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Research Article

Environmental pre-school education: Methodological positions of pre-service pre-school teachers

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ABSTRACT

Environmental education is a fundamental factor, enabling people to recognize nature and the environment. The preparation of pre-service pre-school teachers in the field of environmental education is an important area. However, quite often pre-service pre-school teachers are not sufficiently prepared in the field of environmental education, and especially how to integrate environmental education into the curriculum and everyday practice. From this point of view, it is rational to highlight their methodological position: how environmental literacy is understood, what topics are considered priority, what challenges and solutions are associated with the practice of environmental education. A complex qualitative and quantitative study was conducted, and the results of qualitative content analysis were obtained, quantifying category frequencies. The study was conducted in January-March 2025. Students from two Lithuanian universities participated in the survey (Vilnius, *N* = 45; Klaipeda, *N* = 19). Data were collected anonymously, using four open-ended questions, and the verbal data obtained were coded into semantic units, subcategories, and categories. The quantitative and qualitative parts of the research were analyzed and presented separately, ensuring methodological coherence and allowing for a more comprehensive interpretation of the findings. The results showed that the concept of environmental literacy is dominated by cognitive/value education, followed by environmental behaviors, environmental thinking development, and emotional-social interaction. The most relevant issues were considered to be environmental problems, especially climate change, pollution, consumption, and ecosystem degradation. Meanwhile, the integration of environmental education was considered as necessary, emphasizing practical and experiential activities. There remains a need to consistently strengthen the content of studies, systematically integrate education for sustainable development, and increase the share of practice and community cooperation, so that preschool institutions purposefully educate responsible, conscious, and sustainable children.

Keywords: environmental education, qualitative research, quantitative content analysis, pre-service teachers, pre-school education

INTRODUCTION

From a young age, children feel a natural connection with nature–they want to be there, to explore it. Therefore, it is essential to develop their love for the environment from an early age and to teach them to protect and conserve natural resources. In preschool age, it is especially important to promote children's harmonious relationship with nature, to form environmental thinking through research, experiments, and experiential learning. Research supports that pre-school age is the optimal time to start environmental education, seeking to create positive pre-school children's behavior in terms of the environment (Marina & Rusu, 2023). Young children easily acquire basic values and habits. If they learn to care for nature from early

childhood, this attitude remains for life. Longitudinal studies show that participation in environmental education programs in childhood is associated with a positive attitude towards the environment and behavior in later life. For example, studies involving young adults who participated in environmental activities during their childhood have shown long-term positive effects on their attitudes towards nature and concern for environmental issues (Rhodes, 2013). According to recent studies on children's environmental education, it is necessary to implement effective environmental education in pre-school age (Gökçeli, 2022; Kavaz, 2021). It follows that the preparation of pre-service pre-school teachers in the field of environmental education is an important area, in the context of which the development of their competencies, acquisition of knowledge, and practical skills in working with children, forming a responsible attitude towards nature and sustainability, is often examined. Pre-service pre-school teachers need to have not only theoretical knowledge, but also practical skills, allowing them to effectively develop children's responsibility for the environment and nature from an early age.

International Context

Pre-school environmental education is of particular importance internationally. UNESCO supports education for sustainable development programs, which highlight the preschool age as an important period of change. The importance of this education is also supported by recent scientific research (Melis et al., 2025; Mousavi et al., 2024; Tran, 2024), which emphasizes that early formation of ecological values has a long-term impact. Practical educational methods play a particularly important role–they help children develop ecological awareness, responsibility for nature, and encourage active participation in environmental processes (Mukhlis et al., 2024).

A study analyzing the attitude and practice of preschool educators in the field of sustainability education reveals that these professionals are highly motivated and positively evaluate the integration of sustainability into the educational process. The study emphasizes that in order to effectively implement sustainability, it is necessary to create specially tailored teacher training programs that would ensure their preparation for this important mission (Eryaşar & Özel, 2025). Namely, a strong foundation of environmental education fosters a positive attitude towards the environment, which is very important in shaping children's perceptions of the environment and behavior. Research emphasizes the need to fully include environmental education in the training of pre-service teachers (Kavak & Deretarla Gül, 2023). The study by Dada et al. (2017) showed the impact of environmental education on the environmental literacy of novice teachers in New Zealand. Although knowledge acquisition was low, the confidence of beginning teachers in environmental education increased significantly after completing the course. A comparative study conducted between two countries showed a positive attitude, but relatively low environmental knowledge, highlighting the gap between the attitude and practical knowledge in teacher preparation (Akhmetova et al., 2025). Kocak et al. (2023) focused on the impact of STEM-based environmental education on the environmental literacy of prospective teachers, arguing that integrating STEM tools can increase their understanding and readiness to teach environmental topics (Kocak et al., 2023). On the other hand, some studies show that environmental content is not yet sufficiently integrated or given too little attention in modern study programs, which leads to insufficient preparation of pre-service teachers in this area (Damoah & Omodan, 2023). Therefore, it is necessary to strengthen environmental education programs, integrating both theoretical and practical environmental knowledge, as well as to promote practical activities, so that pre-service teachers can implement environmental education more effectively (Lamanauskas & Makarskaitė-Petkevičienė, 2023).

Thus, it is clear that the role of pre-school teachers in environmental education is essential; however, this requires consistent formation of knowledge, practice, and values through high-quality and context-adapted preparation programs. Environmental education should be integrated comprehensively, covering both cognitive, emotional, and practical components. In summary, it can be stated that although pre-service teachers have a favorable attitude towards environmental protection, their level of knowledge and application of practical skills still require strengthening in study (teaching) programs, and scientific research is aimed at increasing the coherence and effectiveness of these aspects.

National Context

In Lithuania, environmental pre-school education is becoming an increasingly relevant and researched area of education, responding to both the global challenges of climate change and the priorities of educational policy. Research shows that more and more pre-school institutions are including environmental elements in their curricula, and teachers are applying creative, early-age-appropriate methods–from experiential learning in nature to ecological projects and events in the kindergarten community (Makarskaitė-Petkevičienė & Zavackienė, 2023). Research conducted by Bartkevičienė and Bagdonas (2022) reveals that there are enormous opportunities for environmental education in pre-school age groups, for example, integrating environmental programs, creating outdoor educational spaces, and engaging non-formal education institutions and the community. However, these opportunities often remain unexploited. Lamanauskas and Makarskaitė-Petkevičienė (2025) note that environmental citizenship is not prioritized in Lithuanian education, is often implemented chaotically, and lacks integration into the formal education system, resulting in a lack of resources and inadequate pedagogical support. Lamanauskas and Palionienė (2008) also emphasize the importance of the natural environment of pre-school educational institutions for the development of children's cognitive competence and identify limitations hindering its effective development. These limitations are determined by both external and internal factors: poor material base, lack of a consistent natural science policy, one-sided approach of educational institutions to this area, and weak connections with the school education stage. However, even with favorable material and organizational conditions, the effectiveness of environmental activities depends on the readiness of educators to plan creatively, adapt activities to the age of children, and include them in the daily educational process. Therefore, the quality of teacher training becomes a key factor determining whether environmental education will remain fragmented or become a sustainable part of educational culture, based on solid knowledge, pedagogical skills, and the ability to develop children's environmental literacy. In Lithuania, environmental topics are usually integrated into science education subjects during the teacher training process; they are not taught as individual modules, therefore, their application remains fragmented. Lamanauskas and Malinauskienė (2024) reveals that most pre-service teachers feel they lack the knowledge and practical skills to include ecological ideas in the educational process, which is associated with a lack of clear methodological guidelines, examples, and literature. Thus, in Lithuania, environmental pre-school education is becoming increasingly important; however, its potential is not being utilized sufficiently. There is a lack of clearer science policy, methodological support, cooperation between educational stages, and especially, consistent teacher training, providing subject knowledge, a clear methodological position, and practical skills, which would ensure high-quality and sustainable environmental education.

However, despite the challenges, modern pre-school education practices are increasingly focusing on holistic, value-based children's education–children's responsibility for nature is developed, respect for living and non-living nature, sustainable consumption habits, conscious use of resources, and critical thinking about the impact of human activities on ecosystems are promoted. Environmental education is increasingly perceived as an integral part of holistic education, rather than as an additional educational activity. This approach is reinforced by the *guidelines for the pre-school education program* (hereinafter referred to as the *guidelines*) approved in Lithuania (Ministry of Education and Science of the Republic of Lithuania, 2023), which stipulate that environmental topics must be integrated into all education areas and naturally become a part of children's daily learning and experiences. The guidelines emphasize play-based and experiential education, especially in outdoor spaces, which should encourage children to explore nature, to observe it, and develop sustainable, responsible habits from an early age. The guidelines also recommend applying STEAM methods in conjunction with the principles of sustainable development, so that children, through experiments, creative tasks, and games, not only learn about natural phenomena, but also understand the human impact on the environment and learn to protect it.

Summarizing, it can be stated that the *guidelines for the pre-school education program* approved (Ministry of Education and Science of the Republic of Lithuania, 2023) provide a clear direction for strengthening environmental education, foreseeing its integration into all areas of education and children's daily activities. By emphasizing learning based on play, experiential activities, and STEAM principles, children's motivation for learning about nature is promoted, as well as the formation of sustainable habits and a responsible attitude

towards the environment. Such strategic steps allow us to hope that in the near future, environmental education in pre-school institutions will become an integral, consistently implemented part of quality education. However, the implementation of these goals is inseparable from the quality of pre-service teacher training–the challenge remains to ensure solid subject knowledge, methodological support, and practical skills, so that in the future, teachers could systematically and creatively integrate environmental topics into the educational process.

Research Aim and Research Questions

Assessing both international and national contexts, a problem emerges–pre-service teachers are still not sufficiently prepared to integrate environmental topics into the educational process. Although environmental knowledge is acquired and personal beliefs are formed during university studies, they do not always develop into the necessary pedagogical competencies. The main challenges lie in poorly developed didactic skills and insufficient practical experience baggage, which is necessary for the effective implementation of environmental education in pre-school institutions.

Research analyzing pre-service pre-school teachers' attitudes towards environmental protection is extremely important because teachers have a significant influence on the formation of children's values and behavior. Pre-school age children are extremely sensitive to attitudes and value orientations demonstrated by teachers, making teacher preparation an essential prerequisite for effective environmental education. Environmental education in pre-school teacher preparation is a relatively new topic with little research. Overall, the conducted studies emphasize that it is necessary to evaluate current pre-school teacher education programs exhaustively, in order to identify environmental education program development strategies (Tran, 2024). Despite the fact that environmental education is necessary for children to become familiar with nature and the environment and to acquire environmental awareness, pre-school education programs are often not adapted to environmental education (Ağgül Yalçın et al., 2016).

Although the terms *environmental education* and *ecological education* are often used interchangeably, they have distinct conceptual underpinnings. *Environmental education* focuses on fostering knowledge, attitudes, and skills that promote environmentally responsible behavior (Ardoin & Bowers, 2020; Cutter-Mackenzie & Edwards, 2013; Gillett, 1977), while *ecological education* emphasizes understanding ecological systems and interrelationships within the biosphere (Hungerford & Volk, 1990). Clarifying this distinction is crucial, as this study adopts the framework of *environmental education* rather than a purely ecological or biological perspective. Therefore, the term *environmental literacy* is employed to denote the integration of knowledge, values, and behaviors necessary for responsible environmental action.

The aim of the study was to explore the readiness of pre-service pre-school teachers to integrate environmental education by analyzing their understanding of environmental literacy, priority environmental topics for children, and challenges and methodological solutions in practice. Two research questions were formulated:

1. How do pre-service, pre-school teachers understand and evaluate environmental literacy and the possibilities of its integration into early childhood education?
2. What strategies, challenges, and needs do pre-service teachers identify in order to effectively implement environmental education in pre-school education practice?

The research objectives were exploratory and focused on uncovering how pre-service teachers conceptualize environmental literacy and perceive their readiness for its integration. Given these aims, a qualitative design using open-ended responses was deemed appropriate. The study did not aim to verify competencies quantitatively, but rather to understand the meanings that participants attribute to environmental education in practice.

RESEARCH METHODOLOGY

Design

Conducted between January and March 2025, this study employed a mixed-methods approach to allow for a more in-depth exploration of the problem. While it incorporated a quantitative element that was

analyzed separately (Lamanauskas & Malinauskienė, 2026), the research was fundamentally qualitative in its epistemological stance. Situated within the interpretivist paradigm, the primary design sought to explore participants' perspectives and meanings (Tenny et al., 2022). This qualitative approach facilitated inductive reasoning and the identification of emergent themes reflecting pre-service teachers' conceptualizations and experiences, with the quantitative data serving to support this analysis. Such a combination is particularly valuable for the targeted improvement of study programs (Creswell & Plano Clark, 2018). Therefore, the methodological coherence lies in the qualitative inquiry design supported by systematic content analysis.

The research assumes that student feedback and evaluations are of great importance–they help to reveal the existing problems, clarify previous conclusions, and predict directions for improving the quality of studies. The student perspective is indispensable in seeking to ensure an effective teaching process and its continuous improvement (Biggs & Tang, 2011). This approach allows us to get deeper, often unexpected information and encourages exploring phenomena from the participants' perspective, rather than limiting their responses to pre-selected options (Tenny et al., 2022). This results in a rich array of verbal data (Alkan et al., 2022). This article presents only the results of the qualitative data analysis.

Sample

The study involved 64 university students, pre-service pre-school teachers (pre-service early childhood education teachers). The research sample consisted of students from two universities–Vilnius (N = 45) and Klaipėda (N = 19). Student distribution by year of study shows that the majority of respondents (50.0%) were second-year students. First-year students accounted for 25.0%, fourth-year students for 17.2%, and the least number of third-year students, only 7.8%.

Thus, it is assumed that such a sample is quite representative in the case of qualitative research and allows for appropriate conclusions to be drawn. The research sample includes students from two different universities, which increases the diversity of the data and reduces the influence of the specifics of one institution on the results. In qualitative research, samples of various sizes are often encountered, depending on the topic, question complexity, and the desired analytical depth. Many studies indicate that a suitable sample size can range from a few dozen to as many as 100 or more participants. In such cases, a sample size of 60-70 or more participants is considered reasonable and allows for data saturation and diversity (Squire et al., 2024). Such student samples are common in qualitative social science research, as this group is considered homogeneous in terms of the field of study and research objectives (e.g., pre-service teachers) (Guetterman, 2015).

The student survey was conducted in the classrooms, using prepared questionnaires. All students were informed about the objectives of the study, and their participation was voluntary and anonymous. Verbal consent to participate in the survey was obtained from the students.

Instrument

The study used four open-ended questions.

1. How would you define environmental literacy in the context of early childhood education?
2. What do you think are the most pressing environmental issues today, and how do they relate to early childhood education?
3. What do you personally think about environmental sustainability?
4. How important do you think it is to integrate environmental education into pre-school education programs? Explain your arguments.

These questions form a coherent structure, as the first question defines the main concept (environmental literacy). The second question is designed to identify current problems and their relationship to early childhood education. The third question is designed for the respondents to assess the practical importance of integration, referring to arguments. The last question is intended to reveal personal views, adding a subjective position to the study. Open-ended questions provide respondents with the opportunity to respond freely, without being given prepared answer variants beforehand, thus obtaining rich and detailed information. The study aims to examine the phenomenon from the perspective and context of the participants, rather than simply quantifying the frequency of responses (Dahal et al., 2024).

Because they logically move from knowledge (defining the topic) to application (relating it to current concerns), emotion (personal position), and advocacy (professional justification), the questions are consistent. Instead of there being four distinct measurements, they are four linked probes intended to provide a comprehensive and in-depth understanding of the same underlying concept.

In qualitative research, a small number of carefully designed open-ended questions are often sufficient to obtain rich and meaningful data. The aim is depth rather than breadth of responses (Guetterman, 2015; Squire et al., 2024). Several studies in early childhood environmental education employed a similar approach, using 3-6 open-ended questions to explore teachers' conceptions (Collins & Garrity, 2023; Eryaşar & Özel, 2025; Türkoğlu, 2019). Thus, the inclusion of four open-ended questions in this study aligns with qualitative methodological traditions, ensuring manageability and interpretive depth.

Data Analysis

The researchers chose quantitative content analysis to analyze the data, which allows for systematic and objective processing of verbal responses, revealing their semantic structure and quantitative regularities. Namely, content analysis as a procedure is scientifically sound, and it is a sufficiently effective solution that allows drawing reasonable conclusions from various sources of textual information (Coners & Matthies, 2014).

First, all respondents' answers to the questions were collected. Each question was analyzed separately. From the entire data set, meaningful units were extracted–significant phrases, sentences, or words that reflect the central ideas or attitudes, related to a specific question. These meaningful units were semantically summarized and grouped into subcategories, i.e., smaller structures that unite elements of similar meaning. Later, the subcategories were combined into larger, more generalized meaningful structures–categories that reflect more general concepts or thematic groups. Absolute frequencies (how many times the corresponding unit or category was mentioned in the entire data set) and relative frequencies (percentage expression in the context of all units/categories) were calculated both for meaningful units, subcategories, and categories.

In this way, the distribution of categories, their frequency of recurrence, and weight within the entire construct were determined. This allowed identifying which themes and attitudes were most frequently expressed in the respondents' answers and assessing their significance in the context of the study. In other words, coding, meaningful categories, and their frequency calculation and interpretation were essential things in conducting this qualitative analysis (Erdogan et al., 2009).

RESEARCH RESULTS

After analyzing the opinions expressed by respondents about the concept of environmental literacy in the context of early childhood education, four categories were identified: *cognitive/value education*, *environmental behavior*, *environmental thinking development*, and *emotional and social interaction* (**Table 1**).

The category *cognitive/value education* (32.9%) stands out as the most important when analyzing the concept of environmental literacy in early childhood education. This category is specified by two subcategories: *knowledge and understanding development* (19.9%) and *value attitude formation* (13.0%), which reflect two essential directions of early childhood education: knowledge transfer and value formation. According to pre-service teachers' insights, *knowledge and understanding formation* (19.9%) involves introducing children to nature, its phenomena, problem recognition, and the ability to understand environmental situations and seek appropriate solutions. Meanwhile, *value attitude formation* (13.0%) includes the development of children's values, love for nature, development of a sense of responsibility, responsible consumption, and the creation of a relationship with the environment through experience.

The category *environmental behavior* (25.0%) emphasizes the development of children's practical skills and learning how to behave appropriately with nature. In the subcategory *learning environmental activities* (22.1%), pre-service teachers focused most of their attention on the development of specific behavioral models: garbage sorting, electricity and water saving, plant care, and animal care. The subcategory *formation of activity skills* (2.9%) is related to the strengthening/development of habits, moderation, and decision-making abilities.

The category *environmental thinking development* (23.4%) highlights children's ability to analyze environmental problems and gain experience through practical activities. In the subcategory *analysis of*

Table 1. The concept of environmental literacy in the context of early childhood education

Category	*N* (%)	Subcategory	*N* (%)	Subcategory components	*N* (%)
Cognitive/value education	79 (32.9)	Knowledge and understanding development	48 (19.9)	Natural phenomena understanding	18 (7.5)
				Transferring knowledge about nature	17 (7.1)
				The child's ability to identify problems	7 (2.9)
				Involving children in decision-making	2 (0.8)
				Clear understanding of problems	2 (0.8)
				Understanding the interrelationships between natural objects	1 (0.4)
				Speaking a language understandable to children	1 (0.4)
		Formation of value attitudes	31 (13.0)	Development of values	15 (6.3)
				Development of responsibility for the environment	4 (1.7)
				Love for nature	3 (1.3)
				Emotional relationship with the environment	3 (1.3)
				Formation of a relationship with the environment through activities	2 (0.8)
				Reduction of excessive consumption	2 (0.8)
				Responsible consumption	2 (0.8)
Environmentally friendly behavior	59 (25.0)	Learning environmental activities	52 (22.1)	Sorting, garbage management	21 (9.2)
				Plant and animal protection	13 (5.4)
				Water and electricity saving	10 (4.2)
				Activity as a means of cognition	3 (1.3)
				Planting, caring for plants	2 (0.8)
				Children know animals, plants, care for them	1 (0.4)
				Child's ability to behave appropriately in nature	1 (0.4)
				Ways to protect our nature	1 (0.4)
		Formation of activity skills	7 (2.9)	Formation of habits	4 (1.7)
				Moderation in using resources	2 (0.8)
				Development of decision-making	1 (0.4)
Development of environmental thinking	56 (23.4)	Analysis of environmental problems	29 (12.1)	Climate change and consequences	12 (5.0)
				Pollution problems	11 (4.6)
				Solving environmental problems	5 (2.1)
				Problem-based thinking	1 (0.4)
		Practical experience	27 (11.3)	Practical activities in nature	13 (5.4)
				Environmental knowledge through games	5 (2.1)
				Educational activities in the open air	5 (2.1)
				Experiential learning	3 (1.3)
				Linking everyday activities with nature	1 (0.4)
Emotional and social interaction	45 (18.7)	Development of a conscious relationship with nature	31 (12.9)	Children's ecological awareness	13 (5.4)
				Children's interest and curiosity	6 (2.5)
				Developing a relationship with nature	5 (2.1)
				The importance of a child's personal decisions	3 (1.3)
				Observation of nature	2 (0.8)
				Recognition of the connection between self and nature	2 (0.8)
		Educational and family influence	14 (5.8)	Parental/community involvement	8 (3.3)
				Modelling behavior through example	6 (2.5)

Note. 239 semantic units

environmental problems (12.1%), pre-service teachers emphasized introducing children to environmental challenges–climate change and its consequences, pollution, and possible ways to solve them. The subcategory *practical experience* (11.3%) included statements about the importance of practical activities in nature, learning about the environment through games, experiential learning, and the connections between everyday activities and nature.

The category *emotional and social interaction* (18.7%) emphasizes the development of a conscious relationship with nature and the educational context, including the role of family and community. The distinguished subcategory *development of a conscious relationship with nature* (12.9%) is related to children's ecological awareness, children's interest and curiosity, and the perception of the importance of personal decisions. Meanwhile, the subcategory *educational and family influence* (5.8%) highlights the role of parents and community and the importance of adult example in a child's environmental education.

Table 2. Environmental issues and their relationship with children's education

Category	*N* (%)	Subcategory	*N* (%)	Subcategory components	*N* (%)
Environmental issues	57 (53.0)	Climate phenomena	22 (20.7)	Climate change	13 (12.5)
				Temperature increase	4 (3.7)
				Melting glaciers	2 (1.8)
				Extreme climate phenomena (droughts, floods, etc.)	2 (1.8)
				Seasonal changes	1 (0.9)
		Pollution	13 (12.1)	Air pollution	6 (5.6)
				Water pollution	6 (5.6)
				Soil pollution	1 (0.9)
		Waste and consumption issues	13 (12.0)	Excess waste	5 (4.6)
				Plastic pollution	3 (2.8)
				Overconsumption	3 (2.8)
				Food waste	2 (1.8)
		The ecosystem destruction	9 (8.2)	Deforestation	5 (4.6)
				Biological diversity loss	2 (1.8)
				Species loss due to environmental change	2 (1.8)
Environmental awareness development	37 (34.3)	Practical skills development	19 (17.6)	Waste sorting training	11 (10.2)
				Water conservation training	4 (3.7)
				Electricity conservation training	4 (3.7)
		Value education	13 (12.1)	Ecological awareness development	6 (5.6)
				Environmental value formation	4 (3.7)
				Sustainable lifestyle promotion	3 (2.8)
		Cognitive education	5 (4.6)	Integration of nature cognition	3 (2.8)
				Use of secondary raw materials	2 (1.8)
Children's behavior and experiences	14 (12.7)	Children's behavior towards the environment	5 (4.5)	Respectful treatment of animals	2 (1.8)
				Animal protection	2 (1.8)
				Not damaging plants	1 (0.9)
		Experiential education	5 (4.6)	Planting	3 (2.8)
				Outdoor activities	2 (1.8)
		Sustainable choices	2 (1.8)	Using reusable containers	2 (1.8)
		Daily responsibilities	2 (1.8)	Cleaning up after activities	2 (1.8)

Note. 108 semantic units

After analyzing which environmental problems pre-service teachers consider to be the most relevant and how they relate them to the education of young children, three categories were identified: *environmental problems*, *development of environmental awareness*, and *children's behavior and experiences* (**Table 2**).

The category *environmental problems* (53.0%) has the most significant contribution compared to the assessment of the other two categories. The content indicates that pre-service teachers' attention is primarily focused on the deterioration of environmental conditions, including phenomena such as climate change, pollution, waste consumption, and ecosystem destruction, which are categorized into four subcategories. In the subcategory *climate phenomena* (20.7%), pre-service teachers singled out climate change as the most significant environmental problem, likely to have a direct impact on the stability of the planet and the quality of life of humanity, especially children, in the present/future. Subcategories *pollution* (12.1%) and *waste and consumption problems* (12.0%) encompass issues such as air, water, and soil pollution, as well as excessive waste, posing a threat to both nature and children's health and well-being. The subcategory *ecosystem destruction* (8.2%) encompasses issues such as deforestation, biodiversity loss, and species extinction, primarily due to environmental problems. These challenges reveal concerns about the loss of natural habitats and disruption of the natural environment balance, which in the long term can lead to irreversible ecological processes associated with the loss of wildlife and the overall weakening of ecosystem functioning.

The category *environmental awareness development* (34.3%) reveals that pre-service teachers' pay significant attention to the development of children's environmental awareness. This category consists of three subcategories: *practical skills development* (17.6%), *value education* (12.1%), and *cognitive education* (4.6%), which reflect pre-service teachers' pedagogical aspirations to develop a responsible, environmentally friendly, and conscious personality. In the subcategory *practical skills development* (17.6%), the main focus is on waste sorting, water, and electricity saving accents. This shows that pre-service teachers see the necessity to form specific environmental behavior models in children from an early age, helping to develop sustainable habits

in everyday situations. Subcategory *value education* (12.1%) includes ecological awareness development, environmental value formation, and sustainable lifestyle promotion. This allows us to assume that pre-service teachers seek not only to teach responsible behavior, but also to develop children's value-based relationship with nature and the environment. In the subcategory *cognitive education* (4.6%), the Integration of nature cognition and the promotion of the use of secondary raw materials are emphasized. These themes demonstrate that experiential knowledge, exploration, and practical activities are crucial elements in forming children's understanding of the importance of environmental resources and their sustainability.

The category *children's behavior and experiences* (12.7%) is considered to be the least significant from the point of view of respondents when examining the links between environmental issues and children's education. The category is divided into four subcategories: *children's behavior towards the environment* (4.5%)*, experiential education* (4.6%), *sustainable choices*, and *daily responsibilities* (1.8% each). The subcategory *children's behavior towards the environment* (4.5%) mentions respectful behavior with animals, their protection, and not damaging plants. This shows that pre-service teachers emphasize children's emotional and responsible relationship with nature. Such behavioral models contribute to the formation of empathy, caring, and early value attitudes. The subcategory *experiential education* (4.6%) includes planting plants and outdoor activities. These activities provide children with the opportunity to develop practical environmental knowledge skills, a sense of responsibility, and create an emotional relationship with nature through direct experience and active participation. In the subcategories *sustainable choices* and *daily responsibilities* (1.8% each), we focus on using reusable containers and clearing up after activities. These activities show that pre-service teachers see environmental education as an integral part of everyday education, where not only knowledge is important, but also the development of specific, responsible habits at an early age.

When answering the question *what do you personally think about environmental sustainability?* the respondents expressed diverse views, based on which four categories were distinguished: *principles and dimensions*, *personal and daily practices*, *education and awareness*, and *politics and collective responsibility* (**Table 3**).

The category *principles and dimensions* (45.7%) reveals that pre-service teachers perceive environmental sustainability as a valuable, responsible, and significant phenomenon for well-being, which, in their opinion, is necessary to develop already at an early age. This category includes three subcategories: *essential principles and values* (20.0%), *responsibility* (14.1%), and *dimensions and impact* (11.6%), which reflect a deep understanding of sustainability and the desire to transmit these attitudes to young children. In the subcategory *essential principles and values* (20.0%), the view of sustainability as a necessity and a fundamental value (15.1%) dominates. Pre-service teachers emphasize that sustainability principles must be integrated into children's education as an essential value, forming a responsible attitude towards the environment and its preservation from an early age. Aspects such as the multifaceted nature of sustainability, continuous learning, and personal/professional challenge demonstrate that teachers perceive sustainability as a continuously improving and personally binding process. The subcategory *responsibility* (14.1%) covers aspects of collective and individual responsibility. This shows that pre-service teachers not only acknowledge sustainability as a responsibility of society as a whole but also seek to develop children's understanding of how their behavior affects nature. In the subcategory *dimensions and impact* (11.6%), sustainability is perceived as an ecological, social, and educational phenomenon, emphasizing balance, resource protection, and contribution to well-being.

The category *personal and everyday practices* (35.4%) shows that pre-service teachers understand sustainability as specific behavior and everyday choices that should be formed in children's education from an early age. This category includes subcategories: *daily habits* (17.3%), *motivation and challenges* (15.7%), and *consumption choices* (2.4%). The *daily habits* subcategory (17.3%) highlights sustainable actions that children can take every day - responsible behavior in nature, resource conservation, and waste management. In the subcategory *motivation and challenges* (15.7%), pre-service teachers reflect on obstacles–children's lack of engagement, lack of knowledge, or environmental impact. This shows their readiness to look for motivating methods in education. The subcategory *consumption choices* (2.4%) emphasizes consumption reduction, recycling, and single-use item avoidance, seeking to form responsible and environmentally friendly habits in children.

Table 3. Personal opinion on environmental sustainability

Category	*N* (%)	Subcategory	*N* (%)	Subcategory components	*N* (%)
Principles and dimensions	55 (45.7)	Essential principles and values	24 (20.0)	Sustainability importance and necessity	18 (15.1)
				Multidimensionality and values of sustainability	4 (3.3)
				Sustainability continuous learning	1 (0.8)
				Sustainability: personal and professional challenge	1 (0.8)
		Responsibility	17 (14.1)	Collective responsibility	9 (7.5)
				Individual responsibility and behavior	8 (6.6)
		Dimensions and impact	14 (11.6)	Ecological balance and future well-being	6 (5.0)
				Protection of natural resources and ecosystems	5 (4.1)
				Sustainability contribution to well-being	3 (2.5)
Personal and daily practices	43 (35.4)	Daily habits	21 (17.3)	Nature protection and community	7 (5.8)
				Resource conservation	5 (4.1)
				Waste management and recycling	5 (4.1)
				Daily sustainability habits	4 (3.3)
		Motivation and challenges	19 (15.7)	Behavioral barriers and disengagement	8 (6.6)
				Motivational factors and threat perception	6 (5.0)
				Sustainability efforts need	5 (4.1)
		Consumption choices	3 (2.4)	Consumption reduction and recycling	2 (1.6)
				Single-use item avoidance	1 (0.8)
Education and awareness	17 (14.1)	Formal and non-formal education	10 (8.3)	The importance of education and methods	7 (5.8)
				Instilling values in childhood	3 (2.5)
		Society perception	7 (5.8)	General lack of awareness	4 (3.3)
				Nature and future generation example	3 (2.5)
Politics and collective responsibility	5 (4.8)	Governance and regulation	4 (3.2)	Regulation and sanctions	2 (1.6)
				Broad responsibility	1 (0.8)
				Global sustainability	1 (0.8)
		Long-term vision and commitment	2 (1.6)	Long-term commitment	1 (0.8)
				Action continuity	1 (0.8)

Note. 121 semantic units

The category *education and awareness* (14.1%) shows that pre-service teachers consider sustainability topics to be an essential part of education. The category consists of subcategories: *formal and non-formal education* (8.3%) and *public perception* (5.8%). The subcategory *formal and non-formal education* (8.3%) emphasizes that the implementation of sustainability principles must take place in both formal and non-formal education contexts, using various educational methods that help children acquire environmental values at an early age. The subcategory *public perception* (5.8%) highlights the general lack of public awareness of environmental sustainability issues. It emphasizes the need to set a positive example for children in order to form a responsible attitude towards nature and future generations.

The category *politics and collective responsibility* (4.8%), although it distinguishes itself as having the lowest significance among other categories, highlights an important aspect of institutional sustainability. This category consists of two subcategories: *governance and regulation* (3.2%) and *long-term vision and commitment* (1.6%). Pre-service teachers acknowledge that their efforts to develop children's sustainability attitudes will be more effective if they are supported by institutional solutions, accompanied by broad collective responsibility, long-term political commitments, and action continuity.

After analyzing respondents' assessments of the importance of integrating environmental education into pre-school education programs, four categories were extracted: *children's personal development*, *importance of education*, *integration and long-term impact*, *practical teaching/learning*, and *social context and external influence* (**Table 4**).

The category *children's personal development* (33.5%), according to pre-school teachers' assessment, is considered the most important when discussing the possibilities of integrating environmental education into pre-school education programs. This category consists of five subcategories: *habit formation* (10.2%), *understanding nature* (8.5%), *sustainability education* (8.0%), (4.0%), *everyday life and routine* (4.0%), and *emotional connection* (2.8%). The subcategory *habit formation* (10.2%) emphasizes that habits are formed in childhood and remain for life. The subcategories *understanding nature* (8.5%) and *sustainability education* (8.0%) are nearly equal in evaluation and closely related in content, as both emphasize respect for nature,

Table 4. Assessments of the importance of integrating environmental education into pre-school programs

Category	*N* (%)	Subcategory	*N* (%)	Subcategory components	*N* (%)
Children's personal development	59 (33.5)	Habit formation	18 (10.2)	Habits last a long time	8 (4.5)
				Habits are formed in childhood	6 (3.4)
				Skills/habits last a lifetime	4 (2.3)
		Understanding nature	15 (8.5)	Respect for nature	6 (3.4)
				Conservation of nature	5 (2.8)
				Connection with nature	4 (2.3)
		Sustainability education	14 (8.0)	Teaching sustainability	7 (4.0)
				Teaching about ecological products	4 (2.3)
				Teaching responsible consumption	3 (1.7)
		Everyday life and routine	7 (4.0)	Permanent/daily position	4 (2.3)
				Self-evident behavior	3 (1.7)
		Emotional connection	5 (2.8)	Love for nature	3 (1.7)
				Empathy	2 (1.1)
Importance of education, integration and long-term impact	53 (30.3)	Importance of early education	24 (13.8)	Important from a young age	12 (7.0)
				Important already in a pre-school institution	7 (4.0)
				Important at an early age	5 (2.8)
		Importance of integration into programs	19 (10.8)	Important to integrate	10 (5.7)
				Very important to integrate	6 (3.4)
				Must include	3 (1.7)
		Impact on future generations	10 (5.7)	Importance for future generations	6 (3.4)
				Contribution to problem-solving	4 (2.3)
Practical teaching/learning	45 (25.5)	Practical activities	17 (9.6)	Waste sorting	9 (5.1)
				Water conservation	5 (2.8)
				Plant growing	3 (1.7)
		Importance of games and experiences	12 (6.8)	Learning through games	5 (2.8)
				Nature observation	4 (2.3)
				Experimentation	3 (1.7)
		Teaching methods	9 (5.1)	Experiential	5 (2.8)
				Explanatory	4 (2.3)
		Critical thinking	7 (4.0)	Teaching critical thinking	4 (2.3)
				Teaching asking questions	3 (1.7)
Social context and external influence	19 (10.7)	Social responsibility	8 (4.5)	Responsible citizens	6 (3.4)
				Community contribution	2 (1.1)
		Problem-solving	6 (3.4)	Climate change	4 (2.3)
				Plastic pollution	2 (1.1)
		Family role	5 (2.8)	Parental example	3 (1.7)
				Homeschooling	2 (1.1)

Note. 176 semantic units

conservation, and strengthening the connection with nature, including the development of sustainability and ecological consumption. The subcategory *everyday life and routine* (4.0%) reflects the view that environmental values should become a natural behavior for children in everyday activities. Meanwhile, the subcategory *emotional connection* (2.8%) includes those pre-service teachers' opinions that emphasize the importance of developing love for nature and empathy for the environment.

The category *importance of education, integration and long-term impact* (30.3%) is also significant in terms of pre-service teachers' evaluation when analyzing the importance of integrating environmental education into pre-school education programs. This category consists of three subcategories: *importance of early education* (13.8%), *importance of integration into programs* (10.8%), and *impact on future generations* (5.7%). The subcategory *importance of early education* (13.8%) reveals pre-service teachers' belief that environmental education should begin at an early age, as this stage of development forms the foundational principles. In the subcategory *importance of integration into programs* (10.8%), pre-service teachers emphasize that environmental education must be purposefully and consistently included in pre-school education programs, aiming for long-term positive impact on children's environmental awareness. The subcategory *impact on future generations* (5.7%) reflects the attitude that early environmental education contributes to future generations' ability to solve environmental/ecological problems.

The category *practical teaching/learning* (25.5%), according to pre-service teachers' assessment, should be implemented through practical actions, encouraging children's active participation, experiential learning, and development of thinking skills. This category comprises four subcategories: *practical activities* (9.6%), *importance of games and experiences* (6.8%), *teaching methods* (5.1%), and *critical thinking* (4.0%). The subcategory *practical activities* (9.6%) emphasizes that children have to actively participate in waste sorting, water saving, plant growing, and other everyday activities, which help to form responsible environmental habits. The subcategory *importance of games and experiences* (6.8%) reveals that games, nature observation, and experiments are particularly effective educational methods that allow children to learn about natural processes and understand environmental principles through direct experience. In the subcategory *teaching methods* (5.1%), it is emphasized that environmental education should be based on experiential and explanatory teaching methods that promote children's active involvement, curiosity, and practical skills. The subcategory *critical thinking (*4.0%) highlights the need to develop children's ability to ask questions, analyze ecological problems, and critically evaluate their own behavior. In this way, the aim is to educate environmentally responsible children from an early age.

The category *social context and external influence* (10.7%), according to pre-service teachers' assessment, emphasizes that not only the pedagogical process but also the broader social environment in which the child grows up is important for the success of environmental education. The category consists of three subcategories: *social responsibility* (4.5%), *problem-solving* (3.4%), and *family role* (2.8%). The subcategory *social responsibility (*4.5%) emphasizes that children's education should be directed towards developing responsible citizens and a sense of community, to make children aware of the impact of their actions on the environment and society. The subcategory *problem-solving* (3.4%) indicates that environmental education should encompass discussions on current ecological problems, including the impact of climate change and plastic pollution. Introducing children to environmental challenges helps them better understand global issues and develops a responsible approach to solving them. The subcategory *family role* (2.8%) highlights the importance of parents and family in shaping children's environmental awareness. Pre-service teachers note that the example set by parents and children's learning at home is necessary to ensure that environmental values are permeated in everyday life.

DISCUSSION

The study aimed to assess pre-service pre-school teachers' preparation in the field of environmental education, examining their knowledge, priorities, and practical methodological solutions.

This study uses the concept of environmental literacy to capture pre-service teachers' integrated awareness of environmental knowledge, beliefs, and behaviors. It should be highlighted, nonetheless, that environmental literacy is not a theoretically operationalized concept but rather represents participants' perceived positions and self-reported understandings. This is consistent with earlier research that employed environmental literacy as a descriptive rather than a diagnostic category (Kocak et al., 2023; Saribas et al., 2016). To guarantee conceptual coherence, future research should further link the theoretical framework and environmental literacy assessment.

The obtained results showed that the greatest weight in terms of the concept of pre-service teachers falls on cognitive/value education, while environmental behavior remains in the second position. Much less attention is paid to the development of environmental thinking. The study revealed that pre-service pre-school teachers perceive environmental literacy as a multifaceted phenomenon that includes cognitive, value, behavioral, and social aspects. Priority is given to practical things (for example, garbage sorting, saving), but a deep understanding is lacking (for example, problem-solving and critical thinking). It is noticeable that values and emotions are not sufficiently developed, i.e., love for nature, emotional connection, or sustainable consumption remain in the second place. A study conducted in New Zealand showed that environmental education during university studies increases pre-service teachers' self-confidence and strengthens the connection between their knowledge and attitudes towards the environment (Dada et al., 2017). This study is very important in developing and improving teacher training programs aimed at preparing pre-service teachers in the field of environmental education. The other studies show similar results, stating that pre-service teachers' preparation in this area is neither sufficient nor insufficient. However, the reason often lies

elsewhere, namely insufficient environmental education due to limited time and lack of special courses in university studies (Kocak et. al., 2023). It is obvious that researchers emphasize the need to prepare pre-school education teachers with sufficient environmental literacy knowledge, attitude, and skills, and encourage them to effectively integrate environmental education into teacher training and pre-school education programs (Ardoin & Bowers, 2020; Lamanauskas & Malinauskienė, 2024; Ramulumo & Shabalala, 2024; Saribas et al., 2016; Tuncer et al., 2009).

The conducted study showed that pre-service teachers assess environmental issues and their integration into education through three main categories: environmental issues, environmental awareness development, and children's behavior and experiences. The position is also observed that problematic aspects are mostly associated with cognitive education (e.g., explanation of climate change). Still, little attention is paid to involving children in solutions or preventing problems. It can be reasonably said that a reactive approach dominates because most attention is paid to existing issues (climate, pollution), and not to their prevention. The activities which would develop love for nature or critical thinking (e.g., nature art and problem-solving games), are very rarely mentioned. However, in general, pre-service teachers are open to development in this area, as the other research results show. For example, according to Türkoğlu (2019), pre-service teachers are quite sensitive to environmental issues, are interested in environmental education, and are ready and open to improvement. However, although pre-service teachers generally understand environmental problems, they are often grounded in theoretical knowledge. Thus, it is important to enrich and improve pre-service teachers' preparation in the field of environmental protection so that they acquire the necessary knowledge, competencies, and skills (Dolenc et al., 2021). A strong, suitable for today's challenges study at university process needs to be promoted (Rodríguez-Marín et al., 2020).

The study revealed that pre-service preschool teachers perceive environmental sustainability as a multifaceted phenomenon, which includes principles, daily behavior, educational aspects, and social responsibility. On the other hand, although sustainability is considered essential, only 0.8% mentioned its integration into personal and professional life, and lifelong learning was almost not mentioned. It can be reasonably stated that pre-service teachers perceive sustainability mainly at a theoretical level (principles, responsibility); however, in practice, superficial habits (e.g., sorting, saving) dominate, and more radical solutions (e.g., low consumption, zero waste) are definitely lacking. Other studies demonstrate similar results. For example, Davis (2009) and Hedefalk et al. (2015) found that pre-school teachers' knowledge about sustainability is often abstract, lacking practical application in educational programs. Meanwhile, Mogren and Gericke's (2019) study showed that teachers' understanding of sustainability is often based on general awareness, but not on specific action methods. In general, pre-school teachers believe that sustainability is an important issue that should be included in the curricula, as it would help them develop the ability to educate children about the importance of sustainability in the future (Maidou et al., 2019). This requires reorientation of the curricula (Tomas et al., 2015; Yavetz et al., 2013).

The study also showed that pre-service pre-school teachers consider the integration of environmental education into programs as an essential component of children's education; however, certain aspects dominate in their attitude, and others remain undervalued. Respondents emphasize that environmental education must be integrated at the pre-school stage. However, despite recognizing the need for integration, there is a lack of specific methods and skills for effective implementation. Of course, students understand that this should be a long-term process, and not a one-time activity. Other researchers' work shows that pre-school teachers rated significantly lower the need for content integration compared to teachers who are already working (Miščević Kadijević et al., 2019). In general, there is a positive attitude towards environmental education and readiness to participate in sustainable development practice. At the same time, the potential for deeper integration of these topics into teacher education programs is emphasized (Eryaşar & Özel, 2025). A study conducted in Turkey also found that the majority of pre-service pre-school teachers would like to integrate environmental education into their future training practices, and the main reason for wanting to do so was to increase children's environmental awareness (Ünlü Çetin, 2019).

Limitations

The limitations of this study are primarily due to the sample and design peculiarities: data were collected from 64 pre-service pre-school teachers at two universities. Although the subjects were from various study

courses/years, the majority were second-year students, so the findings do not apply to a broader context, especially when it comes to the practicing teachers' population. The analysis was conducted applying quantitative content analysis (category creation and counting their frequencies); therefore, the results are sensitive to coding decisions and do not reveal causal relationships or context peculiarities. Finally, this is a cross-sectional study, so it does not capture changes in attitudes and positions over time. Despite its limitations, the study is significant because it provides an empirically based, relevant structure of the pre-service, pre-school teachers' position. From a methodological perspective, the study systematizes four research axes: the environmental literacy concept, the treatment of environmental problems, positions on sustainability, and the importance of integration into educational programs. It is also important that the study diagnoses strategic shortcomings, i.e., the dominance of theoretical principles over a deeper, practical, reactive, rather than preventive view of problems.

CONCLUSIONS AND IMPLICATIONS

The research revealed that environmental literacy in early childhood education is mainly associated with a cognitive or value basis. This is the dominating element. The latter is accompanied by practical behavior, the development of environmental thinking, and emotional-social interaction. This shows knowledge transfer and value formation priority. Environmental problems are primarily treated as challenges of environmental condition degradation (climate change, pollution, waste, ecosystem destruction), and educational responses are mainly associated with children's daily habits and practices. Sustainability is perceived as a valuable phenomenon that requires responsibility. Environmental education integration into pre-school programs is considered extremely important: early start, consistent inclusion in educational programs, and practical teaching/learning are emphasized as a condition for a long-term impact on children's habits and values.

The results suggest that pre-service teachers already have a reasonably strong knowledge and value foundation and are oriented towards practical environmental action. It is obvious that at the level of university studies and pre-school educational institutions, it makes sense to purposefully strengthen environmental thinking: age-appropriate problem analysis, cause-and-effect relationships, and solution analysis through playful, exploratory, and experiential tasks. It is also worth systematically establishing integration between formal and non-formal education so that sustainability experiences are continuous and not fragmented. Finally, it is recommended that programs clearly align the components of knowledge, values, behavior, and thinking.

Longitudinal and (quasi) experimental studies would be important in the future, which would assess how different educational techniques change children's knowledge, values, and real behavior over time. It is appropriate to supplement the current qualitative content analysis with broader studies of mixed design.

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