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Preschool education as a foundation for sustainable development and early environmental awareness in children

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Abstract

Sustainable development encompasses the integration of environmental, social, and economic dimensions to ensure balanced societal progress. Historically, development models have prioritized economic expansion, often resulting in environmental degradation and widening social disparities. These negative consequences were frequently regarded as acceptable tradeoffs for economic gain, contributing to pressing global issues such as climate change, biodiversity loss, pollution, and social inequity. Early childhood education plays a critical role in shaping values and behaviors aligned with sustainability. As the foundational stage of institutional learning, preschool education offers a unique opportunity to instill environmental awareness and sustainable habits. This study explores the perceptions and practices of educators regarding education for sustainable development in preschool settings. A survey was conducted among educators to assess the roles of key stakeholders, including educators, parents, and the community, in fostering sustainable attitudes and behaviors. The findings underscore the pivotal role of early education in developing responsible and environmentally conscious individuals. The collaborative involvement of families and communities further enhances the effectiveness of sustainability education, contributing to the long-term goal of cultivating future generations committed to sustainable living.

Keywords: Early childhood education; environmental awareness; preschool education; stakeholder involvement; sustainable development.

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1. INTRODUCTION

Education may contribute to a new sustainable global development vision (UNESCO, 2015b); in other words, high-quality education makes up the basis of sustainable development. As is explained in the Sustainable Development Goals, individuals should be sustainability change-makers to create a more sustainable world (UNESCO, 2015b; Buckler & Creech, 2014). Children are a common factor for all aspects of sustainable development. Therefore, to have a positive impact on the future, children must acquire the necessary skills from an early age. Sustainable development, which aims solely to support "the child in its entirety," can ensure real development progress by simultaneously promoting and protecting children's emotional, social, physical, and cognitive development and their basic life needs (UNICEF, 2013). Children have the right to develop fully their potential and live in a sustainable world (Chan, 2013). To this end, children should have the knowledge, skills, values, and attitudes that will enable them to contribute to sustainable development. Integrating STEM education into early childhood curricula has been shown to enhance children's understanding of sustainability concepts, fostering critical thinking and problem-solving skills essential for sustainable development (Boyd et al., 2022). Therefore, education is very important for achieving sustainable development. Sustainable development and education policies are becoming more and more compatible (Sachs, 2012). Nevertheless, not all kind of education supports sustainable development (UNESCO, 2015a).

Education for Sustainable Development means including the key sustainable development issues (climate change, reducing the risk of disaster, biological diversity, reducing poverty, and sustainable consumption) in teaching and learning. ESD gives every person the opportunity to acquire the knowledge, skills, attitudes, and values necessary to shape a sustainable future (Buckler & Creech, 2014). Recent bibliometric analyses indicate a growing trend in higher education institutions focusing on ESD, highlighting its increasing importance in academic research and policy development (Tafese & Kopp, 2024). Furthermore, ESD should adopt innovative, participatory teaching and learning methods to reach and motivate all students for them to implement their creative and critical thinking skills and actively lead the sustainable development process (Spiteri, 2020; Sterling, 2016; UNESCO, 2017). Participatory teaching methods have been found effective in promoting critical thinking and student engagement in sustainability topics (Mokhtar et al., 2024). As a result, education for sustainable development promotes competences such as critical thinking, imagining future scenarios, and cooperative decision making. Sustainable development, which states that both values can be protected and development can be realized, is one of the most important tools for presenting the right to live in a healthy environment, which is one of the fundamental rights defined by the United Nations (Buckler & Creech, 2014). Empowering pre-service teachers with critical thinking competencies is crucial for guiding students' informed decisions and actions towards sustainability (Kurniawan et al., 2023).

The conceptualization of sustainable development is effectively grounded in the early sensitization of children to environmental issues, alongside the cultivation of self-confidence, independent initiative, foundational knowledge, communication proficiency, and environmental management competencies. A thorough understanding of developmental needs and the specific characteristics of children represents a fundamental prerequisite for structuring developmentally appropriate educational activities. These activities must align with the cognitive, emotional, and social capabilities corresponding to each developmental stage. Early childhood education for sustainability (ECEfS) underscores the significance of integrating sustainability principles into early learning frameworks, thereby promoting environmental awareness and fostering responsible behaviors from an early age (Scollan and Farini, 2022).

Education is a long-term, continuous, systematized and expedient process, so it cannot be expected that all the desired goals will be achieved simultaneously and in a short period, but, with a high probability, pedagogical science confirms that the continuous use of methods that enable a high level of activity for children contributes to that process. According to Lepičnik Vodopivec (2006), the development and application of problem-solving strategies is an important pedagogical aspect of environmental education and education for sustainable development. It means experiencing, getting to know, and appreciating the environment, based on which the child develops certain skills. To be able to experience, get to know and determine the values of the environment, the child must get to know itself, its senses and how to include them in the process of getting to know the environment, to be able to name, describe, determine common and different characteristics, to know how to measure, to classify according to established groups and different characteristics, to investigate and predict the critical values of the results and their use.

The early development of environmental sensitivity in children plays a pivotal role in fostering intrinsic motivation (Luo and Li, 2024). Direct engagement with the natural environment is essential for acquiring foundational experiential knowledge. Consequently, early childhood education settings, particularly kindergartens as the initial formal educational institutions, must incorporate systematic and daily environmental engagement into their pedagogical planning. This process unfolds along two primary trajectories: the first involves the child narrating personal experiences during activities, emphasizing imagination and creativity; the second entails continuing the activity through interpersonal comparison, facilitated by both verbal and nonverbal communication.

This dynamic raises essential pedagogical questions: Are children able to articulate perceptions, emotions, and experiences? How can emotional states such as fear or discomfort be expressed when corresponding conceptual frameworks are undeveloped? What are the implications of limiting environmental learning to passive media exposure, such as television? What strategies enable educators to assist children in identifying appropriate language for subjective experiences?

Friedrich Fröbel (1826), a foundational figure in early childhood education, underscored the primacy of experiential learning by asserting that children must first comprehend the language of objects before acquiring the language of words. According to Fröbel, children are initially unable to differentiate sensory experiences such as color, taste, texture, and temperature, reinforcing the assertion that the natural environment constitutes the earliest curriculum. This philosophy continues to underpin early childhood education theories advanced by Fröbel, Montessori, Steiner, Piaget, and Vygotsky. A shared pedagogical tenet among these theorists emphasizes the alignment of curricular content with activities that stimulate intrinsic interest and agency in children. This principle remains prevalent in contemporary educational practice.

The question of "who benefits from education" emerges as central to the discourse on educational philosophy and environmental pedagogy. Gardner's appeal, grounded in educational psychology, positions psychological insight as critical not only for personal ecological development but also for the advancement of sustainable development. The legacy of industrial-era education, characterized by mechanistic replication of pedagogical models suited to the needs of technological efficiency and market demands, persists in contemporary systems. The commodification of education and the material exploitation of natural resources reflect a broader societal orientation driven by mechanization. However, ecological equilibrium and sustainable development are inherently human concerns, underscoring the necessity of reorienting educational goals toward environmental stewardship and self-realization.

In examining educational influence, attention must shift from direct instruction to the cultivation of objective relationships within which the learner develops positive affective and cognitive orientations toward nature. Subjectivity, conceptualized as a network of relational dynamics, is essential in guiding pedagogical praxis. This approach to environmental education is grounded in the ontogenetic development of the individual, interpreted through the interrelated dimensions of biosystemic, personal, and social identity.

Definitions of ecologically sustainable development vary widely, reflecting conceptual complexity and frequent ideological divergence. Similarly, upbringing and education are not fixed entities but are constructed through didactic and methodological processes aimed at achieving specific objectives. The intersection of education and sustainable development, therefore, comprises two fluid constructs capable of reciprocal engagement. Educational and sustainability goals may be pragmatic, ideological, scientific, or otherwise, yet are united by shared aspirations. Importantly, education does not presuppose scientific content, as historical precedents reveal educational agendas ranging from humanistic to ecocidal.

Clarifying the aims of education necessitates a deliberate articulation of desired outcomes. When integrated with ecological science, the resultant framework becomes one of ecological education. A primary objective of such education is to translate sustainability challenges into scientific discourse, thereby rendering abstract concerns into actionable domains. The incorporation of scientifically validated concepts and hypotheses into global environmental education practices aims to institutionalize sustainability within national curricula. According to United Nations directives, environmental protection constitutes the core of environmental education.

Nonetheless, effective environmental education requires widespread cognitive and cultural acceptance, quantifiable assessments of anthropogenic impact, equitable governance, and intergenerational justice. These conditions form the foundation of ethical and effective sustainability education. A persistent dilemma concerns the feasibility of education for sustainable development. A central issue within global education initiatives lies in establishing a robust scientific foundation for sustainability pedagogy. Science is characterized by defined subjects and methodologies, whereas sustainable development remains a conceptually fluid process. Within the United Nations' designated Decade of Education for Sustainable Development, efforts must focus on synthesizing analytical approaches, delineating subject matter, and developing humane strategies for managing sustainability transitions. The marginalization of scientific rigor in sustainability discourse highlights the need for a universally accepted, empirically grounded definition of sustainable development, capable of guiding both policy and pedagogy.

People can learn about different environmental problems, contribute to resolving them, and take steps to preserve and enhance the environment through this process. People learn more about environmental issues and how to solve them through environmental education. They also gain the knowledge and skills they need to make responsible choices. It is made up of several elements. Here are some of them:

- Knowledge of the environment and care for natural problems and issues.
- Environmental awareness and familiarity with ecological issues.
- An understanding of the environment and a desire to keep, protect, or improve the quality of the environment.
- People who care about the environment and want to keep it in a good state and improve it should have

certain skills. These skills can help people find and solve environmental problems.

- Doing things and taking actions that contribute to solving environmental problems.

1.1. Purpose of the study

Environmental education doesn't support a single point of view or activity over another. Instead, environmental education educates people how to think critically about different sides of an issue. It also helps the person get better at making decisions and resolving issues. The purpose of the study is to highlight the role of environmental education in developing the knowledge, skills, attitudes, and critical thinking necessary to understand and address environmental issues. It aims to foster awareness, promote responsible decision-making, and encourage active participation in environmental protection. Rather than promoting a single viewpoint, environmental education equips individuals to evaluate multiple perspectives, solve problems, and take informed action to support sustainability.

2. METHOD AND MATERIALS

2.1. Research design

The present study is a qualitative investigation designed to determine the perspectives of preschool teachers. Qualitative research constitutes a descriptive and inductive methodology that facilitates the extraction of meaning from participants' viewpoints, enabling detailed data collection and presentation through a holistic framework. In alignment with this objective, the phenomenological approach was employed, emphasizing individuals' lived experiences and their interpretation of specific situations. Phenomenological studies seek to provide an in-depth description of personal experiences related to a defined phenomenon. The phenomenon addressed in this research is environmental education, focusing on the experiences of preschool teachers and parents.

A comprehensive research strategy was adopted to clarify methods for enhancing the structure and efficacy of environmental education within preschool environments. This strategy incorporated qualitative interviews, quantitative surveys, and participatory observations to support the collection of data necessary for evaluating existing practices and identifying potential avenues for advancing environmental education among young children.

2.2. Participants

The preschool age is the most suitable for forming children's basic perceptions of the world around them, in which parents, but also teachers in kindergartens, play a big role. Education for sustainable development, preservation of the environment, and rational use of energy are part of lifelong education that should start from early childhood (Huljev et al., 2024). The research included 27 educators employed in the kindergarten "Pavlina Veljanova" in Kočani and the kindergarten "Goce Delcev" in Probishtip, located in eastern Macedonia. Educators who work with all age groups (small, medium, and large) are equally represented in percentage. Regarding the work experience of the educators, it can be noted that in the kindergartens of our sample there is an equal percentage of educators with work experience of 5-10 years and 10-20 years (45%), 27% with work experience of 1- 5 years, and the rest are under one year of work experience. In terms of gender, predominantly (99%) of respondents are female.

2.2.1. Qualitative interviews

Semi-structured interviews were conducted with educators and parents. The interview questions were developed to explore the following thematic areas:

- Assessment of the current state of environmental education and upbringing in preschool institutions.
- Identification of challenges and barriers in the organization and implementation of environmental education and upbringing programs in preschool institutions.
- Determination of effective strategies and practices for enhancing the organization and impact of environmental education and upbringing in preschool institutions.
- Formulation of recommendations related to interventions, professional development, and resource allocation.

Interviews were conducted either in person or virtually, contingent upon participant availability and access.

2.2.2. Quantitative survey

Quantitative data were gathered through a structured survey instrument designed to assess the organization, content, and effectiveness of environmental education and upbringing programs for preschool-aged children. The survey was administered to a representative sample of kindergarten educators and parents whose children attended the same institutions. The instrument included items addressing the following dimensions:

- Frequency and duration of environmental education and upbringing activities, with reference to the themes included in the relevant educational programs.
- Availability of resources, professional training, and institutional support for educators in kindergartens.
- Perceived effectiveness of environmental education and upbringing programs in meeting established learning objectives.
- Challenges and barriers encountered during the implementation of environmental education and upbringing initiatives.

Survey responses were collected through online platforms or distributed in printed format. Anonymity was ensured to maintain confidentiality and to promote the provision of honest and comprehensive feedback.

2.2.3. Participatory observation

Participatory observation was employed in natural and outdoor learning environments to complement the qualitative and quantitative data collection methods. This approach provided direct insight into the structuring and implementation of environmental education activities in preschool settings. The following elements were systematically documented:

- Nature and extent of environmental education and upbringing activities.

- Pedagogical methods and instructional strategies adopted by educators.
- Levels of engagement and interaction among children, educators, and environmental stimuli.
- Opportunities and challenges encountered in integrating environmental education and upbringing into daily preschool activities.

2.3. Data analysis

The qualitative data obtained through interviews and participatory observations were analyzed using thematic analysis to identify recurring themes. Quantitative data derived from the surveys were processed through descriptive statistical methods, including frequencies, means, and percentages, to summarize principal findings and detect emerging trends. The application of a triangulation approach, encompassing both qualitative and quantitative data, facilitated a comprehensive understanding of the complexity and diversity inherent in environmental education and upbringing within kindergarten contexts.

In the context of preschool education, the physical environment is complemented by a stimulating social environment, which plays a critical role in early learning. Through social interaction, children acquire fundamental competencies such as cooperation, sharing, and participation in various problem-solving situations. Within this social learning environment, educators assume a pivotal role and are expected to possess the ability to recognize developmental processes and principles in early childhood. Accordingly, they are responsible for planning, preparing, and establishing conditions that allow each child to optimally realize and enhance developmental potential (Lepičnik Vodopivec, 2013).

Based on this pedagogical foundation, the initial set of research questions focused on the knowledge and attitudes held by educators regarding sustainable development and ecological activities incorporated within kindergarten work programs. It is noteworthy that all participating educators reported familiarity with the concepts of ecology and sustainable development. Definitions provided for the term *ecology* commonly include: care for a clean and healthy environment and the planet as a whole; awareness and responsible behavior toward nature; environmental protection; and maintaining cleanliness in the environment.

When defining *sustainable development*, educators offered responses such as: improving the quality of life for all global inhabitants without compromising planetary survival; maintaining natural resources through sustainable use, conservation, and recycling; and overall environmental stewardship.

Regarding perceived awareness levels, 50 percent of respondents described themselves as very informed about ecology. In contrast, awareness of sustainable development varied: 50 percent reported being less informed, 33 percent described themselves as informed, and 17 percent as very informed. A substantial proportion (57 percent) indicated no prior participation in training or seminars focused on ecology or sustainable development. Among those who had attended such training, most reported that the sessions did not significantly enhance their knowledge or understanding of the topics.

Overall, educators in the sample demonstrated foundational knowledge of ecology and sustainable development. However, in alignment with the principles of lifelong learning and professional development, increased engagement in structured educational opportunities such as seminars and workshops remains essential. Emphasis should also be placed on the quality of such professional development initiatives, including the provision of detailed content, practical activities, exemplary practices, and actionable guidelines. These should support the effective integration or correlation of environmental themes with

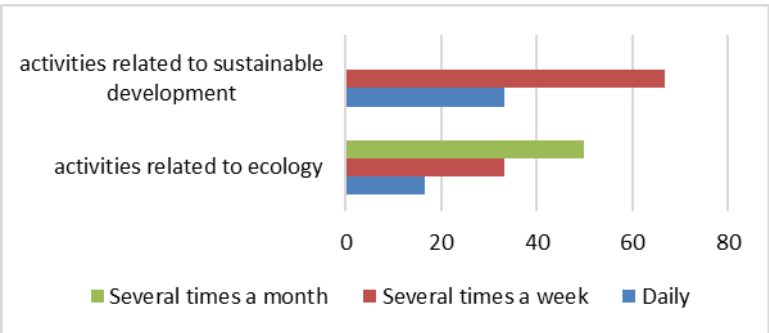
broader curricular content to enhance pedagogical implementation.

3. RESULTS

Among the ecology-related activities offered, the highest proportion of responses (67 percent) indicated that environmental clean-up is regularly practiced within preschool groups, while 33 percent reported implementing activities involving nature observation. Regarding sustainable development, the most frequently implemented activities include recycling (50 percent), water and energy conservation (33 percent), and the use of renewable energy sources (17 percent). In terms of the frequency of engaging children in discussions and activities related to ecology, 50 percent of educators reported doing so several times per month, 33 percent several times per week, and 17 percent daily. For activities specifically addressing sustainable development, 67 percent reported implementation several times per week, while 33 percent indicated daily inclusion (Figure 1).

Figure 1

Educators' opinions on how often they involve children in conversations and activities related to ecology and sustainable development



It is positive that a large percentage (83%) of the study's participants believe that children show interest in activities related to sustainable development, while 16% of them are not sure about that statement.

For the successful implementation of the planned activities, in general, and especially those related to sustainable development, the support of the entire educational and administrative-management staff is needed.

To the question: *How do you evaluate the resources and support you receive for implementing activities on education for sustainable development?* 67% of educators evaluate them *as good*, while 33% *as unsatisfactory*. Regarding the support they receive from the administration for the implementation of activities of this type, 50% answered that they receive *partial support*, 31% that they receive *complete support*, and 19% that they *do not receive support*.

In terms of cooperation with parents, educators state that they are *partially* (61%) involved in activities related to sustainable development, 22% that they are *involved*, and the rest that they are *not involved* in activities of this type. In terms of the type of activities they are involved in, dominating (70%) activities from home (recycling, gardening), and a small part in workshops, seminars, and volunteer activities/projects

organized by the preschool.

In addition, the biggest challenges faced by educators during the realization of activities that include topics of sustainable development are: *Lack of resources* (67%), *insufficient training of educators* (21%), and *lack of time* (12%) for the realization of these types of activities. This also correlates with the previously received finding, as well as noted recommendations from the educators included in the sample, that educators are not sufficiently informed about the concept of sustainable development and the way to implement activities of this type in everyday activities, whether through correlation with other areas/topics or as an independent activity. This is followed by the fact that it is necessary to work on raising the knowledge and skills of educators by organizing additional training on this topic and its implementation in the current activities in preschool institutions. And, of course, for all this to be planned and implemented, the unreserved support of the management staff of kindergartens is necessary, among other things, by providing the necessary material, technical and spatial conditions for their successful realization, as well as opportunities for greater involvement in projects and project activities to exchange them, as well as deepen and expand their experiences for implementing activities of this type in their practice.

4. DISCUSSION

The acquisition of knowledge and experience through play and direct engagement provides a robust foundation for the development of the communication and interaction dimension, particularly in fostering sensitivity and awareness toward the environment (Huljev et al., 2024). During the preschool period, children experience rapid development across multiple domains, including cognitive, socio-emotional, physical, psychomotor, linguistic, and aesthetic growth. In addition to acquiring fundamental habits and skills, the cultivation of environmental awareness during this stage is of particular importance. The development of such awareness, along with the internalization of ecological values, can be facilitated through diverse activities tailored to the developmental stage and individual needs of preschool children. Consequently, beyond the theoretical knowledge educators possess regarding education for sustainable development, the extent to which this content is operationalized in daily pedagogical practice plays a crucial role. In this context, attention was directed toward the degree to which educators incorporate sustainability-related knowledge into routine educational activities with children.

Qualitative interviews with preschool educators yielded valuable insights into the organization, challenges, and potential improvements in environmental education and upbringing programs. These discussions illuminated the current state of environmental education in preschools, highlighting the necessity for a standardized curriculum, sustained professional development opportunities for educators, and enhanced access to educational resources. While most preschools incorporate environmental education into their daily activities, often through informal means such as nature walks, gardening, and recycling projects, there exists notable variability in the depth and consistency of implementation across institutions.

Challenges identified included limited time and resources, insufficient training and institutional support, and competing curricular demands. Additionally, a stronger alignment between environmental education and parenting practices, as well as national educational standards, was deemed essential. Despite these obstacles, several opportunities were recognized for enhancing environmental education in preschool settings. These include the potential for collaborative partnerships, greater community involvement, and the adoption of innovative pedagogical approaches. Participants suggested strategies such as integrating

environmental topics across different areas of learning, utilizing open-air learning spaces, and leveraging technology to enrich the educational experience.

Quantitative surveys conducted among preschool educators provided data concerning the structure, content, and perceived effectiveness of environmental education and upbringing programs. Results revealed that, on average, environmental activities are conducted three to four times per week, though frequency varies based on weather conditions and resource availability. Commonly addressed topics include recycling, biodiversity, water and energy conservation, and sustainable practices. However, there is a disparity in the comprehensiveness of these topics across different institutions.

Access to necessary educational materials, including books, manipulatives, and outdoor learning environments, was reported as limited in several cases, which has affected both the scope and quality of environmental programming. While most educators affirmed the importance of environmental education for child development, varying views were expressed regarding the actual effectiveness of existing programs in achieving stated objectives. A prevalent theme among responses was the need for expanded training, support systems, and resources to enhance both program content and delivery.

Participatory observations conducted in natural, outdoor settings further enriched the research findings by providing direct evidence of how environmental education is organized and enacted in preschool environments. Observations indicated that many institutions have adopted nature-based learning activities such as nature walks, gardening, and ecosystem exploration to engage children in experiential learning. Educators employed diverse pedagogical strategies, including storytelling, role-playing, and interactive discussions aimed at fostering comprehension of environmental concepts and promoting respectful attitudes toward nature. Notably, children displayed high levels of curiosity, enthusiasm, and creativity throughout these activities, reflecting a genuine interest in environmental exploration and discovery.

The integration of qualitative interviews, quantitative surveys, and participatory observations enabled a comprehensive analysis of the strengths, challenges, and opportunities associated with environmental education and upbringing in preschool institutions. The triangulated methodology revealed convergent thematic patterns and offered diverse perspectives regarding the organization and effectiveness of existing programs.

Findings underscore the current status of environmental education in early childhood settings, encompassing established practices, systemic limitations, and potential avenues for enhancement. Data obtained through multiple research instruments provided valuable insight into the structural and pedagogical dimensions of environmental education, including its content, implementation strategies, and perceived outcomes.

Based on the identified gaps and strengths, several strategic recommendations are proposed to enhance the quality and impact of environmental education initiatives for preschool children. These include the provision of ongoing professional development and targeted training for educators; expanded access to outdoor learning environments, instructional materials, and relevant infrastructure; and the integration of environmental themes across multiple areas of the curriculum. Furthermore, the establishment of collaborative partnerships with community organizations and key stakeholders is essential for fostering a supportive ecosystem that sustains and enriches early environmental education.

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5. CONCLUSION

The findings indicate that the existing framework for early childhood education is grounded in a holistic approach to child development, structured around various developmental domains. Within this framework, the domain of cognitive development and the subdomain of science, focused on understanding the environment, provide a structured opportunity for the inclusion and deepening of topics related to ecology and sustainable development. The curriculum allows flexibility and pedagogical autonomy, enabling educators to adapt the implementation of these topics according to the developmental stage of the children, available resources, institutional facilities, and environmental context.

Despite this flexibility, the results highlight several critical concerns. Preschool institutions, while theoretically supported by a curriculum that accommodates educator creativity and initiative, lack clearly defined strategies or models that formally integrate the role of early education in fostering sustainability. The analysis of educator responses further reveals insufficient institutional support for the practical implementation of sustainable development content, indicating that these efforts are often unrecognized or absent in organizational planning.

Early exposure to environmental concepts must extend beyond passive engagement with nature or factual knowledge about ecological phenomena. Children should be actively guided toward understanding their role in sustainability, which requires educators who are not only informed but also empowered to make intentional pedagogical choices that align with principles of sustainable development.

Education for sustainability in early childhood should be conceived as a dynamic and continuous process, rather than a fixed or isolated objective. It must function as a catalyst for ongoing cultural and societal transformation rather than serving as a narrowly defined educational outcome. Extensive research in the field of child development confirms the long-term significance of early childhood experiences, emphasizing that a nurturing and stimulating environment during this period is foundational for lifelong learning and adaptation. Responsibility for cultivating such an environment lies not only with educators but also with parents, policymakers, and the broader community, all of whom play a vital role in fostering the skills, values, and dispositions necessary for children to become conscientious and responsible members of a sustainable society.

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Ethical Approval: The study adheres to the ethical guidelines for conducting research.

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