enhanced children's understanding of the importance of environmental protection. Their awareness of recycling increased, and they became more actively engaged in environmental conservation, particularly in maintaining cleanliness and promoting recycling practices.

KEYWORDS

Early childhood; environmental education; recycling; waste management; sustainability

SUSTAINABLE DEVELOPMENT GOALS

SDG 12: Responsible consumption and production; SDG 15: Life on land

Introduction

The increasing population and industrial activities in today's world have led to the depletion of natural resources and an increase in waste. Consequently, environmental issues are on the rise, and globally, challenges such as air pollution, water pollution, global warming, and plastic waste in the oceans are becoming critical (Demir, 2025). Among these, waste management through recycling, reuse, and reduction has gained particular importance as a concrete way to mitigate environmental problems and sustain natural resources for future generations. Universally, every child has the right to grow up, receive education, and develop in a healthy environment (United Nations Convention on the Rights of the Child [UNCRC], [United Nations, 1989]). Adults,

CONTACT Tuğba Abanoz tugbabaskent@gmail.com, tabanoz@ankara.edu.tr Department of Early Childhood Education, Faculty of Educational Sciences, Ankara University, Ankara, Turkiye.

© 2026 Informa UK Limited, trading as Taylor & Francis Group

including educators, have the responsibility not only to provide these rights but also to teach children their roles in caring for the environment (UNICEF, 2018). One of these roles is understanding and practicing responsible waste management, which can be fostered form early childhood onward through Environmental Education (EE) (Environment Foundation of Turkey, 2007). There is an urgent need to strengthen EE so that people become more aware of and responsible for protecting the environment (Yadav et al., 2022). EE in early childhood can establish a strong foundation for fostering appreciation and care for nature, nurturing pro-environmental attitudes and behaviors, and ultimately promoting the development of environmentally literate individuals (Ardoin & Bowers, 2020; Gugssa, 2023).

In Turkiye, the Preschool Education Program implemented between 2013 and 2023 was revised by the Ministry of National Education (MoNE) in 2024. In the revised program, integrated skills and sub-learning outcomes related to the environment, EE, and sustainability are embedded within the domains of science, social studies, physical and health education, and music. It emphasizes the importance of outdoor learning centers and encourages the use of temporary learning spaces to support experiental learning. Incorporating environmental events such as *Animal Protection Day* or *Forest Week* into these settings can strengthen children's understanding and long-term engagement with EE (Yaşar Ekici, 2025). Also, EE has been progressively incorporated into national school curriculum. Since 2022–2023 academic year, the MoNE has introduced an elective course titled *Environmental Education and Climate Change* for middle school students (grades 6–8) (MoNE, 2022).

Given the growing recognition of EE as a critical component of early childhood education, it is important to examine how research has addressed the role of EE in fostering young children's environmental awareness and behaviors, particularly in relation to waste management.

Review of existing research on environmental education in early childhood

Research on pro-environmental behavior has moved beyond early linear models that assume a direct progression from knowledge to attitudes and behavior. Current perspectives emphasize that children's pro-environmental behavior emerges from the interaction of multiple factors, including individual values, social influences, perceived behavioral control, and contextual conditions. As highlighted by Kollmuss and Agyeman (2002), environmental knowledge alone is insufficient to produce behavior change. Recent systematic reviews further demonstrate that factors such as parental influence, contact with nature, and socio-environmental contexts jointly shape children's pro-environmental behaviors, and that the transition form intention to action is complex and non-linear (Liu & Green, 2024).

Within this multifactorial and non-linear framework, EE plays a central role in shaping children's pro-environmental behaviour. EE has been shown to significantly foster pro-environmental behaviors related to waste reduction, reuse, and recycling by enhancing children's environmental knowledge, attitudes, and perceived behavioral control (Liu & Green, 2024). Studies in diverse contexts reveal that when children engage in EE programs emphasizing hands-on waste sorting, recycling, and creative

reuse, they are more likely to adopt sustainable waste habits both at school and at home (Sihvonen et al., 2024). For example, research conducted in Chile demonstrated EE programs in early childhood can positively shape children's values and habits, fostering more sustainable consumption and plastic waste disposal behaviors (Salazar et al., 2024). Similarly, a comparative study conducted in England and Poland revealed that even from the age of four, children are capable of developing a sophisticated understanding of waste issues. The study emphasized that structured teaching materials, well-designed educational programs, and effective teacher preparation are critical to promoting such understanding and fostering holistic approaches to waste management education (Palmer et al., 2003). These findings collectively indicate that EE not only builds cognitive awareness but also cultivates emotional engagement and action-oriented habits, key drivers of responsible waste management behaviors from an early age. Embedding such experiences in early childhood setings enables children to perceive waste as a resource rather than a problem, promoting lifelong environmental responsibility. Using this as a guide, we focused on both the knowledge and attitudes related to waste management, which represent key components of EE.

EE partially involves providing information, thereby increasing children's knowledge about the environment. The efforts in EE have a common goal worldwide to enhance and sustain environmental quality and prevent future environmental problems. EE essentially entails the collaborative and democratic engagement of children, educators, and communities in addressing environmental questions, issues, and challenges (Davis, 1998). EE is a comprehensive process aimed at enhancing the understanding of individuals, communities, and organizations regarding the environment, equipping them with the skills to analyze environmental issues, and enabling them to make informed and responsible decisions to protect it. It holds the potential to transform lives and society, catalyzing awareness, inspiration, and action. As a critical tool, EE contributes to fostering healthier communities and promoting civic engagement (North American Association for Environmental Education [NAAEE], 2021). Students learn about global warming, solid waste, and other environmental issues; they learn about ecology and how the world operates; they learn about the consequences of environmental degradation and discover their roles in the emergence and prevention of environmental problems (Environment Foundation of Turkey, 2007). The first years of life are critical for the development of positive environmental attitudes and behaviors that can last a lifetime (Güler Yıldız, 2017; Lamanauskas, 2023), and EE during this period serves as an effective means of enhancing children's environmental knowledge, attitudes, intentions, and behaviors (Erdaş Kartal & Ada, 2020; Lubomira, 2004; Tunçeli & Zembat, 2017; van de Wetering et al., 2022).

Research shows that a substantial portion of what individuals learn throughout their lives is acquired during this period, particularly in the preschool years, when children actively observe, explore, and learn about their surroundings (Önder & Özkan, 2013). The opportunities and guidance provided by adults during this formative stage play a pivotal role in shaping children's future experiences, leaving lasting impressions that influence their lifelong development (Önder & Özkan, 2013; Sanginova, 2024; Tran, 2024). As Bailie (2012) also emphasizes, integrating early

childhood education with EE creates a more impactful approach than implementing either independently.

An increasing focus is being placed on integrating sustainable practices into daily experiences and early childhood education programs (Li et al., 2019). Despite the inclination of early childhood children toward environmental topics, many studies report that early childhood educators do not provide opportunities for EE for sustainability to children (Collins & Garrity, 2025; Ginsburg & Audley, 2020; Köklü Yaylacı & Feriver, 2020).

Education for Sustainable Development (ESD), commonly referred to as the Brundtland report, is the contemporary equivalent of EE. "Development that meets the needs of the present without compromising the ability of future generations to meet their own needs" is how EE was defined in this report (Acosta Castellanos & Queiruga-Dios, 2022, p. 623). Philosophically, this reflects the principle of intergenerational equality, emphasizing the importance of thinking not only about current needs but also about the well-being of future generations. In this way, sustainability becomes a rejection of self-centeredness and a call for shared responsibility. In education practices for sustainable development, there are integrated and open-to-development program titles including future education, citizenship, peace education, multiculturalism, gender education, health education, environmental education, and media literacy (Samuelsson, 2011). EE and ESD share common goals, but ESD extends EE by explicitly integrating economic and social dimensions alongside environmental concerns. ESD encourages a transformative and action-oriented approach that equips learners with the skills to make informed decisions for sustainable living (Scott & Vare, 2020). Thus, ESD can be seen as an evolution of EE within the broader sustainability agenda.

In the present study, however, EE is used as the central concept, as it more directly reflects the educational focus and scope of the emprical studies reviewed. While ESD provides a broader sustainability-oriented framework, EE offers a more precise lens for examining educational practices and learning outcomes related specifically to environmental understanding and attitudes. The essence of sustainability is based on the efficient use of natural resources, the reduction of waste, ensuring the recycling of resources, and the continuous preservation of the environment to meet the needs of future generations (Önder & Özkan, 2013).

The World Organization for Early Childhood Education (OMEP) has developed 7 R, which integrates all components of sustainable development, to guide ESD practices in early childhood. The 7Rs of Respect, Rethink and Reflect address the socio-cultural component of sustainable development, Recycle and Redistribute to address the economy, and Reuse and Reduce to address the environmental component (Kahriman Öztürk et al., 2012). Environmental pillar of the ESD is the most frequently discussed. However, interventional studies are limited (Güler Yıldız et al., 2021), particularly those focusing on practical, constructivist based approaches to waste education. The present study focuses specifically on waste education activities within a preschool setting.

In response to challenges in implementing environmental themes in early years curricula, Otitoji et al. (2022) proposed a pro-environmental behavioral framework that incorporates curriculum guidelines and the 7Rs (reduce, reuse, recycle, respect,

reflect, reuse, and redistribute). They emphasize the role of recycling and reuse in promoting conscious consumption, transformation, and environmental awareness. Introducing these concepts early helps children develop responsible habits and an understanding of waste management and resource conservation. A study conducted in a Finnish kindergarten group by Sihvonen et al. (2024) found that early childhood sustainability education promoted through active, collaborative methods rooted in community and family engagement effectively instills recycling habits in young learners. From a different perspective recognizing and upholding children's rights such as their right to express opinions, participate in decision-making, and take meaningful action, fosters their sense of agency, enabling them to become confident advocates for sustainability who can influence peers, families, and communities (Mackey, 2012).

The literature emphasizes the importance of initiating EE at the earliest possible age and highlights the value of implementing such education through experiential learning with young children (Ahi & Alisinanoglu, 2018; Lukman et al., 2013). For instance, Pancheri-Ambrose and Tritschler-Scali (2013) found that when preschool teachers integrate natural materials and outdoor experiences into daily routines, they help children develop a stronger connection to nature and enhance their environmental awareness. Similarly, Šorytė and Pakalniškienė (2019) reported that children form their understanding of environmental protection through various sources, including family members, school activities, books, computer games, television programs, and by observing the behaviors of those around them. Most of the environmental aspects that children said they valued were based on their direct experiences and influenced by the environmental attitudes and practices encouraged in their school environment (Owens, 2005). Encouraging children to actively participate in caring for the environment fosters deeper engagement and supports the development of long-term pro-environmental behaviors (Kollmuss & Agyeman, 2002). The children maintain that they are capable of addressing the environmental problems by utilizing strategies within their current knowledge base (Iliopoulou, 2018). Providing young people with action-related knowledge is a key factor in fostering their belief that they can make a meaningful environmental impact, ultimately leading to positive behavioral change (Otto & Pensini, 2017). Building on the broader principles of EE, addressing ecological challenges and scarce natural resources makes waste management a key focus, particularly in developing countries. Beyond technological solutions, education waste and its impacts on the environment is essential. Schools, local authorities, supported by national policies, can help children and communities understand that waste is a source, not a problem (Kalambura et al., 2015). Although this is a long-term process, it offers opportunities to foster sustainable behaviors from an early age.

Grounded in these insights, through the age-appropriate activities for preschoolers, the goal of this research is to make children aware of the importance of environmental protection, to inform children about what recycling, and reuse are, what can be recycled and what can be reused, to ensure that children understand recycling and realize the importance of recycling in protecting the environment, and to inspire their active participation in protecting our environment. To achieve these aims, the study was designed around a structured teaching intervention focusing on waste education, which

was implemented through developmentally appropriate acivities in early childhood settings. By centering the study on waste education under the broader EE framewrok, the research provides a clear, more focused case study while still contributing to the overarching goals of environmental education and sustainability. In alignment with this purpose, the following research questions were addressed in the scope of this study:

- How did the teaching intervention influence preschool children's knowledge about the importance of protecting the environment?
- In what ways did preschool children's awareness of recycling develop following the teaching intervention?
- How did preschool children demostrate active participation in environmental protection after the teaching intervention?

Methodology

This study is grounded in a constructivist and interpretivist epistemological stance (Creswell, 2013), which assumes that knowledge is actively constructed through individuals' interactions with their social and physical environments rather than objectively measured as a fixed reality. From an ontological perspective, the study adopts a relativist view, acknowledging that children's understandings of environmental concepts are shaped by their experiences, interactions, and contextual factors. These assumptions align with the use of qualitative inquiry and support an in-depth exploration of meaning-making processes within a natural educational setting.

The research method employed in this project is the case study design among qualitative research methods. A case study is a qualitative research approach in which the researcher extensively investigates one or more bounded cases over time using multiple sources of data (observations, interviews, audio-visual materials, documents, reports) (Creswell, 2007; Yin, 2018).

In this research, the case refers to an eight-wek EE intervention implemented once a week for approximately 40 min in two kindergarten classrooms, 25 typically developing children aged 60–72 months, and the duration and structure of the activities. This case was selected to provide an in-depth understanding of how young children engage with EE activities across multiple developmental domains. The study is grounded in constructivist learning theory, particularly Piaget's view that children actively build knowledge through interaction with their environment (Piaget, 1952). A child-centered approach also guided the process, emphasizing learning experiences tailored to children's developmental needs and interests (Dewey, 1916). Accordingly, the researchers assumed an active role in interpreting children's meaning-making processes rather than seeking generalizable outcomes. In line with this, the EE activities were designed to support hands-on engagement and promote meaningful learning.

Participants

Convenience sampling was employed to form the study group, as it offers practically, cost-effectiveness, and accessibility in qualitative research contexts (Creswell & Poth,

2018; Yıldırım & Şimşek, 2006). The study group consisted of twenty-five typically developing kindergarten students aged 60 to 72 months.

Curriculum content

The EE content was prepared within the framework of the Turkish Ministry of National Education (MoNE, 2013) preschool education program. Activities were designed according to children's developmental characteristics and included science, mathematics, drama, music, and Turkish language activities. These were implemented once a week for an average for40 minutes across eight weeks,allowing the children to learn through hands-on experience.

The EE content addressed objectives related to language, cognitive, social-emotional, and psychomotor development. Activities incorporated concepts and terminology such as recycling, waste, forest, trash, nature, environment, responsibility, and compost. To ensure quality and relevance, the activities were reviewed by three experts in science education and EE in early childhood, revised based on their feedback, and finalized. Detailed examples of the implementation process are presented in subsequent sections.

First week: Squirrel City

This week's integrated large group activity involved Turkish and drama. The teacher read the story to the children in this activity, which is based on the story of the squirrel who lost his home in a world that changed due to the actions of people who do not care about the environment. The children were then given a variety of dramatic scenarios to act out. Following the conclusion of the acting scenarios, the children narrated the activity procedure, which comes to a close when they finished explaining their drawings of the activity process.

Second week: transforming with the music

After reading the illustrated storybook about recycling, the children were asked questions related to the book about waste, recycling, and organic waste and listened to their responses. The teacher then mentioned that some waste can be reused, thus protecting the environment by reducing the amount of waste. The process of creating maracas and drums that could be used in music activities using waste materials began. When the process was completed, rhythm practice activity was performed together. Finally, the children were asked to think about what else they could reuse in this way and share their ideas with their friends based on the visuals shared with the children. At the end of the activity, to ensure family participation, families were asked to design a flowerpot together with their children, using appropriate waste materials from their homes. Figure 1 illustrates various flowerpots crafted by families with children using recycled materials.

Third week: heroes in the recycling world

The teacher began the process with an audiobook about waste separation and reuse. The teacher then explained the difference between garbage and waste. Once the



Figure 1. Flower pots created by families with children using waste materials.



Figure 2. "We sort waste" game placemat.

audiobook was completed, the teacher asked the children for their suggestions on how to keep the environment clean. After gathering all the ideas, the class voted on each suggestion, ranking them from the most to the least popular. The class then decided on the most appropriate suggestions. The activity concluded with this final decision-making.

Fourth week: sorting waste

At the beginning of the learning process, the teacher read the storybook about waste to the children and showed them the recycling bins prepared in advance and colored in green, yellow, blue, and brown. Children were asked why the recycling bins were made up of different colors, which waste was thrown into which color, and what happened to the waste thrown into the recycling bins. The 'We Sort Waste' game (Figure 2) was then started (waste, recycling, organic waste).



Figure 3. Children's drawings about colored waste bins.

After the game was over, children were asked to draw a picture showing (Figure 3) which waste would be thrown into which color waste bin.

Fifth week: environmental detectives

The teacher told the children that they would carry out their activities in an open area, collecting waste, and recycling. Children put on their gloves and started cleaning the environment. The teacher asked why waste harms nature, discussed how it could be recycled, and showed them how to use the correct recycling bins. The teacher then asked the children to think about the balance between humans and nature and encouraged them to draw a picture of human actions in nature. At the end of the day, the teacher took notes of the children's thoughts about the environment and recycling, and how to protect nature, gave them the identity card of "Environmental Detective" and tried to ensure that they did not forget the topics. Also that week, a seminar on "Environmental Education" based on voluntary participation was organized for the parents of the children involved in the project, which was conducted through drama.

Sixth week: fruits on my plate, and vegetables in my basket are being recycled

The teacher entered the classroom with plates filled with fruit and vegetables. Children formed a circle and exchanged ideas about what to do with fruits and vegetables. Then, it was explained that "compost" will be made, and children are given information about compost. An interactive story was told by *Dodo*, a puppet.

The teacher prepared the recycling bins while the children sorted composted and non-composted waste. During composting, the children participated and went out to the garden to make compost with organic waste, with one child taking on the task of mixing it every day. Figure 4 illustrates the composting process with children.

Data collection

Every procedure carried out in research with human subjects complied with ethical guidelines of Ankara University Rectorate Ethics Committee Presidency Social Sciences Sub Ethics Committee, dated 05.12.2023 and numbered 56786525-050.04.04/1176240. After the ethics committee permissions were obtained the school administration shared information about the study. The study's intended target population, the parents of young children, provided parental consent forms.

To gather information for the study and assess children's environmental awareness, the researchers employed the following techniques. The researchers developed a semi-structured interview form and submitted it to three experts specializing in early childhood and environmental education for evaluation. Based on the experts'



Figure 4. Children who experience composting.

feedback, modifications were made to ensure that the questions on the interview form were comprehensible to the children. For the pre-interview conducted before implementation and the post-interview conducted following implementation, separate interview forms were created. There were 5 open-ended questions in the semi-structured pre-interview form and 6 open-ended questions in the post-interview form prepared for 60-72-month-old children before and after the research to learn children's awareness of environmental and sustainability issues.

At the beginning of the research process, pre-interviews were conducted on a one-to-one basis with each child in a quiet and calm setting to provide a comfortable atmosphere and minimize distractions. Following this, an eight-week program focused on EE was implemented. Lastly, a post-interview session was conducted to assess the impact of the implemented activities. Interviewing is the most commonly used qualitative research method. The fundamental method used in interviews is verbal communication (Yıldırım, 1999). Through interviews, efforts are made to understand unobservable aspects such as experiences, attitudes, thoughts, intentions, comments, and mental perceptions and reactions (Yıldırım & Şimşek, 2006).

Data analysis

The data collected from the pre and post-interviews were analyzed using content analysis, a qualitative data analysis method, using the MAXQDA software. The analysis focused on understanding how children engaged with the EE activities, their emerging knowledge, and the processs through which they developed awareness of environmental concepts. By situating the analysis within this specific case, the study aimed to capture the richness and contextual nuances of children's learning experiences. Patterns were identified both within individual children's responses allowing for an in-depth understanding of engagement, learning processes, and developmental outcomes. The findings are presented with reference to the bounded context of this case, emphasizing the interplay between the intervention activities, and the children's responses.

Content analysis requires in-depth examination of the collected data and allows the emergence of themes and dimensions that were not previously evident (Yıldırım & Şimşek, 2006). The main purpose of content analysis is to reach concepts and relationships that can explain the collected data. To achieve this, the data are first conceptualized, then organized systematically according to the emerging patterns, and finally categorized into themes that rhe best represent the underlying meanings (Elo & Kyngäs, 2008; Yıldırım & Şimşek, 2006).

The validity of this study was ensured by reporting the data collected within the scope of this research in detail and trying to explain how the results were reached. Reporting the collected data in detail and explaining how the researcher reached the results are among the important criteria of validity in qualitative research (Yıldırım & Şimşek, 2006). To ensure the reliability of this study in the analysis of the data, the results were confirmedthrough analysis by another researcher. In other words, peer review or debriefing provides an external check of the research process (Lincoln & Guba, 1985). The transferability of qualitative research results depends on an adequate description of the data on which they are based. Direct quotations

are frequently used by researchers for this purpose (Yıldırım & Şimşek, 2006). In this study, direct quotations were frequently included to ensure that the data gained more meaning for the reader. To protect the privacy of the children, each child is assigned a code, such as C1, C2, and so on.

Results

The study's findings are presented within the framework of the research questions.

Children's understanding of environmental protection

When the data obtained from the pre-interviews and post-interviews with the children are analyzed, Table 1 shows how the children's views on why it is important to protect the environment changed after environmental education. The frequency with which the children responded to the questions is represented by the letter "f" in the table.

Children attempted to explain the value of protecting the environment in the pre- and post-interviews by citing their sensitivity to living things and the cleanliness of the surroundings; notably, there was a marked increase in expressions specifically related to the protection of living beings following the implementation. In the pre-interviews of the research conducted with 25 children, it was revealed that 3 children did not make any statement about keeping the environment clean and protected.

In the pre-interview, children talked about the cleanliness of their environment (nature), home, and classroom, but in the post-interview, they made more behavioral and detailed comments regarding environmental protection. Children discussed the importance of recycling and throwing trash in the trash can to preserve the environment during the post-interview. Furthermore, in the post-interview, children began to explicitly connect recycling with environmental protection, a theme that was absent in their pre-interviews. This shift suggests a growing awareness that recycling contributes to the preservation of nature and living beings. Some children

Table 1. The changes in children's knowledge about the importance of protecting the environment after the intervention.

	Pre-interview			Post-interview		
Categories	Codes	Children	f	Codes	Children	f
Being Sensitive to Living Things	To keep animals safe	C3, C11, C20	3	To keep animals safe	C1, C9, C2, C4, C11, C8, C5, C12, C18, C23	10
	To keep trees (forest)safe	C18	1	To keep trees (forest) safe	C18, C21, C23	3
	To make sure people don't feel uncomfortable	C7	1	To keep humans safe	C1, C9	2
Keeping the Environment Clean	World (nature)	C3, C4, C5, C8	4	Throwing trash in the trash can	C5, C7, C10,	3
	Classroom	C6	1	Recycle	C3, C6, C11	3
	Home	C9	1			

emphasized that protecting the environment also means safeguarding animals, demonstrating an emerging understanding of ecological interdependence:

> So that animals are not harmed. If they are harmed, they will become extinct. (C4)

> So that our forests are not polluted, so that animals do not become extinct. (C23)

These statements reveal that children started to internalize the broader implications of recycling, linking it not only to waste management but also to the protection of ecosystems and animal life. Pre-interview focus on cleanliness likely reflects children's everyday experiences and surface-level understandings of what it means to protect the environment. For young children, cleanliness is a tangible and familiar concept, often emphasized by adults in their immediate surroundings. In contrast, the post-interview responses reveal a deeper cognitive engagement.

Developing recycling awareness among children

When the data obtained from the pre-interview and post-interview with the children are analyzed, Table 2 reflects the change in children's awareness of what recycling is, what can be recycled, and the importance of recycling.

Table 2. The changes in children's awareness of recycling following the teaching intervention.

	Pre-interview			Post-interview		
Categories	Codes	Children	f	Codes	Children	f
Definition of Recycling	Throwing trash into the trash can	C1, C3, C4, C6, C8, C15	6	Throwing trash into the recycling bin	C6, C10, C15, C23	3
	Changing something to become something else	C11, C13, C17, C18, C19, C23	6	Changing something to become something else	C1, C12, C13, C16, C17, C18, C19, C22, C23, C24	10
	Keeping environment clean	C5, C20, C22	3	Keeping environment clean	C9, C3, C4, C5, C7, C8	6
	Recycling box	C2, C14	2			
Awareness of Recyclable Materials	Paper	C1, C4, C5, C8, C9, C11, C12, C15, C18, C23, C25	11	Paper	C1, C3, C4, C7, C8, C9, C11, C12, C13, C14, C16, C17, C18, C19, C20, C21, C22, C23, C25	19
	Glass	C1, C8, C11, C12, C20, C21	6	Glass	C1, C5, C7, C8, C11, C12, C13, C18, C20, C21, C22, C23, C25	13
	Plastic	C7, C11, C12, C18, C21, C23	6	Plastic	C1, C11, C7, C8, C13, C14, C18, C19, C20, C21, C23, C25	12
	Toy	C13, C15, C19	3	Toy	C5, C6, C9, C15, C22	5
	Clothes	C18	1	Clothes	C12, C25	2
				Organic waste	C3, C6, C11, C12,	3
Awareness of the Role of Recycling Box	To prevent them (waste) from becoming mixed	C6, C8, C11, C12, C13, C15, C16, C17, C18, C25	10	To prevent them (waste) from becoming mixed	C1, C3, C6, C7, C8, C13, C16, C17, C18, C19, C20, C21, C23,	13
	To be recycled	C1, C7, C8, C19	4	To be recycled	C9, C10, C4, C11, C24	5

In the pre-interview, two of the children who participated in the study stated that they did not know what recycling was. It is possible to consider the fact that more children responded to the definition of recycling and recyclable waste after EE as evidence of the program's beneficial effects on children. Before the implementation, children's definitions of recycling varied. In the pre-interviews, children often defined recycling as simply throwing trash into the trash can. However, in the post-interviews, a majority of the children described recycling as the process of transforming one item into another.

In addition, the analysis showed an improvement in children's awareness of recyclable materials. In the pre-interviews, children's understanding of recyclable paper materials appeared to be limited but emerging. Several children mentioned examples such as cardboard, newpapers, books, and toilet paper. Some children related these materials to their own experiences, demonstrating an early awareness of reuse:

> For instance, I once used cardboard to create a puppet. (C4)

Others reflected a more general understanding of recycling and reusability across materials, suggesting that they were beginning to grasp the broader idea of waste separation:

> We don't throw all the garbage in the garbage, some of it is recycled and we can reuse it. Like glass, plastic, paper. (C23)

Together, these responses illusrate that children were able to identify common recyclable materials and had a preliminary sense of how recycling contributes to reuse.

In the post-interview, children made more statements about recyclable materials than in the pre-interview, although they still emphasized paper, glass, and plastic regarding recyclable materials. It's noteworthy that children mentioned in the post-interview that organic waste could be recycled. This finding suggests that the environmental education activities applied to children within the scope of the study increased their awareness.

Furthermore, children showed notable improvement in understanding the purpose of the recycling box. During the pre-interview, the children made no remarks regarding the colors of the recycling boxes. In the post-interview, children demonstrated a clearer understanding of recyclable materials and the function of recycling boxes. For instance, some children began to identify specific items that could be recycled, such as cardboard or paper products:

> For instance, a toy, an old sponge, and a cardboard cup that can be recycled. cardboard boxes and paper towels (toilet). (C9)

Others expanded their descriptions by recognizing a wide range of recyclable and organic materials, showing a more detailed awareness:

> Plastic bottles, glass bottles, paper, newspaper and organic waste like banana peel, rotten parts of apples, parts of carrots we can't eat. (C11)

One child also emphasized the importance of sorting materials correctly, indicating an understanding of the recycling process rather than mere listing:

> We need to throw the glass into glass boxes, which can be recycled incorrectly if they are mixed. (C21)

These reponses together illustrate a progression in children's conceptual understanding from identifying recyclable items to recognizing the correct separation and recycling process.

Children's active engagement in environmental protection practices

When the data obtained from the pre-interviews and post-interviews with the children are analyzed, Figure 5 reflects the changes in children's active role in protecting the environment after environmental education.

Upon analyzing Figure 5, it becomes evident that during the pre-interviews with the children, they primarily mentioned that they cleaned their surroundings to protect the environment. There is a clear increase in children's recognition of proper waste disposal, particularly the use of trash and recycling bins. This indicates a growing understanding of individual responsibility in environmental care.

In the last interview, it was seen that children's understanding of what they do to protect the environment has changed from a more general knowledge of keeping the environment clean to more specific actions such as throwing trash in the trash bin and recyclable materials in the recycling bin. In the post-interviews, more children expressed that they throw trash into trash cans to protect the environment. This progression demonstrates that with appropriate educational support, even young children can move beyond surface-level environmental practices and begin to adopt more structured and informed behaviors. It also highlights the importance of explicitly addressing specific environmental actions (e.g., recycling, sorting waste) in early childhood curricula to cultivate deeper ecological understanding. The rise in he "trash can" and "recycling box" categories suggests that children may have been influenced by explicit, practical teaching or visible tools (e.g., bins, labels) during

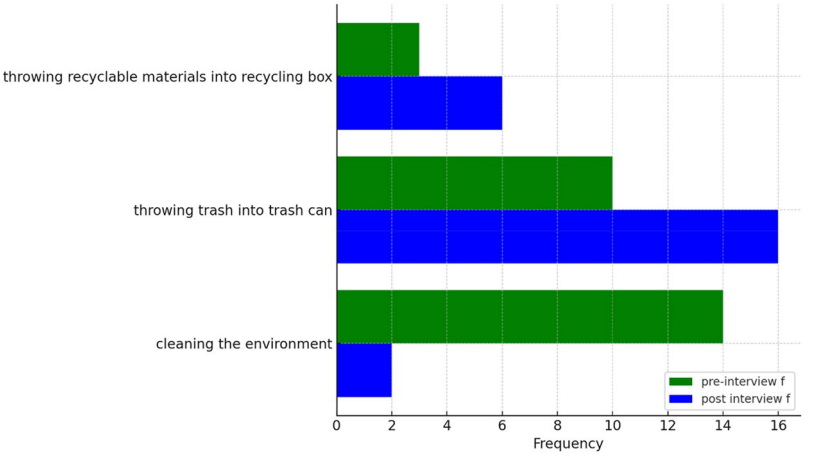


Figure 5. The changes in children's self-reported active participation in environmental protection following the teaching intervention.

the intervention.The children's statements in the post-interview about their actions in protecting the environment are shared as a direct quote below:

> When we go to school we get chocolate milk from the shop. I drink it, but I do not throw it on the floor. If I find rubbish, I throw it away. (C13)

Discussion and conclusions

In the final interviews conducted with the children after the implementation, it was observed that they more frequently expressed ideas related to the importance of protecting animals, trees (forests), and human life, reflecting a deeper understanding of the significance of environmental conservation. Similarly, the study conducted by Šorytė and Pakalniškienė (2019) in Lithuania with children aged 9–10 categorized children's views on the importance of environmental protection. Notably, several categories identified in their study such as the protection of human life and health, and the protection of animals and plants correspond closely with the themes that emerged in our research. The fact that the 6-year-old children in our study expressed ideas similar to those of the 9–10-year-olds in the study by Šorytė and Pakalniškienė (2019) is noteworthy from a developmental standpoint. While older children are typically expected to demonstrate a more advanced understanding of abstract concepts such as environmental protection, the presence of comparable themes such as the protection of animals, plants, and human life in the responses of younger children suggests that even preschool-aged children may be capable of grasping and articulating basic ecological values. This observation raises the possibility that well-designed educational interventions can support the emergence of environmental awareness in early childhood, and that, when appropriately guided and contextualized, moral and prosocial reasoning, including empathy for living beings and concern for nature, may begin to emerge at earlier developmental stages than traditionally assumed.

The findings of this study, when examined through the lens of the United Nations Sustainable Development Goals (SDGs), provide compelling evidence of the value of early EE in promoting sustainable attitudes and behaviors among young children. Specifically, the emphasis placed by children on the importance of protecting animals after participating in the educational activities directly supports SDG 15: Life on Land, which advocates for the conservation of biodiversity and protection of terrestrial ecosystems. The children's increasing concern for trees and forests also aligns with this goal, reinforcing the notion that respect for nature can be cultivated through age-appropriate environmental experiences.

This conclusion is further supported by relevant literature. It was revealed that EE given through drama methods had a positive effect on children's environmental awareness, especially on the importance of trees/forests (Šorytė & Pakalniškienė, 2019; Spiteri, 2021), the relationship between living things, and the importance of air (Spiteri, 2021) and water (Koçak Tümer & Kaya, 2023). Additionally, engaging in environmental science experiences cultivates an appreciation for both animals and the natural environment (Fortino et al., 2014).

The findings of the study highlight the positive impact of early waste related EE on children's environmental awareness. Pre-interview data indicated that children's

understanding of recycling was limited to basic actions such as disposing of trash, whereas post-interview responses reflected a broader understanding, emphasizing environmental cleanliness. Furthermore, while children initially identified common recyclables like glass, paper, and plastics, the post-interview revealed an expanded awareness, including items like toys and organic waste. The findings of this study reveal that early waste related EE enhances children's understanding of recycling. In the pre-interviews, children commonly defined recycling as simply throwing trash into the bin, whereas in the post-interviews, the majority described it as a process of transforming one item into another. In contrast, the study conducted by Iliopoulou (2018) found that older children (ages 11–12) tended to suggest proactive and long-term environmental strategies such as recycling, while younger children (under age 9) were more likely to propose immediate actions, such as putting waste in the bin. In this context, the present study suggests that a waste-focused teaching intervention implemented in early childhood can support children, despite their developmental level, in understanding more complex and long-term environmental actions. This finding highlights the value of introducing targeted, context-specific EE experiences such as waste management activities during the early years.

One may argue that the fact that recycling is the main topic of the environmental education provided to children in the current study explains why so many of their answers to protecting the environment revolve around putting waste into recycling boxes. Another explanation can be that this result was due to the fact that the children believed recycling could be managed through their daily habits or the activities they encountered indicating that the practical, action-oriented nature of recycling makes it more accessible and relatable for young learners.

This aligns with previous research (Abanoz & Yabaş, 2025) which reveals notable advancements in children's comprehension of concepts related to waste, reduction, reuse, and recycling, which were facilitated through STEM education. In particular, their understanding of recycling demonstrated significant improvement Similarly, in line with the study by Lukman et al. (2013), the findings indicated that children exhibited mainly *direct actions*—concrete and short-term efforts implemented after a environmental problem has occurred. This tendency toward concrete thinking can be interpreted in light of the developmental characteristics of early childhood.

The results indicate a noticeable development in children's understanding of waste-related and environmentally responsible behaviors as a result of the teaching intervention. In the pre-interviews, children mainly mentioned general actions such as "cleaning their surroundings" or "throwing trash in the trash can" as ways to protect nature, reflecting a basic level of environmental awareness. However, by the end of the intervention, their responses became more specific and action-oriented, including practices such as separating recyclable materials, reusing items, and reducing waste, demonstrating the positive influence of the waste-focused learning experiences. Also, this statement could be interpreted as children perceiving their role in protecting the environment as primarly focused on preventing environmental pollution. However, in the post-interviews, their responses became more specific and informed. This shift suggests that their environmental knowledge evolved from general cleanliness to more concrete and actionable behaviors, indicating a growing capacity for environmental responsibility. This progression suggests the intervention

or educational experience successfully moved children from a passive awareness to an active, informed role in environmental protection. It indicates the emergence of pro-environmental behavior, not just environmental awareness. From a developmental perspective, this reflects a shift from egocentric and concrete thinking toward more abstract and socially informed reasoning, aligning with cognitive growth expected in the preschool years (as per Piaget's theory). These results align with Otto and Pensini's (2017) work provides that young people with *action-related knowledge*, such as how to recycle waste, can effectively instill a belief that their actions can make a meaningful environmental impact, thereby promoting behavioral change.

These results suggest that the waste related EE activities implemented during the study significantly enhanced children's knowledge especially in recycling and active engagement in protecting the environment. The findings of the current study align with the literature. Young children who receive EE will be able to understand and appreciate the environment and form conscientious attitudes toward environmental preservation (Gülay, 2011). Education is the leading key to implementing environmental education (Dolenc Orbanić & Kovač, 2021).

Early childhood sustainability education employs a variety of methods and techniques, including digital storytelling (Tzima et al., 2020), drama (Akyol et al., 2018; Özkan, 2021), video (Borg & Gericke, 2021; Duran & Bozok, 2021), play (Ardoin & Bowers, 2020; Kornilaki et al., 2022). In the current study, waste related EE activities incorporated drama-based practices, storybooks, videos, and utilized the power of play. This multifaceted approach may enable young children to engage more effectively with environmental issues by aligning with their learning styles. The integration of diverse techniques may contribute to the development of environmental knowledge and behaviors, thereby fostering sustainability awareness from an early age.

Overall, these findings suggest that a waste-focused teaching intervention in early childhood, grounded in active and contextually meaningful pedagogies, can effectively foster children's environmental responsibility and contribute to the achievement of SDG-related goals. This case further illustrates the importance of integrating focused, action-based environmental learning experiences into preschool curricula.

Limitations

Several limitations to this study should be acknowledged. The findings of this study are derived from the self-reports from 5 to 6-year-old children before and after their eight-week experience of EE activities, rather than direct observation of the practices. Future studies should involve observational analysis of the EE activities in early childhood settings. The characteristics of the study group also present limitations. It was observed that the school where the children in the study were enrolled carried out several activities related to the environment within the framework of science education activities. In this case, the EE activities carried out within the scope of this research may have a greater and lasting effect on children. For this reason, we suspect that the effects of a similar EE on preschool children in schools that do not EE activities may be more limited. This constitutes a limitation in terms of the generalizability of the study.

Future studies

The short program duration (four weeks) may have contributed to the lack of impact the four-week EE program had on children's attitudes toward the environment, according to Yılmaz et al. (2020) study. Given the data from this study, the fact that children's knowledge changed after eight weeks of environmental education can be interpreted as a guide for determining how long an environmental education program should last for preschoolers. On the other hand, according to Gülay (2011), studies on EE should provide subjects and instructional strategies to children in a variety of ways or the greatest effect. In this regard, the study's utilization of a variety of techniques and activities may be considered as an argument that can be used to explain the effect of the EE program on children. When the statements of the children after EE were analyzed, it was seen that they expressed more opinions on issues such as reuse, recycling and respect for all living things. It is seen that these issues are among the themes of education for sustainable development that can be carried out in the preschool period as suggested by the Early Childhood World Organisation (OMEP). Applying the 7R themes (reduce- reuse- respect- reflect- rethink- recycle- redistribute) is advised in order to concretize sustainability education for children (Kahriman Öztürk et al., 2012).

In this study, EE was carried out in eight weeks. In this context, longer-term study plans might be used to realize a comprehensive EE that incorporates all themes. Although it has some limitations, this study enhances our understanding of how EE influences young children's awareness of environmental issues. Also, building on the study conducted by Abanoz & Yabaş (2025) which demonstrated the significant improvements in children's understanding of waste, reduction, reuse, and recycling concepts through STEM education, future research on EE could explore several key areas. Specifically, studies could investigate the integration of STEM-based curricula with a focus on sustainability. Research could examine how combining hands-on environmental science activities with technology and engineering concepts enhances children's comprehension of complex environmental issues. Furthermore, it would be valuable to assess the long-term effects of STEM-based EE on children's behaviors toward sustainability. Additionally, exploring the role of educators in facilitating environmental learning, including the effectiveness of various teaching methods, could contribute to optimizing the impact of such programs. Finally, studies might investigate how integrating local environmental challenges into the curriculum can deepen children's connection to their surroundings, leading to more engaged and proactive involvement in sustainability efforts.

EE, at its core, encompasses the collaborative and democratic efforts of children, educators, and communities to address and resolve environmental challenges, questions, and issues. Early childhood education requires educators with an environmental perspective, who actively guide children to resist a focus on material consumption and possessions. These educators should help children develop the skills to collaborate and foster a sense of responsibility as caretakers and protectors of both the earth and one another (Davis, 1998). Additionally, instructional materials on EE offer educators valuable insights into the connection between self-efficacy and language skill development, particularly in early childhood (NAAEE, 2021). In this

regard, it is essential to develop and support the knowledge and skills of early childhood educators in EE, as they play a crucial role in fostering awareness and sensitivity among today's children who will form the society of the future regarding environmental conservation (Sanginova, 2024; Tran, 2024).

On the other hand, the previous research confirms that the EE program had a more significant impact on children in schools with greater vulnerabilities; however, no notable effect was observed on parents (Jaime et al., 2023). Moreover, it is suggested that children with scientific knowledge can play a crucial role in enhancing their parents' awareness of environmental responsibilities (Fortino et al., 2014). However, since parents largely influence the behaviors deemed acceptable for their children, achieving lasting behavioral change may require combining child-focused EE programs with additional interventions specifically designed to engage and support parents. An important implication for future research is that EE initiatives could yield more significant outcomes when complemented by strategies that actively involve families, particularly parents, in the learning process.

Acknowledgments

We would like to express our gratitude to all research participants. Likewise, we would like to thank The Scientific and Technological Research Council of Türkiye (TUBITAK) for providing support for the first author in the realization of the research project.

Authors' contributions

The study was conceptualized and the paper was written by the first and second authors. The first, third, fourth, and fifth authors conducted the fieldwork with assistance from the second author.

Disclosure statement

No potential conflict of interest was reported by the author(s).

Ethics approval and consent to participate

The Ministry of National Education provided official permission to conduct interviews in schools. Ethical approval was obtained from the Ankara University Ethics Committee. The voluntary participants signed informed consent forms, ensuring confidentiality and their right to withdraw from the study at any time.

Funding

This research was supported by The Scientific and Technological Research Council of Türkiye (TUBITAK) 2209-A Research Project Support Programme for Undergraduate Students under Grant [1919B012304337].

ORCID

Tuğba Abanoz http://orcid.org/0000-0001-8905-4002

References

Abanoz, T., & Yabaş, D. (2025). Seeding sustainable futures: enhancing children's knowledge of content and skills through early STEM education. *Environmental Education Research, 31*(5), 981–1000. https://doi.org/10.1080/13504622.2025.2465722

Acosta Castellanos, P. M., & Queiruga-Dios, A. (2022). From environmental education to education for sustainable development in higher education: A systematic review. *International Journal of Sustainability in Higher Education*, *23*(3), 622–644. https://doi.org/10.1108/IJSHE-04-2021-0167

Ahi, B., & Alisinanoglu, F. (2018). Effect of environmental education program integrated into preschool education on children's mental model development about "environment" concept. *International Journal of Innovative Research in Education*, *5*(2), 29–40. https://doi.org/10.18844/ijire.v5i2.1247

Akyol, T., Kahriman-Pamuk, D., & Elmas, R. (2018). Drama in education for sustainable development: Preservice preschool teachers on stage. *Journal of Education and Learning*, *7*(5), 102–115. https://doi.org/10.5539/jel.v7n5p102

Ardoin, N. M., & Bowers, A. W. (2020). Early childhood environmental education: A systematic review of the research literature. *Educational Research Review*, *31*, 100353. https://doi.org/10.1016/j.edurev.2020.100353

Bailie, P. E. (2012). *Connection children to nature: A multiple case study of nature center preschools* [Doctoral dissertation]. https://digitalcommons.unl.edu/teachlearnstudent/24

Borg, F., & Gericke, N. (2021). Local and global aspects: Teaching social sustainability in Swedish preschools. *Sustainability*, *13*(7), 3838. https://doi.org/10.3390/su13073838

Collins, S., & Garrity, S. (2025). Early childhood educators' understanding of education for sustainable development. *Irish Educational Studies*, *44*(2), 281–299. https://doi.org/10.1080/03323315.2023.2266688

Creswell, J. W. (2007). *Qualitative inquiry & research design: Choosing among five approaches* (2nd ed.). SAGE Publications.

Creswell, J. W. (2013). *Qualitative inquiry and research design: Choosing among five approaches* (3rd ed.). SAGE Publications.

Creswell, J. W., & Poth, C. N. (2018). *Qualitative inquiry and research design: Choosing among five approaches* (4th ed.). SAGE Publications.

Davis, J. M. (1998). Young children, environmental education, and the future. *Early Childhood Education Journal*, *26*(2), 117–123. https://doi.org/10.1023/A:1022911631454

Demir, M. (2025). The devastating effects of global population growth on natural resources and the environment. *Ufuk University Journal of Social Sciences Institute*, *14*(28), 180–205. https://doi.org/10.58635/ufuksbedergi.1764073

Dolenc Orbanić, N., & Kovač, N. (2021). Environmental awareness, attitudes, and behaviour of preservice preschool and primary school teachers. *Journal of Baltic Science Education*, *20*(3), 373–388. https://doi.org/10.33225/jbse/21.20.373

Duran, M., & Bozok, Ş. Ş. (2021). Views of pre-school teacher candidates on sustainable development. *Journal of Individual Differences in Education*, *3*(2), 44–59. https://doi.org/10.47156/jide.1031352

Elo, S., & Kyngäs, H. (2008). The qualitative content analysis process. *Journal of Advanced Nursing*, *62*(1), 107–115. https://doi.org/10.1111/j.1365-2648.2007.04569.x

Environment Foundation of Turkey. (2007). http://www.cevre.org.tr/en/home-page

Erdaş Kartal, E., & Ada, E. (2020). Recycling from the perspective of preschool children. *Journal of Uludag University Faculty of Education*, *33*(3), 778–801. https://doi.org/10.19171/uefad.635508

Fortino, C., Gerretson, H., Button, L., & Masters, V. (2014). Growing up WILD: Teaching environmental education in early childhood. *International Journal of Early Childhood Environmental Education*, *2*(1), 156–171.

Ginsburg, J. L., & Audley, S. (2020). "You don't wanna teach little kids about climate change": Beliefs and barriers to sustainability education in early childhood. *International Journal of Early Childhood Environmental Education*, *7*(3), 42–61.

Gugssa, M. A. (2023). Characterizing environmental education practices in Ethiopian primary schools. *International Journal of Educational Development*, *102*, 102848. https://doi.org/10.1016/j.ijedudev.2023.102848

Gülay, H. (2011). Ağaç yaş iken eğilir: Yaşamın ilk yıllarında çevre eğitiminin önemi. *TÜBAV Bilim Dergisi*, *4*(3), 240–245.

Güler Yıldız, T. (2017). Environmental education (Çevre Eğitimi). In B. Akman, G. Uyanık Balat, & T. Güler Yıldız (Eds.), *Science education in early childhood* (pp. 267–287). Anı Publishing.

Güler Yıldız, T., Öztürk, N., İlhan İyi, T., Aşkar, N., Banko Bal, Ç., Karabekmez, S., & Höl, Ş. (2021). Education for sustainability in early childhood education: A systematic review. *Environmental Education Research*, *27*(6), 796–820. https://doi.org/10.1080/13504622.2021.1896680

Iliopoulou, I. (2018). Children's thinking about environmental issues. *Educational Research*, *60*(2), 241–254. https://doi.org/10.1080/00131881.2018.1453753

Jaime, M., Salazar, C., Alpizar, F., & Carlsson, F. (2023). Can school environmental education programs make children and parents more pro-environmental? *Journal of Development Economics*, *161*, 103032. https://doi.org/10.1016/j.jdeveco.2022.103032

Kahriman Öztürk, D., Olgan, R., & Güler Yıldız, 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 & Practice—Special Issue*, *12*, 2987–2995.

Kalambura, S., Racz, A., & Kalambura, D. (2015). Education in waste management. In M. Alamgir, K. A. B. M. Mohiuddin, S. M. T. Islam, & M. H. Hasan (Eds.), *Proceedings of the WasteSafe 2015 – 4th International Conference on Solid Waste Management in the Developing Countries* (pp. 1–9). Khulna, Bangladesh.

Koçak Tümer, N. B., & Kaya, Y. (2023). The effects of environmental education given by creative drama method on environmental awareness of preschool children. *European Journal of Education Studies*, *10*(10), 178–198. https://doi.org/10.46827/ejes.v10i10.5010

Köklü Yaylacı, H., & Feriver, Ş. (2020). Early childhood environmental education and education for sustainable development. In M. Pala & N. Avcı (Eds.), *Environmental education in early childhood (Erken Çocukluk Döneminde Çevre Eğitimi)* (pp. 19–40). Anı Publishing.

Kollmuss, A., & Agyeman, J. (2002). Mind the gap: Why do people act environmentally and what are the barriers to pro-environmental behavior? *Environmental Education Research*, *8*(3), 239–260. https://doi.org/10.1080/13504620220145401

Kornilaki, E. N., Skouteris, H., & Morris, H. (2022). Developing connections between healthy living and environmental sustainability concepts in Cretan preschool children: A randomized trial. *Early Child Development and Care*, *192*(11), 1685–1698. https://doi.org/10.1080/03004430.2021.1925664

Lamanauskas, V. (2023). The importance of environmental education at an early age. *Journal of Baltic Science Education*, *22*(4), 564–567. https://doi.org/10.33225/jbse/23.22.564

Li, M., Zhang, Y., Yuan, L., & Birkeland, Å. (2019). A critical analysis of education for sustainability in early childhood curriculum documents in China and Norway. *ECNU Review of Education*, *2*(4), 441–457. https://doi.org/10.1177/2096531119893483

Lincoln, Y. S., & Guba, E. G. (1985). *Naturalistic inquiry*. Sage Publications.

Liu, J., & Green, R. J. (2024). Children's pro-environmental behaviour: A systematic review of the literature. *Resources, Conservation and Recycling*, *205*, 107524. https://doi.org/10.1016/j.resconrec.2024.107524

Lubomira, D. (2004). Environmental education at pre-school. *International Research in Geographical and Environmental Education*, *13*(3), 258–263. https://doi.org/10.1080/10382040408668520

Lukman, R., Lozano, R., Vamberger, T., & Krajnc, M. (2013). Addressing the attitudinal gap towards improving the environment: A case study from a primary school in Slovenia. *Journal of Cleaner Production*, *48*, 93–100. https://doi.org/10.1016/j.jclepro.2011.08.005

Mackey, G. (2012). To know, to decide, to act: The young child's right to participate in action for the environment. *Environmental Education Research*, *18*(4), 473–484. https://doi.org/10.1080/13504622.2011.634494

Ministry of National Education (MoNE). (2013). *Preschool Education Program*. Ankara.

Ministry of National Education (MoNE). (2022). *Environmental education and climate change elective course curriculum (Grades 6–8)*. https://www.meb.gov.tr/environment-education-and-climate-change-curriculum-is-completed/haber/25946/en

North American Association for Environmental Education (NAAEE). (2021). *Environmental education materials: Guidelines for excellence*. https://naaee.org/about-us/about-ee-and-why-it-matters

Önder, A., & Özkan, B. (2013). *Sustainable child development – Environmental education with preschool activities (Sürdürülebilir Çocuk Gelişimi-Okul Öncesinde Etkinliklerle Çevre Eğitimi)*. Anı Publishing.

Otitoji, A. M., Ismail, H. M., Abdullah, H., Dodo, Y. A., & Jagun, Z. T. (2022). Implementing environmental education in preschools: A systematic literature review. *Journal of Engineering, Computational & Applied Sciences*, *1*(1), 15–23. https://doi.org/10.56892/jecas.v6i01.260

Otto, S., & Pensini, P. (2017). Nature-based environmental education of children: Environmental knowledge and connectedness to nature, together, are related to ecological behaviour. *Global Environmental Change*, *47*, 88–94. https://doi.org/10.1016/j.gloenvcha.2017.09.009

Owens, P. (2005). Children's environmental values in the early school years. *International Research in Geographical and Environmental Education*, *14*(4), 323–329. https://doi.org/10.1080/10382040508668366

Palmer, J. A., Grodzinska-Jurczak, M., & Suggate, J. (2003). Thinking about waste: Development of English and Polish children's understanding of concepts related to waste management. *European Early Childhood Education Research Journal*, *11*(2), 117–139. https://doi.org/10.1080/13502930385209201

Pancheri-Ambrose, B., & Tritschler-Scali, J. (2013). Preschool: Beyond green: Developing social and environmental awareness in early childhood. *YC Young Children*, *68*(4), 54–61.

Piaget, J. (1952). *The origins of intelligence in children*. International Universities Press.

Salazar, C., Jaime, M., Leiva, M., & González, N. (2024). Environmental education and children's pro-environmental behavior on plastic waste. Evidence from the Green School Certification Program in Chile. *International Journal of Educational Development*, *109*, 103106. https://doi.org/10.1016/j.ijedudev.2024.103106

Samuelsson, I. P. (2011). Why we should begin early with ESD: The role of early childhood education. *International Journal of Early Childhood*, *43*(2), 103–118.

Sanginova, G. B. (2024). Improving organization in the first environmental education of preschool children. *Multidisciplinary Journal of Science and Technology*, *4*(4), 440–447.

Scott, W., & Vare, P. (2020). *Learning, environment and sustainable development: A history of ıdeas*. Routledge.

Sihvonen, P., Lappalainen, R., Herranen, J., & Aksela, M. (2024). Promoting sustainability together with parents in early childhood education. *Education Sciences*, *14*(5), 541. https://doi.org/10.3390/educsci14050541

Šorytė, D., & Pakalniškienė, V. (2019). Why it is important to protect the environment: Reasons given by children. *International Research in Geographical and Environmental Education*, *28*(3), 228–241. https://doi.org/10.1080/10382046.2019.1582771

Spiteri, J. (2021). Why is it important to protect the environment? Reasons presented by young children. *Environmental Education Research*, *27*(2), 175–191. https://doi.org/10.1080/13504622.2020.1829560

Tran, H. U. (2024). Environmental education in preschool teacher training program: A systematic review. *Natural Sciences Education*, *53*(2), 1–14. https://doi.org/10.1002/nse2.20154

Tunçeli, H. İ., & Zembat, R. (2017). The ımportance and assessment of early childhood development [Erken Çocukluk Döneminde Gelişimin Değerlendirilmesi ve Önemi]. *Journal of Education, Theory and Practical Research [Eğitim Kuram ve Uygulama Araştırmaları Dergisi]*, *3*(3), 01–12.

Tzima, S., Styliaras, G., Bassounas, A., & Tzima, M. (2020). Harnessing the potential of storytelling and mobile technology in intangible cultural heritage: A case study in early childhood education in sustainability. *Sustainability*, *12*(22), 9416. https://doi.org/10.3390/su12229416

UNICEF. (2018). *Child rights education toolkit: Rooting child rights in early childhood education, primary and secondary schools*. https://www.unicef.org/documents/child-rights-education-toolkit

United Nations. (1989). *Convention on the Rights of the Child*. https://www.ohchr.org/en/instruments-mechanisms/instruments/convention-rights-child

van de Wetering, J., Leijten, P., Spitzer, J., & Thomaes, S. (2022). Does environmental education benefit environmental outcomes in children and adolescents? A meta-analysis. *Journal of Environmental Psychology*, *81*, 101782. https://doi.org/10.1016/j.jenvp.2022.101782

Yadav, S. K., Banerjee, A., Jhariya, M. K., Meena, R. S., Raj, A., Khan, N., Kumar, S., Sheoran, S. (2022). Environmental education for sustainable development. In M. K. Jhariya, R. S. Meena, A. Banerjee, & S. N. Meena (Eds.), *Natural resources conservation and advances for sustainability* (pp. 415–431). Elsevier. https://doi.org/10.1016/B978-0-12-822976-7.00010-7

Yaşar Ekici, F. (2025). Türkiye Yüzyılı Maarif Modeli Okul Öncesi Eğitim Programı'nın Çevre/Çevre Eğitimi ve Sürdürülebilirlik Bağlamında Değerlendirilmesi. In P. Ünüvar (Ed.), *Okul öncesi eğitimde çağdaş araştırmalar-II* (1. bölüm). Vizetek Yayıncılık.

Yıldırım, A. (1999). Nitel Araştırma Yöntemlerinin Temel Özellikleri ve Eğitim Araştırmalarındaki Yeri ve Önemi. *Eğitim ve Bilim*, *23*(112), 7–17. https://open.metu.edu.tr/handle/11511/80803

Yıldırım, A., & Şimşek, H. (2006). *Sosyal Bilimlerde Nitel Araştırma Yöntemleri*. Seçkin Yayıncılık.

Yılmaz, S., Yılmaz Bolat, E., & Gölcük, İ. (2020). The impact of an early childhood environmental education program on children's attitudes toward environment. *YYÜ Eğ˘itim Fakültesi Dergisi (YYU Journal of Education Faculty)*, *17*(1), 557–578. https://doi.org/10.33711/yyuefd.693833

Yin, R. K. (2018). *Case study research and applications: Design and methods* (6th ed.). Sage.