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Envıronmental Educatıon And Chıldren's Ecologıcal Attıtudes: Play-Based Approaches

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Abstract
This study investigates the positive impacts of play-based environmental education on children's ecological attitudes and environmental awareness. Findings reveal that engaging children with nature through play significantly improves their environmental behaviors, emphasizing the importance of active and experiential learning over traditional methods. Statistical analysis showed a 30-45% increase in children's environmental attitude scores after participation in play-based programs. These behavioral improvements also contribute to cognitive, social, and emotional development, fostering empathy and stronger connections with nature. The study highlights the crucial roles of family and school environments in shaping children's environmental attitudes. Involving families in education enhances the integration of environmentally responsible behaviors into daily life, suggesting that environmental education should adopt a multidimensional approach, including schools, families, and communities. Recommendations include expanding play-based curricula, providing teacher training and resources, encouraging family and community involvement, increasing funding and policy support, utilizing digital tools, and integrating both local and global environmental issues into programs. For future research, the study suggests examining the long-term effects of play-based environmental education, comparing different age groups, developing more comprehensive measurement tools, investigating cultural and socioeconomic impacts, evaluating technology-supported learning, and exploring the relationship between environmental education and psychosocial development. Overall, play-based environmental education emerges as an effective and sustainable strategy to cultivate environmentally conscious behaviors in children, supporting their holistic development and preparing them to address environmental challenges thoughtfully.
Keywords: Play-Based Learning, Environmental Education, Ecological Attitudes, Child Development

INTRODUCTİON

Environmental education is the awareness-raising process aimed at enabling individuals to understand their relationship with the environment, develop sensitivity toward environmental problems, and adopt sustainable lifestyles (UNESCO, 2021). This education plays a critical role in shaping ecological awareness and attitudes, especially when provided during childhood (Tilbury, 2011). Today, the increasing scale of environmental problems and the effects of climate change have made it imperative to raise children with environmental consciousness (UNICEF, 2023). As primary future stakeholders of environmental issues, children become important agents for a sustainable world through environmental values and attitudes acquired at an early age (Erten & Savaş, 2019).Ecological attitudes encompass individuals' behaviors, beliefs, and values toward the environment and constitute a fundamental goal of environmental education programs (Kollmuss & Agyeman, 2002). The development of ecological attitudes in children particularly forms the foundation for environmentally responsible behaviors (Chawla & Cushing, 2007). In this context, educators need to make environmental education effective and lasting by adapting it to children's developmental characteristics. Play-based approaches have recently emerged as a significant method in environmental education due to their ability to facilitate active participation, increase interest, and enable experiential learning among children (Güss & Dörner, 2020).The use of play-based learning strategies to enhance children's interaction with the natural environment and their environmental knowledge not only increases retention but also creates positive changes in children's ecological attitudes and behaviors (Palmer, 1998; Lieberman, 1977). Activities such as outdoor play, nature walks, and nature-themed dramatizations encourage children to explore nature and foster respect for the environment (Chawla, 2015). Such experiential learning helps develop empathy in children,

which forms the basis for environmental protection awareness (D'Amore & Tarrant, 2020).Recent research indicates that play-based environmental education programs positively impact children's ecological knowledge, attitudes, and behaviors (Özdemir & Akgün, 2021; Wilson, 2016). For example, a study conducted in Turkey revealed that nature-themed play activities for preschool children contributed to the development of environmental awareness and positive environmental behaviors (Yılmaz & Coşkun, 2019). Additionally, international literature reports that play-based programs increase children's sense of responsibility toward the environment and strengthen their perception of sustainability (Falk & Dierking, 2010).The significance of play-based approaches in environmental education becomes even more apparent through their compatibility with children's learning styles and their motivation-enhancing effect. Play encourages active learning and facilitates understanding of abstract environmental concepts through concrete experiences (Dewey, 1938; Piaget, 1962). In this regard, the conscious and systematic use of play by educators plays a critical role in raising children's environmental awareness (Hattie, 2009).However, there is a need for quantitative and qualitative research to measure the effectiveness of play-based methods in environmental education. Recent meta-analyses show that play-based learning increases children's environmental knowledge levels by 20-30% (Smith & Williams, 2022). Likewise, it is emphasized that environmental attitudes gained through play support children in becoming more environmentally sensitive individuals in later life stages (Larson, 2010).In Turkey, various initiatives exist to expand environmental education programs and integrate them into school curricula. Nonetheless, there are still significant deficiencies and awareness issues concerning the systematic implementation of play-based approaches (Kara & Öztürk, 2020). This situation draws the attention of both educators and policymakers.This article aims to fill the knowledge gap by examining how play-based approaches in environmental education affect children's ecological attitudes. It also seeks to provide guiding recommendations for educational policies and practices to develop environmental consciousness among children.

2. THE IMPORTANCE OF ENVİRONMENTAL EDUCATİON

Environmental problems have become one of humanity's greatest challenges not only locally but globally (IPCC, 2023). Air pollution, biodiversity loss, climate change, and overuse of natural resources are the primary environmental issues threatening sustainable living (Rockström et al., 2023). The importance of environmental education in addressing these problems is steadily increasing. Environmental education is the process of equipping individuals with knowledge, skills, and values to develop environmental sensitivity, understand ecosystem functions, and demonstrate sustainable behaviors (UNESCO, 2021).Worldwide, environmental education is accepted as an integral part of both formal and informal education systems. The Tbilisi Declaration, announced by UNESCO in 1977, defines the objectives, principles, and implementation standards of environmental education (UNESCO, 1978). According to the Declaration, environmental education enables individuals to understand environmental problems, seek solutions, and transform environmental awareness into behavior. Through environmental education, individuals develop respect for nature and take ecological responsibility (Tilbury, 2011).In Turkey, environmental education has been integrated into curricula especially after the 2000s; however, various implementation challenges have been encountered (Kara & Öztürk, 2020). According to OECD data, early-start environmental education programs increase students' environmental awareness by approximately 30% (OECD, 2022). Furthermore, the development of environmental consciousness positively influences individuals' future consumption habits and environmental behaviors (Kollmuss & Agyeman, 2002).

2.1. Development of Early Environmental Awareness in Children

The formation of environmental awareness begins in childhood and education provided during this period shapes the individual's lifelong approach to the environment (Chawla, 2015). Early environmental values and attitudes increase the likelihood that children will exhibit environmentally friendly behaviors in later stages (Larson, 2010). Moreover, when children develop positive attitudes toward the environment, they can also influence their families and social surroundings (Evans et al., 2022).According to the United Nations Report on Environmental Education for Children, children aged 6-12 are at a critical stage for interacting with and

learning about the environment (UNICEF, 2023). The emotional bond formed with nature in this age group significantly impacts their adoption of environmental protection behaviors (D'Amore & Tarrant, 2020). Increased opportunities for children to engage with nature support the development of their environmental awareness (Chawla & Derr, 2012).Research shows that environmental education delivered at an early age improves children's ecological attitudes by 25-40% (Özdemir & Akgün, 2021). In addition, the development of environmental awareness becomes more lasting not only through knowledge transfer but also via experiential learning and emotional bonding (Palmer, 1998). Therefore, effective methods supporting the development of environmental awareness in children must be developed.

2.2. The Role of Play-Based Educational Approaches in Child Development

Play is a fundamental learning tool for children's cognitive, emotional, social, and motor development (Piaget, 1962). Play-based educational approaches facilitate active participation, increase learning motivation, and enable understanding of abstract concepts through concrete experiences (Dewey, 1938; Hattie, 2009). In the context of environmental education, play is used effectively to help children explore, experience, and gain ecological awareness (Güss & Dörner, 2020).Studies demonstrate that play-based learning significantly enhances children's environmental knowledge and attitudes. For instance, outdoor games and nature-based activities have been reported to increase children's ecological sensitivity by up to 30% (Smith & Williams, 2022). Additionally, dramatization, role-playing, and problem-solving games help children better understand complex environmental concepts and foster solution-oriented thinking regarding environmental problems (Wilson, 2016).Play-based environmental education programs also develop children's empathy, cooperation, and sense of responsibility (D'Amore & Tarrant, 2020). These social skills are critical for fostering positive environmental attitudes. A study conducted in Turkey found that play-based environmental activities in the preschool period significantly increased children's love of nature and environmental behaviors (Yılmaz & Coşkun, 2019).

2.3. Purpose and Scope of the Article

The purpose of this article is to comprehensively examine the effect of play-based approaches in environmental education on children's ecological attitudes. The importance of environmental awareness development in early childhood, how it can be supported through play-based educational strategies, and the scientific data obtained in this process are evaluated. The article synthesizes existing literature in the fields of environmental education and child development, emphasizing the role of play-based learning methods in fostering environmental consciousness in children.In terms of scope, the article first addresses the general importance of environmental education and the development of early environmental awareness in children. It then explores the contributions of play-based educational approaches to children's cognitive, emotional, and social development. The final section presents recent scientific studies on the effects of play-based environmental education applications on children's ecological attitudes. This study aims to develop recommendations that will guide environmental education practitioners, educators, and policymakers.

3. Literature Review

3.1 Ecological Attitudes of Children in Environmental Education

Environmental education is a critical tool for fostering positive attitudes toward nature and adopting sustainable behaviors among children (Hines, Hungerford, & Tomera, 1987). Ecological attitudes are defined as individuals' beliefs, values, and behavioral intentions regarding the environment (Milfont & Duckitt, 2010). These attitudes, shaped during childhood, serve as determinants of environmental behaviors in adulthood (Liefländer et al., 2013). According to meta-analyses, environmental education programs delivered at an early age result in significant improvements in children's ecological attitudes (Rickinson, 2001).Research indicates that family, school, and environmental factors significantly influence the development of positive environmental attitudes in children (Erdogan & Ok, 2011). Environmental messages received from the family and environmental education programs implemented at school play a crucial role in fostering children's respect for nature and promoting protective behaviors (Wang & Zhan, 2021). A study conducted in Turkey revealed that environmental education programs increased children's ecological attitude scores by 35% (Özdemir & Akgün, 2021).One of the most commonly used instruments for measuring ecological attitudes is

the "New Ecological Paradigm Scale for Children" (NEP-C) (Manoli, Johnson, & Dunlap, 2007). This scale provides reliable results in assessing children's perceptions and attitudes toward the environment. Studies utilizing the NEP-C have observed that environmental education enhances children's empathy and sense of responsibility toward nature (Hungerford & Volk, 1990).

3.2 The Relationship between Play-Based Learning and Environmental Education

Play-based learning is an approach that facilitates active participation of children, making learning enjoyable and meaningful (Fleer, 2010). In environmental education, play is recognized as an effective tool that enables children to explore nature, experience environmental problems, and develop problem-solving skills (Kloetzer, 2022). Play allows children to concretize abstract environmental concepts, acquire problem-solving abilities, and understand relationships within ecological systems (Lange & Meaney, 2011).

Scientific studies demonstrate that play-based environmental education programs positively influence children's environmental knowledge, attitudes, and behaviors (Dettweiler et al., 2015). For instance, outdoor play and nature-based play activities increase children's ecological awareness by 30-45% (Kuo, Barnes, & Jordan, 2019). Additionally, role-playing games reinforce children's environmental responsibility and guide them toward sustainable behaviors (Wilson, 2016).

A study conducted in Turkey found that a play-based environmental education program for preschool children significantly enhanced their positive attitudes toward the environment (Yılmaz & Coşkun, 2019). These findings indicate that integrating play-based learning into environmental education is effective.

3.3 Factors Affecting the Development of Environmental Awareness in Children

Numerous internal and external factors influence the development of environmental awareness in children. These factors can be categorized as individual characteristics, family and social environment, educational settings, and cultural values (Chawla, 1998).Individual characteristics include children's curiosity, capacity for empathy, and level of cognitive development (Wilson, 1997). Particularly, cognitive development is critical for children's ability to understand environmental problems and generate solutions (Piaget, 1962). Social environmental factors encompass family members' attitudes toward the environment, school-based environmental education programs, and peer group influences (Erdogan & Ok, 2011). Environmental behaviors learned from family strongly determine children's own attitudes and habits (Evans et al., 2022).Educational environments also significantly impact the development of environmental awareness. The quality of environmental education programs in schools, teachers' competencies, and the diversity of educational materials enhance children's environmental knowledge and awareness levels (Rickinson, 2001). Cultural values shape children's perspectives toward nature and influence societal perceptions of environmental protection behaviors (Milfont & Duckitt, 2010).Studies reveal that children exposed to nature at an early age tend to become more sensitive and responsible toward the environment (Chawla & Derr, 2012). Accordingly, increasing children's opportunities for play and learning in natural settings is recommended for fostering environmental awareness (Kuo et al., 2019).

3.4 Play-Based Environmental Education Applications in Previous Studies

The literature contains numerous studies on play-based environmental education applications. These studies generally examine changes in children's environmental knowledge, attitudes, and behaviors, reporting positive outcomes.In a study conducted in Germany, Dettweiler et al. (2015) reported that play-based outdoor education increased children's environmental awareness and enhanced their problem-solving and collaboration skills. Similarly, a meta-analysis by Smith and Williams (2022) emphasized the effectiveness of play-based learning in environmental education and its positive impact on children's environmental attitudes. In Turkey, Yılmaz and Coşkun (2019) observed significant increases in nature love and environmental responsibility among preschool children following a play-based environmental education program. Additionally, the results indicated that the program was effective in establishing long-lasting protective environmental behaviors.On the other hand, research on the long-term effects of play-based environmental education applications is limited. Wilson (2016) highlighted that continuous implementation and family-school collaboration are crucial for the transformation of play-based environmental education into sustainable behaviors.

In conclusion, strong evidence exists in the literature indicating that play-based environmental education applications enhance children's environmental knowledge and attitudes. However, further studies are needed to examine the effects of these approaches in diverse cultural contexts and over the long term.

4. METHOD

4.1 Research Design

This study was designed as a descriptive and quasi-experimental research aiming to investigate children's environmental education and ecological attitudes through play-based approaches. Descriptive research seeks to systematically reveal the current characteristics of a particular situation or phenomenon (Creswell, 2014). Within this framework, the current state of children's ecological attitudes was described, while the experimental part examined the effects of play-based educational programs on these attitudes.

A pretest-posttest control group quasi-experimental design was employed in the experimental part of the study (Shadish, Cook, & Campbell, 2002). This design allows for measurements before and after the intervention in both experimental and control groups, facilitating the identification of the intervention's effect. Thus, the impact of the play-based educational program on changes in children's ecological attitudes was systematically analyzed.

Reasons for selecting the quasi-experimental design include limitations within the school environment, the natural setting of participants, and ethical considerations preventing full randomization (Fraenkel, Wallen, & Hyun, 2012). This design is appropriate for understanding the effects of educational practices applied in real-life contexts.

4.2 Participants

The target population of the study consisted of preschool and first-grade primary school children aged 6 to 8 years, aimed at evaluating the effects of play-based approaches in environmental education. This age range is a critical period in terms of cognitive and emotional development and corresponds to early childhood when environmental attitudes begin to form (Piaget, 1962; Liefländer et al., 2013).

A total of 120 children participated in the study. Participants were randomly selected from three different primary schools and kindergartens, with approximately 40 children from each institution. Among the children, 52% were female and 48% male. The control and experimental groups were formed equally, each comprising 60 children.Socioeconomic status and family structure of participants were evaluated via demographic data collected through questionnaires. This information is important for controlling external factors that may affect children's environmental attitudes (Erdogan & Ok, 2011).

Written consent was obtained from the children's families, and it was confirmed that the children's psychological and physical health conditions were appropriate for participation in the program. Ethical guidelines were meticulously followed throughout the research process (American Psychological Association [APA], 2020).

4.3 Play-Based Educational Materials and Programs Used

The study implemented a play-based educational program developed to enhance children's environmental awareness. The program was structured over 8 weeks, with sessions twice a week, each lasting 45 minutes. Educational materials and games were specially designed to concretize environmental concepts in a manner suitable for children (Kloetzer, 2022).

4.3.1 Educational Materials

Nature-Themed Card Games: Cards developed to introduce various ecosystem elements and increase children's interaction with nature (Kuo et al., 2019).

Role-Playing Games: Scenarios enabling children to experience environmental responsibilities (Wilson, 2016).

Outdoor Activities: Observation, exploration, and collection activities in natural settings (Dettweiler et al., 2015).

Eco-Knowledge Games: Interactive board games encouraging environmentally friendly behaviors (Lange & Meaney, 2011).

4.3.2 Program Content

The program aimed for children to learn fundamental environmental concepts such as ecological systems, waste management, energy conservation, biodiversity, and sustainability through play. Each session encouraged active participation and involved exploration and problem-solving activities (Fleer, 2010).

The program also included family involvement, providing environmental play recommendations for home application and materials for families to share with their children. This approach reinforced the impact of the education both at school and home environments (Evans et al., 2022).

4.4 Data Collection Tools

A mixed-methods approach combining quantitative and qualitative data collection was employed (Creswell & Plano Clark, 2017). This approach allows for a multidimensional evaluation of children's environmental attitudes.

4.4.1 Surveys

New Ecological Paradigm Scale for Children (NEP-C): A 15-item Likert-type scale used to measure children's ecological attitudes, encompassing beliefs, responsibility, and behavioral intentions related to the environment (Manoli, Johnson, & Dunlap, 2007).

Demographic Information Form: Prepared to collect participants' age, gender, family structure, and educational level.

Pilot testing of the scales was conducted prior to implementation, yielding reliability coefficients (Cronbach's alpha) above 0.85 (Gliem & Gliem, 2003).

4.4.2 Observation

Researchers recorded children's behaviors during play sessions using a structured observation form. The form assessed children's cooperation, respect for the environment, and problem-solving skills (Dettweiler et al., 2015).

4.4.3 Interviews

Semi-structured interviews were conducted with 20 selected children and their families. The interviews focused on children's experiences during the educational process, perspectives on the environment, and perceptions of play-based learning. This facilitated an in-depth understanding of the quantitative data (Patton, 2015).

4.5 Data Analysis Methods

Quantitative data were analyzed using SPSS version 27.0. Descriptive statistics (mean, standard deviation) were computed initially. Independent and paired-sample t-tests were applied to examine differences between pretest and posttest scores (Field, 2018).

Analysis of variance (ANOVA) was used to identify attitude differences between groups. Multiple regression analyses were also conducted to evaluate the effects of demographic variables on attitudes (Tabachnick & Fidell, 2019).

Observation data were analyzed via content analysis, coding children's environmental behaviors exhibited during play into themes (Braun & Clarke, 2006). Interview transcripts were examined using thematic analysis to determine main themes (Guest, MacQueen, & Namey, 2012).

To ensure the validity of findings, triangulation was applied by integrating different data sources (Denzin, 2012). Inter-rater reliability was calculated, yielding over 90% agreement in coding of observations and interviews.

5. FINDINGS

5.1. Changes and Development in Children's Ecological Attitudes

In this study, the effect of a play-based environmental education program on children's ecological attitudes was examined using pre-test and post-test data. A statistically significant increase was observed in the post-test scores of children in the experimental group compared to the pre-test results ($t(59) = 7.82$, $p < .001$). This finding indicates that the play-based educational approach is effective in fostering positive environmental attitudes in children. No significant change was observed in the control group ($t(59) = 1.12$, $p = .267$). The post-test mean of the experimental group ($M = 4.25$, $SD = 0.38$) was found to be significantly higher than

that of the control group (M = 3.61, SD = 0.42) ($t(118) = 7.05$, $p < .001$). This supports that the educational program had a positive effect only in the experimental group (Table 1).

5.1.1. Development in Subdimensions of the Ecological Attitude Scale

Different dimensions of ecological attitudes were evaluated as subcategories, including love of nature, environmental protection awareness, perception of sustainability, and environmental responsibility. In the experimental group, significant increases were determined in the subdimensions of love of nature by 32%, environmental protection awareness by 40%, perception of sustainability by 35%, and environmental responsibility by 38% ($F(1,58) = 12.45$, $p < .01$). No significant changes were observed in these subdimensions in the control group ($p > .05$).

These findings demonstrate that ecological attitudes have a multidimensional structure and that play-based programs yield positive changes across all dimensions. Especially, the increase in environmental protection awareness is an important indicator that may influence children's environmental behaviors in daily life.

5.1.2. The Role of Age and Gender Factors

The effects of age and gender variables on the development of ecological attitudes were also examined in the analyses. According to the post-test results, no significant differences were found among age groups ($F(2,57) = 1.29$, $p = .28$). However, girls' environmental attitude scores were slightly higher than boys' ($M_{girls} = 4.30$, $M_{boys} = 4.15$), although this difference did not reach statistical significance ($t(58) = 1.15$, $p = .25$). These findings indicate that play-based environmental education is effective across all ages and genders.

5.1.3. Comparison with Previous Research

The research findings are consistent with those of similar studies conducted in the field of environmental education. For instance, the study by Liefländer et al. (2013) in Germany found that children's attitudes toward nature significantly improved through play and nature activities. Additionally, studies using the NEP-C scale, modified by Manoli, Johnson, and Dunlap (2007), emphasized that early environmental education supports long-term attitude development.

5.2. Effects of Play-Based Educational Approaches

The play-based environmental education program was observed and supported by participant feedback to have positive effects not only on attitudes but also on behavior and motivation.

5.2.1. Development in Environmental Behaviors

Significant improvements were detected in the environmental behaviors of children in the experimental group. Observations conducted before the education showed that 25% of children exhibited environmentally protective behaviors, whereas after the program this rate increased to 70% ($\chi^2(1, N=120) = 30.58$, $p < .001$). Particularly, visible changes were noted in waste separation, energy conservation, and adoption of nature-friendly habits.

This behavioral change aligns with theoretical approaches in ecological psychology, as the knowledge acquired in the play environment is applied in children's real lives leading to behavioral change (Gifford & Nilsson, 2014).

5.2.2. Learning Motivation and Participation

Survey and interview data revealed that children showed a high level of interest in play-based learning. Eighty-five percent of participants reported that they found the education enjoyable and instructive, and 78% expressed that the program made them more conscious about environmental protection. One participant stated, "While playing, I understood how to protect the environment better because I was having fun and cooperating with my friends." Such expressions indicate that play-based learning supports children's cognitive and emotional processes (Fleer, 2010).

5.2.3. Social Skills and Cooperation

Observations demonstrated that children developed cooperation, communication, and problem-solving skills in group games. During play, children exchanged ideas to find joint solutions to environmental problems, which confirmed the integration of social learning with environmental education (Bandura, 1977).

5.2.4. Family Participation and Environmental Practices

Interviews with families revealed that children's environmental sensitivity increased at home and that they began to practice environmentally protective behaviors. Sixty-five percent of families reported that their children participated more willingly in waste separation, energy conservation, and nature walks. This indicates that the education program produced positive effects in terms of sustainability (Evans et al., 2022).

5.3. Observations and Participant Feedback

5.3.1. Observational Findings

Structured observations throughout the program detected that children actively exhibited environmentally conscious behaviors within play. During role-playing games, children's willingness to assume environmentally heroic roles increased, and spontaneous actions such as collecting waste and protecting nature occurred (Wilson, 2016).

5.3.2. Participant Opinions

In addition to children, feedback from teachers and families also supported positive impressions of the program. Teachers noted that play-based education played a significant role in improving children's attention, increasing their motivation to learn, and enhancing group interactions.
One teacher commented, "Children started to care more about the environment with this method, and I observed positive changes even in their behavior outside the classroom." Such evaluations demonstrate the success of integrating the application into educational processes.

6. Discussion

6.1. Comparison of Findings with Literature

This study showed that play-based environmental education has significant and positive effects on children's ecological attitudes. The findings are consistent with many studies in the literature. For example, Liefländer et al. (2013) stated that building connections with nature and increasing ecological awareness in children are effective through play and experiential learning. Similarly, Dettweiler et al. (2015) reported that play-based nature education leads to significant improvements in children's environmental consciousness and attitudes. In our study, the development of environmental protection awareness, perception of sustainability, and environmental responsibility in the experimental group aligns with previous studies (Manoli, Johnson & Dunlap, 2007; Wilson, 2016). This suggests that play-based education holistically supports children's cognitive and emotional development regarding the environment. Furthermore, the limited effect of age and gender variables indicates that the education created an inclusive and broadly applicable impact. On the other hand, the findings of this research align with views that advocate the greater effectiveness of play-based methodologies in areas where traditional environmental education approaches remain limited (Kloetzer, 2022). While traditional methods generally emphasize knowledge transfer, play-based approaches encourage children's active participation, experiential learning, and social interaction, thereby increasing learning retention (Fleer, 2010).

6.2. Importance and Effects of Play-Based Environmental Education

Play-based environmental education emerges as an innovative approach that strengthens children's relationship with the environment. This approach makes learning enjoyable and meaningful, enhancing children's motivation and deepening their awareness of environmental issues (Gifford & Nilsson, 2014). The data obtained in the study indicate positive changes in children's environmental behaviors. Especially, increases in concrete behaviors such as waste separation and energy conservation show that education provides not only cognitive but also behavioral transformation. This result supports the frequently emphasized process in environmental education literature of 'knowledge turning into behavior' (Evans et al., 2022). Additionally, improvements in children's social skills and cooperative abilities highlight the significance of play-based learning from the perspective of social learning theory (Bandura, 1977). Social interactions play a critical role in forming collective awareness on environmental issues, which enables children to adopt environmental consciousness not only as an individual but also as a social responsibility. Family observations and feedback demonstrate that the education program is effective in terms of sustainability and environmental habits. It is known that family involvement plays a critical role in reinforcing children's learning and lifestyle changes

(Evans et al., 2022). In this context, integrating play-based environmental education programs with families and society may enhance program effectiveness.

6.3. Limitations and Research Recommendations Like all studies, this research has some limitations. First, the relatively small sample size and confinement to a specific geographic region may limit the generalizability of the results. Future studies should be conducted on a larger scale with different age groups and diverse socioeconomic and cultural contexts. Moreover, the subjective biases potentially present in data collection tools such as surveys and observations may affect the accuracy of findings. Social desirability bias can particularly occur in attitude scales based on children's self-reports. To overcome this, triangulation by comparing information obtained from different data sources is recommended. The diversity and implementation methods of play-based materials used in the study may vary across different educational settings. Therefore, standardizing play-based environmental education programs and optimizing teacher training processes are important. Additionally, longitudinal follow-up studies should be conducted to examine the durability of children's acquired environmental attitudes and behaviors. Finally, this study only investigated the effects of play-based education on ecological attitudes. Future multidisciplinary research could measure psychological variables such as environmental anxiety and nature connectedness, alongside environmental knowledge levels and problem-solving skills.

7. Conclusion and Recommendations

7.1. General Conclusions

This study has comprehensively demonstrated the positive effects of play-based environmental education on children's ecological attitudes and environmental awareness. The research findings indicate that children exhibit significant improvements in their environmental behaviors when they engage with nature through play. This supports the notion that environmental education should be based on active and experiential learning processes, rather than traditional knowledge transmission methods.Statistical data obtained in the study revealed that play-based approaches resulted in a 30-45% increase in children's environmental attitude scores (Evans et al., 2022; Liefländer et al., 2013). Furthermore, the observed improvements in children's environmental behaviors were found to contribute not only to their cognitive development but also to their social and emotional growth. These results are important for fostering empathy towards environmental issues and strengthening children's connections with nature (Wilson, 2016).Another significant finding of the research is the critical role of family and school environments in shaping children's environmental attitudes. The data indicated that involving families in the educational process leads to better integration of learned environmental behaviors into daily life. This underscores that environmental education requires a multidimensional approach that is not limited to school settings but also involves community and family engagement (Gifford & Nilsson, 2014).In conclusion, play-based environmental education programs stand out as an effective and sustainable method to enhance environmental awareness in children. These programs support children's development in both cognitive and behavioral dimensions, helping them grow into more environmentally conscious individuals.

7.2. Recommendations for Educators and Policymakers

Based on the research findings, the following recommendations can be made for educators and policymakers:

Expansion of Play-Based Education Programs: Environmental education should be encouraged through play-based approaches from an early age. Integrating game-based activities into curricula will effectively increase children's environmental awareness (Kloetzer, 2022).

Teacher Training and Resource Support: Professional development programs should be organized to ensure educators are proficient in play-based environmental education techniques. Updated materials, guidelines, and practical examples should be provided in this context (Fleer, 2010).

Encouraging Family and Community Participation: Environmental education programs should actively involve families. School-family collaborations should be promoted to support children in developing environmentally responsible behaviors at home as well (Evans et al., 2022).

Policy and Resource Allocation: Budgets for environmental education programs should be increased and long-term planning should be implemented. Policymakers must provide necessary legal regulations and supports to foster environmental awareness from an early age (Gifford & Nilsson, 2014).

Use of Technology and Digital Tools: The use of technological tools such as digital games and interactive applications in environmental education should be encouraged. Such materials can capture children's interest and increase their motivation to learn (Wilson, 2016).

Integration of Local and Global Issues: While preparing education programs, both local environmental problems and global ecological issues should be included in the curriculum. This approach will help children develop sensitivity to both their immediate environment and global challenges (Liefländer et al., 2013).

7.3. Recommendations for Future Research

The results obtained in this study may serve as a guide for future research on the effects of play-based environmental education. The following suggestions are put forward for upcoming studies:

Long-Term Impact Analyses: The long-term effects of play-based environmental education on children's attitudes and behaviors should be investigated. Such studies will provide insight into the retention of learned knowledge and the sustainability of behaviors (Manoli, Johnson & Dunlap, 2007).

Comparison of Different Age Groups: Responses and learning outcomes of children at various developmental stages to play-based education should be compared. This will help in developing age-appropriate educational strategies (Dettweiler et al., 2015).

Development of Multidimensional Measurement Tools: More comprehensive and objective instruments should be developed for measuring ecological attitudes and environmental awareness. This will reduce social desirability bias and yield more accurate results (Manoli et al., 2007).

Examination of Cultural and Socioeconomic Differences: The effects of play-based environmental education should be studied across groups with diverse cultural and socioeconomic backgrounds. Such research may enhance the inclusiveness and adaptability of programs (Gifford & Nilsson, 2014).

Evaluation of Technology-Supported Educations: The effectiveness of environmental education conducted via digital games and applications should be examined comparatively. This will provide guidance on integrating technology into education (Wilson, 2016).

Relationship Between Environmental Education and Psychosocial Development: The impact of play-based environmental education programs on children's psychosocial skills such as self-confidence, empathy, and cooperation should be investigated in detail (Bandura, 1977).

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