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Research Article

Environmental pre-school education: Pre-service teachers' reflection on practical professional preparation

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ABSTRACT

Environmental education in early childhood is an important part of education for sustainable development, helping to form children's environmental awareness, values, and responsible behavior towards the environment. However, research studies show that pre-service pre-school teachers often lack practical skills and methodological knowledge needed to effectively integrate environmental topics into the educational process. Therefore, the aim of this study was to reveal the strategies of environmental education expected by pre-service pre-school teachers, their perceived implementation challenges, and the evaluation of the preparation provided by the study program. The research is based on a sustainable development education paradigm, theories of social constructivism and experiential learning, concepts of teachers' professional competence and self-efficacy, and the ecological systems theory. The research was conducted using a mixed-methods design that combines qualitative and quantitative analyses. Data were collected using a written survey with four open-ended questions, designed to elicit planned teaching strategies, anticipated challenges, curriculum assessment readiness, and the need for additional professional support. 64 pre-service pre-school education teachers from two Lithuanian universities participated in the study. The data collected were analyzed by applying quantitative content analysis, identifying meaningful units, forming subcategories and categories, and calculating their frequencies. The results of the study showed that pre-service teachers attach the greatest importance to experiential and practical activities in the natural environment. The main expected challenges are related to limited parental involvement, a lack of material and organizational resources, children's developmental peculiarities, and insufficient professional training for teachers (especially in practical implementation). The results of the study show an obvious need to strengthen the integration of environmental education into preschool teacher training programs, to develop practical training opportunities, and to provide greater methodological and professional support for pre-service teachers.

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

INTRODUCTION

Environmental education at pre-school age is an essential part of education for sustainable development (ESD), helping to form children's values, develop their cognitive abilities, and instill the basics of responsible behavior towards the environment. In early childhood, social, emotional, and cognitive processes develop at an extremely rapid pace. At this age, purposefully organized environmental education activities can have a long-term effect on children's relationship with nature and environmental protection in general. Research shows that early development of ecological and environmental awareness promotes the formation of sustainable habits, develops critical thinking, and contributes to environmentally friendly decision-making in

later life stages (Rooney & Blaise, 2023; Speldewinde & Campbell, 2024). Thus, integrating environmental education into preschool curricula can be considered a strategically significant step toward creating an environmentally responsible society. Considering the complexity of current environmental problems, the extent of human activities' impact on the environment, uncertainties in assessing the risks of these activities, and the long-term and indirect consequences, the importance and necessity of environmental education become obvious and unquestionable. An extremely important area is the environmental attitudes of teachers who work with pre-school and primary school-age children, who serve as role models for them for many years, and the formation of these attitudes during university studies (Lamanauskas, 2025).

International Context

Environmental education of pre-school teachers is examined in various studies, which reveal both the current situation, challenges, and possible educational strategies. Research shows that environmental education is an important part of pre-school education, and teachers' attitudes toward environmental protection and their ecological awareness influence their beliefs about the importance and practice of this education (Ho Uyen & Thi Anh Kieu, 2024). One of the main challenges is that the environmental competencies of pre-service pre-school teachers are often limited, and the integration of environmental education into teacher training programs is still relatively new and underdeveloped (Tran, 2024). Research also shows that pre-service teachers often have positive attitudes towards environmental protection but lack knowledge and practical skills (Sönmez Eryaşar & Özel, 2025; Tran, 2024). A study conducted in the USA showed that teachers focus mainly on activities in nature and daily habits, believing that a love of nature is the basis of sustainable behavior. Although teachers would like to include more ethical aspects of sustainability, they feel constrained by the curriculum and parental expectations (Ginsburg & Audley, 2020). Gülçiçek (2021) study revealed a relationship between pre-service pre-school teachers' self-efficacy beliefs in environmental education and their attitudes towards environmental sustainability. In other words, the more pre-service teachers believed in their ability to effectively teach environmental topics, the more favorable their attitudes towards environmental sustainability were. In addition, the experience of learning at university can influence pre-service teachers' environmental attitudes (Keles, 2017).

To introduce young children to environmental topics, pre-service teachers intend to apply various teaching strategies that promote students' active participation and personal involvement in the learning process. Research shows that environmental education courses focused on sustainable development positively affect pre-service teachers' pro-environmental habits and behavior, enabling them to more effectively transmit knowledge and promote children's awareness of environmental issues (Bibi et al., 2026). However, in practice, it is often observed that pre-school educational institutions are not sufficiently prepared to implement effective environmental education due to a lack of a long-term strategy, a shortage of responsible individuals, and insufficient evaluation of results and communication (Ivorra-Catalá et al., 2024). This suggests that although teachers are aware of the importance of environmental education, the organization and implementation of teaching activities are not optimal. Research also shows that pre-service pre-primary teachers would benefit from training that includes theoretical knowledge, practical activities, specialized environmental tools, and encouragement of creativity, as well as the opportunity to collaborate with specialists. Such support could strengthen their confidence and ability to effectively educate young children in the field of environmental education (Torquati et al., 2017; Wilson, 1995).

National Context

The unique situation of environmental education at pre-school age in Lithuania reveals a purposefully emerging yet still fragmented field of scientific research. Although the topic of ecological and sustainable development education has been developed in Lithuanian educology for several decades, the issue of environmental education of pre-school children is more often analyzed within broader educational research, rather than as an independent, systematically conceptualised direction of scientific research.

In Lithuanian education, only a few researchers (Lamanauskas, 2025; Lamanauskas & Malinauskienė, 2024, 2025; Lapėnienė & Neverauskienė, 2023) made a significant contribution to environmental education research. Their works analyze the concept of environmental education, actualize the potential of the environment as a third educator, pre-service teachers' attitudes towards environmental topics, and the

possibilities of integrating sustainable development ideas in primary and pre-school education. Research (Lamanauskas & Malinauskienė, 2025) shows that the majority of pre-service teachers demonstrate a strong environmental awareness and value attitudes. They understand the importance of environmental protection for society and children, feel responsible for protecting nature, and help develop children's respect for it. However, it can also be stated that the vast majority of pre-service teachers often feel they lack the knowledge and practical skills to incorporate ecological ideas into everyday educational activities (Lamanauskas & Malinauskienė, 2024). Research results (Šorytė & Pakalniškienė, 2021) encourage us to pay special attention, namely, to the practical implementation of environmental education, which forms the prerequisites for the formation of environmentally friendly behavior in educational institutions and families, emphasizing the importance of the role of teachers and parents in developing children's environmental responsibility.

In the context of updating the content of pre-school education, the importance of environmental education is increasing. The report of the study "Advanced pedagogical practice and pedagogical innovations in Lithuanian kindergartens" (Monkevičienė et al., 2018) revealed that when applying exploratory and creative science (STEAM) activities in pre-primary and pre-school education, special attention is paid to children's creative science activities, explorations in nature, work with natural objects, and experimental research. The recommendations for Preschool teachers (Monkevičienė et al., 2021) emphasize the implementation of innovative practices and the creation of educational contexts that incorporate environmental education elements. Nevertheless, in Lithuania, environmental education at pre-school age is not recognized as an independent field of education but is integrated into the general educational content, following the guidelines of the pre-school education program (ŠMSM, 2023). The guidelines emphasize the importance of a holistic approach to child development, play, experiential activities, and active exploration. The natural environment is considered an essential space for the formation of knowledge, experience, and value attitudes, encouraging the observation of natural phenomena, the exploration of the living and non-living environment, experimentation, and the search for answers. The development of environmental knowledge and ecological awareness is most clearly evident in the field of education, "Exploring and getting to know the environment," which provides the prerequisites for understanding the regularities of nature, noticing environmental changes, and understanding the relationship between man and nature.

Thus, since pre-school environmental education in Lithuania is still a nascent and fragmented scientific research field, the need for systematic and targeted research on this issue remains particularly relevant.

Research Context, Aim, and Research Questions

In the field of pre-school environmental education, several main research directions prevail, related to the integration of the sustainability principles into educational programs and the evaluation of their impact. One of the important directions is the study of children's knowledge and attitudes about sustainability, environmental protection, and social responsibility, comparing different pre-school education programs, for example, ecological and language education programs. Research shows that students in ecological programs have more detailed knowledge of sustainability topics such as gardening, food, and waste sorting, which underscores the importance of these programs as a basis for sustainable education (Poje et al., 2024). Another direction of research concerns the implementation of sustainability education in pre-school institutions, especially in the context of ecological programs. Research reveals that kindergartens with ecological programs more successfully integrate ecological, social, and economic sustainability aspects into the educational content, apply an integrated approach, and achieve better educational results in the field of sustainability, compared to institutions that do not have such programs (Lepičnik Vodopivec & Šindić, 2025). Research also emphasizes that pre-school education is an important area in which children's social and emotional skills are formed, which are necessary for resistance to negative social and environmental problems. Preventive programs, integrated into the curriculum, promote children's ability to recognize and respond appropriately to negative social phenomena, which is also important in the context of environmental protection, as it develops responsibility for oneself and the environment (Pagirienė & Ramanauskienė, 2023).

However, in the field of teacher education, theoretical knowledge and methodologies often dominate, while the development of practical skills, especially those related to the introduction of social responsibility for environmental protection in pre-school children, remains underdeveloped. This shows that training models often focus on the transfer of theoretical knowledge and provide limited coverage of practical

situations and educational practice, where students could apply this knowledge in real educational contexts. It is evident that teacher education programs often lack specialized knowledge and methods for outdoor education and sustainability topics, which are important for environmental education. Research shows that although there are many topics related to outdoor education and sustainability, their integration into initial teacher education is fragmented, and the development of practical strategies is often insufficient (Setyaningsih et al., 2024; Wolf et al., 2022).

Thus, the current situation indicates the need to develop and implement structured, practical, and theoretical approaches to teacher preparation models grounded in scientific research to better prepare teachers for pre-school environmental education. The study is based on the ESD paradigm, the theory of social constructivism and experiential learning and the concept of teachers' professional competence and self-efficacy (Akça, 2019; Guerra et al., 2024; Hemmer et al., 2024; Kolb, 1984; Vygotsky, 1978). The phenomenon under analysis is also interpreted within the framework of ecological systems theory (Bronfenbrenner, 1979; Christensen, 2016), which emphasizes the interplay among family, institutional, and social factors. This theoretical integration enables a comprehensive disclosure of pre-service teachers' choice of environmental education strategies, perception of challenges, and assessment of professional preparation.

The aim of the study was to reveal the environmental education strategies applied by pre-service pre-school teachers, their expected implementation challenges, assessment of the preparation provided by the study program, and the need for additional professional support and resources. This study extends the previous study examining pre-service teachers' methodological positions (Lamanauskas & Malinauskienė, 2025).

Two research questions (RQs) were formulated:

1. **RQ1.** What environmental education strategies do pre-service pre-school teachers plan to apply in practice, and what challenges do they see in the process of their implementation?
2. **RQ2.** How do pre-service pre-school teachers assess the preparation for environmental education provided by their study program, and what is the need for additional professional support and resources?

RESEARCH METHODOLOGY

Design

The empirical study was conducted in January-March 2025 using a mixed-method design, which combines quantitative and qualitative data collection and analysis methods. As Creswell and Plano Clark (2018) state, the use of mixed methods allows not only a deeper understanding of the phenomenon under study but also the integration of different data perspectives, which increases the validity and reliability of the research results. Quantitative methods help to describe general patterns and connections between variables, while qualitative methods help to reveal individual experiences, subjective meanings, and contextual factors (Bryman et al., 2016). Such triangulation allows not only to capture the scale of the phenomenon, but also to interpret its causes and forms of expression.

The chosen research logic also rests on the assumption that students' experiences and attitudes, as the main participants in the educational process, are a significant source of information that shapes changes in study programs and quality assurance. According to Biggs and Tang (2011), in the constructive alignment paradigm, student feedback is an essential element that helps to identify gaps in the teaching/learning process, improve study content and methods, and ensure compliance with the desired learning outcomes. The analysis of students' perspectives reveals latent problems that often remain unnoticed when relying solely on external assessment criteria (Harvey, 2001).

Furthermore, the qualitative part of the research, the results of which are presented in this article, assumes that phenomena must be studied in their natural environment to understand the meanings that participants themselves give them. As Tenny et al. (2022) emphasize, qualitative methods are particularly valuable for obtaining unexpected, contextualized information that is not limited to predetermined answer variants. This openness to new insights enables the collection of a rich array of verbal data (Alkan et al., 2022),

which reveals deeper aspects of respondents' experiences and helps formulate hypotheses for further research.

Sample

The study involved 64 pre-service preschool teachers (early childhood education teachers) from two Lithuanian higher education institutions–Vilnius University (*N* = 45) and Klaipėda University (*N* = 19). Analyzing respondents' distribution by year of study, it was found that half of the sample (50.0 %) consisted of second-year students. First-year students represented 25.0% of the sample, fourth-year students–17.2%, and third-year students–only 7.8% of all participants.

In the qualitative research context, such a sample should be considered sufficiently representative and justified, allowing the formulation of reliable and valid conclusions. The sample comprises students from two different higher education institutions, ensuring data diversity and reducing the impact of individual institution-specific factors on the research results. As Squire et al. (2024) note, in qualitative research, the sample size can vary depending on the complexity of the topic and the desired analytical depth–a reasonable sample often ranges from a few dozen to 100 or more participants, while a sample of 60-70 respondents allows for reaching data saturation and revealing the diversity of the phenomenon under study. Guetterman (2015) also notes that samples of subjects are common in qualitative research in the social sciences, since this group is characterized by homogeneity in terms of the field of study and research objectives (in this case, the population of pre-service teachers).

Empirical data were collected by conducting a written survey. Each respondent was informed of the study's objectives, and voluntary participation and anonymity were ensured. Verbal consent was obtained from the participants before completing the questionnaires.

Instrument

The study used four open-ended questions.

1. What teaching strategies or activities would you use to introduce young children to environmental topics (e.g., climate change, recycling, and nature conservation)?
2. What challenges do you expect to face when implementing environmental education in a pre-school institution? How would you address them?
3. How well do you think your study program has prepared you to teach environmental topics? What would you suggest improving?
4. What additional support, resources, or training do you think would help you feel more confident in teaching young children about the environment?

These research instrument questions were constructed to comprehensively reveal pre-service preschool teachers' preparation for environmental education, both at the practical and professional levels. The first two questions focus on the projection of pedagogical activity. The aim was to reveal the strategies applied and to obtain a reflection of the expected implementation challenges, thereby creating the prerequisites for assessing respondents' practical thinking and problem-solving competence. The third and fourth questions are aimed at assessing the adequacy of professional preparation and study program and identifying the need for additional support, resources, and qualification improvement. Such a question structure allows analysis not only of declared educational intentions but also of the factors in the institutional and professional environment that potentially influence the implementation of environmental education.

Open-ended questions give respondents the opportunity to respond freely without pre-prepared answer options, thereby obtaining rich, detailed information. The study aims to analyze the phenomenon from the participants' perspectives and contexts rather than simply assess response frequency quantitatively (Dahal et al., 2024).

Data Analysis

Quantitative content analysis was used to analyze the qualitative data collected during the study. This enables systematic, objective, and replicable processing of verbal responses, revealing both their semantic structure and quantitative regularities. As Coners and Matthies (2014) point out, content analysis is a

scientifically sound procedure that allows for drawing reasonable conclusions from various textual information sources. This method is particularly suitable for analyzing open-ended questionnaire responses, interview transcripts, or other textual material when the aim is to identify recurring themes and patterns (Krippendorff, 2018; Schreier, 2012).

The analysis process was carried out in accordance with the logic of systematic content analysis, which is detailed in Mayring (2022) work. This includes the sequential identification of text units, their reduction, and systematic categorization. Erdogan et al. (2009) used a similar procedure when analyzing natural science education content, in which coding, category formation, and counting their frequencies were essential elements of the analysis.

In the first stage, all respondents' answers to the questions were collected. Each question was analyzed separately, in order to maintain thematic clarity and contextuality. From the entire data set, meaningful units were extracted, i.e., significant phrases, sentences, or individual words, reflecting the main ideas or attitudes related to a specific question. This procedure corresponds to the first steps of content analysis, in which researchers, by repeatedly reading texts, identify parts of the texts that answer the RQ.

The identified meaningful units were semantically summarized and grouped into subcategories (smaller structures uniting elements of similar meaning). This corresponds to the paraphrasing and code generation stage described by Mayring (2022), when similar content fragments are grouped into preliminary categories. The subcategories were later combined into larger, more generalized meaningful structures–categories, reflecting more general concepts or thematic groups. This sequential data condensation and structuring allows for a transition from specific textual expressions to more abstract theoretical constructs.

To ensure the reliability of the analysis, the category system was reviewed and discussed within the research group to ensure that all original meaningful units were reflected in the formed categories (Elo & Kyngäs, 2008; Hsieh & Shannon, 2005).

Absolute frequencies (how many times the relevant unit or category was mentioned in the entire data set) and relative frequencies (as a percentage in the context of all units/categories) were calculated for both semantic units and subcategories and categories. This quantitative aspect allows not only to identify, but also to assess their prevalence and significance in the sample studied. As Coners and Matthies (2014) point out, such a transformation of qualitative data into quantitative results is a frequently applied practice in information systems and social research, allowing for the combination of deep understanding with statistical validity.

In this way, the distribution of categories, their recurrence frequency, and their relative weight within the entire construct were determined. This enabled us to identify which themes and attitudes were most frequently expressed in the respondents' answers and to assess their significance in the study context. In other words, coding, the formation of meaningful categories, and the calculation and interpretation of their frequencies were essential elements of this qualitative analysis, consistent with the principles of content analysis, established in the scientific literature (Erdogan et al., 2009; Mayring, 2022; Schreier, 2012).

RESEARCH RESULTS

After analyzing respondents' expressed opinions about environmental education strategies in the early childhood education context, four categories were distinguished: *experiential and practical activities in the real environment*, *informational, narrative, and cognitive activities*, *play, STEAM, and experimental activities*, and *creative, artistic, and project activities* (**Table 1**).

The category *experiential and practical activities in the real environment* (40.6 %) dominates among the preservice teachers' proposed application of teaching strategies. The dominant subcategory–*activities in nature, outdoors, and* environmental management (16.3 %)–includes games, research tasks, nature observation, and environmental management, which are likely to help develop rudiments of early environmental development. The subcategory *planting, growing, and caring for plants* (9.3 %) is a significant part, with opinions stating that this can help children acquire the first sustainable behavior skills. The subcategories *experiential education, excursions, and environmental campaigns* (8.2 %) and *practical sorting and*

Table 1. Evaluation of environmental education teaching strategies and/or activities

Category	N (%)	Subcategory	N (%)	Subcategory components	N (%)
Experiential and practical activities in the real environment	78 (40.6)	Activities in nature, outdoors, and environmental management	31 (16.3)	Activities in nature, outdoors (various tasks, games, activities in the park, etc.)	19 (9.9)
				Observation and exploration of nature	8 (4.2)
				Environmental management, garbage collection in nature/territory	4 (2.2)
		Planting, growing, and caring for plants	18 (9.3)	Planting and growing trees, plants, vegetables	13 (6.7)
				Caring for plants, their maintenance (watering, monitoring, etc.)	5 (2.6)
		Experiential education, excursions, and environmental campaigns	16 (8.2)	Experiential education/learning through activities (emphasis "through experience")	7 (3.6)
				Excursions, trips, education, visits to specialists	6 (3.1)
				Participation in environmental campaigns (campaigns, community initiatives)	3 (1.5)
		Practical sorting and daily sustainable habits	13 (6.8)	Different bins/containers for sorting in the classroom/institution	5 (2.6)
				Sorting tasks (cards, sorting objects, practical tasks)	4 (2.1)
				Daily sustainable habits (saving water, electricity, paper, etc.)	4 (2.1)
Informational, narrative, and cognitive activities	45 (23.4)	Theoretical and conceptual explanations	22 (11.5)	Theoretical explanations about climate change, pollution, impact on nature, species extinction, etc.	14 (7.3)
				Explanation of waste sorting and recycling (why and how it is sorted, what happens after that)	8 (4.2)
		Narrative, visual, and media content	18 (9.4)	Narratives, tales, stories about nature and environmental protection	8 (4.2)
				Educational films, videos, slides	5 (2.6)
				Books and reading about nature, sustainability	4 (2.1)
				Music and songs on environmental topics	1 (0.5)
		Dialogue and reflection	5 (2.5)	Conversations, discussions	3 (1.5)
				Reflections with children	2 (1.0)
Play, STEAM, and experimental activities	37 (19.1)	Play activities	23 (11.8)	Shared games, play activities, competitions	18 (9.3)
				Sorting games, sorting competitions	3 (1.5)
				Role-playing games (staging of environmental situations)	2 (1.0)
		Experiments and STEAM activities	14 (7.3)	Experiments (with water, soil, natural phenomena)	9 (4.7)
				STEAM-type tasks (integrated science, technology, and environmental activities)	5 (2.6)
Creative, artistic, and project activities	33 (16.9)	Creation from waste and secondary raw materials	15 (7.8)	Works from waste/secondary raw materials (use of recycled materials for creation)	15 (7.8)
		General creative and artistic activities	15 (7.7)	Creative activities in general (creative works, tasks, artistic activity)	10 (5.2)
				Creation from natural materials (leaves, twigs, pinecones, etc.)	3 (1.5)
				Visual creativity: drawing, creating posters on environmental topics	2 (1.0)
		Design and construction activities	3 (1.5)	Design activities, long-term works on the topic of environmental protection	2 (1.0)
				Construction, modelling (maquettes, models, related to the topic of environment)	1 (0.5)

Note. 193 semantic units

daily sustainable habits (6,8 %), which are designed to introduce children to real examples of environmental protection and promote sustainable behavior in everyday environments, comprise the smallest part.

The category *informational, narrative, and cognitive activities* (23.4 %) is another relative teaching strategy. A significant part is made up of the subcategory–*theoretical and conceptual explanations* (11.5 %)–which will help convey to children knowledge about climate change, pollution, species extinction, and waste sorting in an understandable way. The subcategory *narrative, visual, and media content* (9.4 %), which includes stories, fairy tales, educational videos, books, and music, would help deepen children's understanding of environmental protection and stimulate their imagination. The smallest subcategory is dialogue and reflection

(2.5 %), which provides opportunities for children to express their opinions and reflect on environmental topics at a level they understand.

Within the subcategory *play, STEAM and experimental activities* (19.1 %), the most prominent subcategory–playful activities (11.8 %)–includes shared games, competitions, sorting, and role-playing games on environmental topics, which could potentially develop practical skills, cooperation, and the basics of responsible behavior. A smaller part is made up of the subcategory *experiments and STEAM activities* (7.3 %), which includes experiments with natural phenomena and integrated STEAM tasks, which would promote the development of children's cognitive abilities and research skills.

The category *creative, artistic, and project activities* (16,9 %) distinguished itself as one more teaching strategy. The subcategory *creation from waste and secondary raw materials* (7.8 %) indicates that this activity fosters sustainability awareness, creativity, and practical skills. Almost an equal share is made up of the subcategory *general creative and artistic activities* (7.7 %), which includes works from natural materials and visual creativity–drawing or creating posters on environmental topics. The smallest share is made up of the subcategory *design and construction activities* (1.5 %), which forms conditions for children to plan, model, and apply what they have learned in activities.

In summary, it can be stated that pre-service teachers, when evaluating environmental education strategies in the early childhood education context, would give priority to experiential and practical activities in the real environment. A smaller, but significant share would go to informational, play, experimental, and creative activities. Such a distribution shows that the greatest attention in the evaluation of pre-service teachers would be paid to experience and practical action, in order to develop children's environmental awareness, practical skills, and the basics of sustainable behavior.

After analyzing what environmental education challenges pre-service teachers see, four categories were identified: *inadequate parental and family influence, insufficient material and organizational resources*, *children's cognitive and motivational characteristics*, and *insufficient teacher competencies and preparation* (**Table 2**).

The category *inappropriate parental and family influence* (29.7 %) emerges as the most significant predicted challenge that pre-service teachers associate with the implementation of environmental education. The most pronounced subcategory–*parental non-involvement and lack of continuity of environmental education in the family* (25.5 %)–suggests that the greatest difficulties may arise from insufficient parental involvement/participation in environmental education. If environmentally friendly behavior is not modelled in the family (e.g., waste sorting and sustainable consumption), children's education may become fragmented and inconsistent. The subcategory *parental disapproval or resistance* (3.0 %) reveals a possible value-attitude conflict, which may complicate the integration of certain environmental topics into the educational process in the future. Meanwhile, the subcategory *need for parental involvement and education* (1.2 %) emphasizes pre-service teachers' desire to strengthen cooperation with the family.

The category *insufficient material and organizational resources* (28.9 %) emerges as the second most significant predicted challenge. The subcategory *lack of material and financial means* (14.1 %) shows that pre-service teachers associate quality environmental education with an adequate material base, and the lack of means and financial resources can limit the variety of activities and practical experience opportunities. The subcategory *organizational and procedural difficulties* (10.6 %) reveals potential challenges in planning activities, ensuring their continuity, and organising field work in larger groups. The subcategory *space and infrastructure limitations,* which account for the smallest share (4.2 %), allows us to state that physical environment limitations can also affect the quality of environmental education.

The category *children's cognitive and motivational characteristics* (27.1 %) reveals challenges related to the specifics of children's development. The dominant subcategory–*children's developmental and comprehension challenges* (15.8 %) reveals that environmental concepts for pre-school-age children can be too abstract; therefore, it is necessary to concretize these concepts and apply experiential teaching strategies. The subcategory Lack of concentration and motivation (7.7 %) indicates that activities should be more dynamic and, likely, more interesting, so that children remain engaged. The subcategory *individual differences of children* (3.6 %) directly emphasizes the importance of differentiated education, as children perceive information and respond to ecological activities differently.

Table 2. Challenges in implementing environmental education

Category	N (%)	Subcategory	N (%)	Subcategory components	N (%)
Inappropriate parental and family influence	51 (29.7)	Lack of environmental education continuity in the family	44 (25.5)	Parents do not observe environmental protection/do not sort themselves	12 (6.9)
				Home environment contradicts kindergarten teaching	10 (5.8)
				Parents are not interested in kindergarten activities	7 (4.0)
				Children see opposite habits at home	6 (3.5)
				Parents do not pay attention to environmental protection	5 (2.9)
				Parents do not encourage children's environmental skills	4 (2.4)
		Parental disapproval or resistance	5 (3.0)	Parents do not approve of environmental education methods	3 (1.8)
				Family values conflict with environmental topics	2 (1.2)
		Need for parental education and involvement	2 (1.2)	Parents need to be educated about the importance of environmental protection	1 (0.6)
				Parents need to be involved in joint projects	1 (0.6)
Insufficient material and organizational resources	49 (28.9)	Lack of material and financial resources	24 (14.1)	Lack of resources (educational, ecological)	10 (5.8)
				Lack of financial resources	6 (3.5)
				Need to creatively compensate for the lack of resources	4 (2.4)
				Lack of green infrastructure (plants, equipment)	3 (1.8)
				Lack of educational materials/literature	1 (0.6)
		Organizational and procedural difficulties	18 (10.6)	Difficulty maintaining the continuity of activities	6 (3.5)
				Difficulty managing large groups outdoors	5 (2.9)
				Requires a lot of planning and coordination	4 (2.4)
				Requires collective cooperation	3 (1.8)
		Space and infrastructure limitations	7 (4.2)	Lack of outdoor spaces	3 (1.8)
				Not always possible to go outdoors	2 (1.2)
				Not enough space for practical activities	1 (0.6)
				Difficult to organize outings due to infrastructure	1 (0.6)
Children's cognitive and motivational characteristics	46 (27.1)	Children's developmental and comprehension challenges	27 (15.8)	Children have difficulty understanding abstract environmental concepts	11 (6.4)
				Need simplified explanation	6 (3.5)
				Children understand only through practical activities	5 (2.9)
				Children forget quickly if there is no regular practice	3 (1.8)
				Children's different family context affects understanding	2 (1.2)
		Lack of concentration and motivation	13 (7.7)	Children lose attention quickly	6 (3.5)
				Need to change activities frequently	4 (2.4)
				Difficulty maintaining interest in the topic	2 (1.2)
				Children are not always motivated	1 (0.6)
		Individual differences in children	6 (3.6)	Differences in children's abilities	3 (1.8)
				Different interests	2 (1.2)
				Some active, others passive in ecological activities	1 (0.6)
Insufficient teacher competencies and preparation	24 (14.3)	Lack of knowledge and preparation	17 (10.1)	Teachers lack environmental knowledge	8 (4.7)
				Fear of harm due to lack of knowledge	3 (1.8)
				Do not know where to start	2 (1.2)
				Need to follow the latest research	2 (1.2)
				Need for training and seminars	2 (1.2)
		Lack of methodology and good practice	5 (3.0)	Lack of methodological tools	3 (1.8)
				Lack of good examples	1 (0.6)
				Lack of sharing of experience between teachers	1 (0.6)
		Insufficient teacher motivation	2 (1.2)	Not all teachers are motivated	1 (0.6)
				Unwillingness to spend additional time	1 (0.6)

Note. 170 semantic units

The category *insufficient teacher competences and preparation* (14.3 %) reveals the self-reflective attitude of pre-service teachers towards their professional preparation. The subcategory–*lack of knowledge and preparation* (10.1 %)–indicates the perceived need among pre-service teachers to strengthen environmental education competencies and methodological preparation through professional development activities. The subcategory *lack of methodology and good practice* (3.0 %) highlights the importance of systematic methodological support, and *insufficient teacher motivation* (1.2 %) suggests that, in the future, it will be relevant to strengthen teachers' internal motivation and devote time to it.

Table 3. Preparation for implementing environmental education

Category	N (%)	Subcategory	N (%)	Subcategory components	N (%)
Insufficient environmental education content in studies	34 (29.5)	Complete or almost complete absence of lectures on environmental protection	22 (19.1)	There have been no lectures on environmental protection yet	14 (12.1)
				This topic has not yet been studied in the first year	5 (4.4)
				Not yet studied	3 (2.6)
		Content superficiality	12 (10.4)	Environmental protection topic has only been touched on episodically	6 (5.2)
				Only basic, superficial knowledge has been provided	4 (3.5)
				Poor/minimal preparation	2 (1.7)
Improvement directions and positive aspects	32 (27.8)	Improvement opportunities	17 (14.8)	More practical activities and real examples	7 (6.1)
				Clearer recommendations should be provided on how to integrate environmental protection into education	4 (3.5)
				More new scientific sources and relevant information	3 (2.6)
				More visits to educational institutions, trips	3 (2.6)
		Positive aspects of the study program	15 (13.0)	Useful activities and practical examples were provided	6 (5.2)
				The program provided basic knowledge	4 (3.5)
				Internships in educational institutions were valuable	3 (2.6)
				Useful activities and practical examples were provided	2 (1.7)
Lack of practical activities and methodological examples	29 (25.3)	Lack of practical activities, experiential learning	18 (15.7)	Lack of practical activities, classes	8 (7.0)
				Lack of real examples from educational institutions	5 (4.4)
				Lack of field research, real projects	3 (2.6)
				Practical skills were not developed	2 (1.7)
		Lack of specific methods and tools to teach children	11 (9.6)	More specific methods are needed for children's environmental education	5 (4.4)
				Lack of examples of games, activities, fairy tales on sustainability topics	4 (3.5)
				Lack of situational analysis and application examples	2 (1.7)
Insufficient integration of environmental protection in the study program	20 (17.4)	Weak emphasis on environmental protection topics	12 (10.4)	The topic is not highlighted enough in the study program	6 (5.2)
				Environmental protection is integrated fragmentarily	4 (3.5)
				The topic is left to the initiative of teachers or students	2 (1.7)
		Lack of systematic integration into other subjects	8 (7.0)	Environmental protection should be integrated into all study subjects	5 (4.4)
				A separate course on environmental education is required	3 (2.6)

Note. 115 semantic units

Summarizing the positions of pre-service teachers on the question under discussion, it can be stated that in order to achieve effective development of environmental education in the future, it is necessary to systematically address the challenges related to limited parental involvement, insufficient material and organizational resources, children's cognitive and motivational characteristics, and lack of teachers' environmental competencies. A targeted, consistent, and integrated approach would create the prerequisites for implementing sustainable, inclusive, and high-quality environmental education.

In response to the question "*how well do you think? Your study program prepared? You to teach environmental topics?*" the respondents expressed a diverse view, on the basis of which four categories were also distinguished: *insufficient environmental education content in studies*, *improvement directions and positive aspects*, *lack of practical activities and methodological aspects,* and *insufficient environmental protection integration in the study program* (**Table 3**).

The category *insufficient environmental education content in studies* (29.5 %) emerges as the main lack of pre-service teachers' preparation to teach environmental topics. The subcategory *complete or almost complete absence of lectures on environmental protection* (19.1 %) makes up the largest part of this category, indicating that for some respondents, environmental topics were not studied at all or were discussed only minimally during their studies. The subcategory *content superficiality* (10.4 %) shows that environmental topics were taught episodically, presenting only basic or fragmentary knowledge. This enables us to assume the lack of systemic and consistent environmental education content in the study program.

The second, according to frequency category, *improvement directions and positive aspects* (27.8 %), reveals the complexity of pre-service teachers' assessments. The subcategory *improvement opportunities* (14.8 %) indicates the need for practical activities, methodological recommendations, relevant sources, and closer cooperation with educational institutions. Meanwhile, the subcategory *positive aspects of the study program* (13.0 %) shows that some of the respondents evaluate the study program favorably, emphasizing useful activities, acquired basic knowledge, and valuable practical experience.

The category *lack of practical activities and methodological examples* (25.3 %) reveals a clear lack of practical preparation. The subcategory *lack of practical activities and experiential learning* (15.7 %) appeals to the lack of practical activities, real examples, field research, and project activities. The subcategory *lack of specific methods and tools for teaching children* (9.6 %) emphasizes the need for more specific environmental education methods and examples of their application.

The smallest share is the category *insufficient integration of environmental protection in the study process* (17.4%), indicating a lack of consistent and systematic integration of environmental topics. The subcategory *weak emphasis on environmental topics* (10.4%) indicates a fragmented presentation of the topic, while the subcategory *lack of systemic integration into other subjects* (7.0%) highlights the need to integrate environmental protection across all study subjects or to offer a separate course in environmental protection.

Summarizing the insights of pre-service teachers, it can be stated that the study program did not provide everyone with sufficient preparation to teach environmental topics. Although some of the respondents see positive aspects and the acquired basic foundation, the shortcomings of environmental education content, practical preparation, and systemic integration dominate. To strengthen the preparation of pre-service teachers in the future, it is appropriate to integrate environmental content more consistently and systematically into the study program, develop practical activities, and provide more methodological examples.

After analyzing respondents' assessments of the need for additional professional assistance and resources for environmental education, four categories were distinguished: *continuous competence improvement*, *methodological and didactic assistance to the educational process*, *Teaching aids and experiential education*, *cooperation, mentoring, and external support* (**Table 4**).

The category–*continuous competence improvement* (39.2 %)–stands out as the main form of additional professional support, helping teachers feel more confident in teaching pre-school children about environmental topics. The largest part of this category is made up of the subcategory *training, seminars, and professional events* (32.2 %), which includes various professional development activities–trainings, seminars, courses, conferences, and discussions, which strengthen knowledge, methodological skills, and self-confidence. The subcategory *independent professional development* (5.4 %), which reflects individual professional development initiatives, and *studies and distance learning* (1.6 %), which provides more flexible development opportunities, make up a significantly smaller share.

The category *methodological and didactic support for the educational process* (32.7 %) reveals the pre-service teachers' need for clearly structured, practically applicable support in organising environmental education. The subcategory *teaching methods and* strategies (9.7 %) highlights the importance of properly selected methods and effective pedagogical strategies. The subcategory *plans, guidelines, and integration into education* (9.1 %) emphasizes the need for methodological materials, recommendations, and consistent integration of environmental topics into the educational process. The subcategory *activity examples and adaptation to children* (8.0 %) emphasizes the importance of specific activity examples that correspond to children's age and individual needs.

Table 4. The need for additional professional assistance and resources for environmental education

Category	N (%)	Subcategory	N (%)	Subcategory components	N (%)
Continuous competence improvement	73 (39.2)	Trainings, seminars, and professional events	60 (32.2)	Trainings	25 (13.3)
				Participation in seminars	16 (8.6)
				Lectures	8 (4.3)
				Courses	5 (2.7)
				Discussions and events	4 (2.2)
				Conferences	2 (1.1)
		Independent professional development	10 (5.4)	Internet resources	4 (2.2)
				Books	3 (1.6)
				Documentaries and other videos	2 (1.1)
				Scientific articles	1 (0.5)
		Studies and distance learning	3 (1.6)	Separate study subject	2 (1.1)
				Online/distance learning	1 (0.5)
Methodological and didactic support for the educational process	61 (32.7)	Teaching methods and strategies	18 (9.7)	Appropriate methodologies	12 (6.5)
				Practical training and practical advice	5 (2.7)
				Teaching strategies	1 (0.5)
		Plans, guidelines, and integration into education	17 (9.1)	Methodological material (recommendations, instructions)	6 (3.2)
				Adapted lesson topics	5 (2.7)
				Educational environment and integration into other subjects	5 (2.7)
				Teaching plans	1 (0.5)
		Activity examples and adaptation to children	15 (8.0)	Activity examples and adapted task sets	14 (7.5)
				Adaptation for children with special educational needs	1 (0.5)
		Content directions and value education	11 (5.9)	Focused topics: climate change, waste recycling, sustainable lifestyle	6 (3.2)
				Value implementation (e.g., love for nature, environmental awareness)	4 (2.2)
				Waste sorting, showing a positive example	1 (0.5)
Teaching aids and experiential education	32 (17.3)	Interactive and visual aids	15 (8.1)	Interactivity and practical participation	5 (2.7)
				Visual and other illustrated materials	3 (1.6)
				Booklets	2 (1.1)
				Posters	2 (1.1)
				Flashcards	2 (1.1)
				Cartoons	1 (0.5)
		Forms and methods of experiential learning	13 (7.0)	Experiments	3 (1.6)
				Observations in nature	3 (1.6)
				Stories	3 (1.6)
				Games	2 (1.1)
				Expeditions and excursions	2 (1.1)
		Material resources	4 (2.2)	Various didactic tools	2 (1.1)
				Various teaching materials	2 (1.1)
Collaboration, mentoring, and external support	20 (10.8)	Professional community and family involvement	6 (3.3)	Collaboration with colleagues	2 (1.1)
				Collaboration with parents	2 (1.1)
				Forums and sharing of experiences	2 (1.1)
		Specialist involvement and consultations	5 (2.7)	Specialist consultations	3 (1.6)
				Expert advice	2 (1.1)
		Exchanges, observation, and project activities	4 (2.2)	Projects and internships in other countries	2 (1.1)
				Activity observation in other institutions	2 (1.1)
		Partnerships with environmental institutions	3 (1.6)	Cooperation with environmental organizations	3 (1.6)
		Communication and publicity	2 (1.0)	Social networks	1 (0.5)
				Publicity activities	1 (0.5)

Note. 186 semantic units

The category *teaching aids and experiential education* (17.3 %) highlights the need for interactive and experiential forms of learning, as well as additional professional support and resources for environmental education. The subcategory *interactive and visual aids* (8.1 %) includes various engaging teaching aids, while

the subcategory *experiential learning forms and methods* (7.0 %) emphasizes the importance of experiments, observations, trips, and games. *Material resources* (2.2 %), related to the availability of didactic aids, make up the smallest part.

The category *collaboration, mentoring, and external support* (10.8 %) emerged as another form of additional professional assistance and resource needs. Although each subcategory accounts for a small share (from 1.0 to 3.3 %), respondents emphasize collaboration with colleagues, parents and the community, specialist consultations, project activities and monitoring activities in other institutions, partnerships with environmental organizations, publicity of activities, and use of social networks. All this is considered an important tool for strengthening professional confidence, developing competencies, and consistently integrating environmental topics into the educational process.

In summary, it can be stated that pre-service teachers' insights about the need for additional professional support and resources for environmental education underscore the importance of more focused cooperation, specialist consultations, and external support in order to strengthen their competencies and ensure consistent implementation of environmental topics in the educational process.

DISCUSSION

The study aimed to reveal what environmental education strategies pre-service pre-school teachers planned to apply in practice, what challenges they saw in implementing this education, how they assessed the professional preparation provided by the study program, and what additional support, resources, and training needs they identified.

In relation to the **RQ1**, the findings on planned environmental education strategies revealed how pre-service teachers prioritize experiential, activity-based approaches while simultaneously anticipating practical and contextual implementation challenges.

The results of the study show that pre-service preschool teachers attach the greatest importance to experiential and practical activities in real environment. Activities in nature, planting and caring for plants, environmental management, and daily sustainable habits such as waste sorting and observing nature dominate respondents' answers. Play, STEAM, and experimental activities are also emphasized, which allow children to explore natural phenomena and learn through active participation. Involving children in specific environmental activities remains also an extremely important educational strategy, as other studies show (Djoehaeni et al., 2017; Fjørtoft, 2004; Torquati et al., 2013). Creative and artistic activities, such as crafting recycled or natural materials, are also seen as an important means of environmental education. Such a strategy distribution shows that pre-service teachers perceive the importance of experiential and active learning at a preschool age and seek to integrate various pedagogical approaches to help children understand environmental topics in ways that are understandable and attractive to them. This position clearly correlates with research conducted in other countries (Dean & Landreth, 2025; Dolenc Orbanić & Kovač, 2021; Ozturk et al., 2025).

An analysis of likely environmental education challenges has shown that the greatest difficulties are associated with family and parental influence, a lack of material and organizational resources, children's cognitive and motivational characteristics, and a lack of teacher competencies. Other studies also reveal significant gaps in the field of teacher environmental education, especially in pedagogical strategies and in professional development (Ginsburg & Audley, 2020). Although teachers are willing to teach environmental education, their knowledge of this field's components is poor (Dada et al., 2017; Gwekwerere, 2014; Otitoju et al., 2025). Respondents also draw attention to pre-school children's cognitive characteristics, arguing that environmental concepts are often too abstract for them; therefore, simpler, more experiential teaching methods should be used. Finally, some pre-service teachers also reflect on the limitations of their professional training, emphasizing the lack of knowledge, methodological materials, and practical examples. Research shows that although teacher training programs provide knowledge about environmental protection (e.g., sustainability), this knowledge does not directly determine their applied practices (Kahriman Pamuk et al., 2026). Pre-service teachers are characterized by greater theoretical knowledge, whereas their practical preparation is poor (Türkoğlu, 2019).

Considering the **RQ2**, the evaluation of study program preparation highlighted notable gaps in environmental education content and emphasized the need for stronger practical training and sustained professional support.

When assessing the study program's preparation for teaching environmental topics, pre-service teachers offered rather critical insights. A large proportion of respondents noted that environmental topics were examined only in a fragmentary manner in the studies or were not discussed at all. Research also shows that pre-service teachers hold many misconceptions about environmental issues (Zarkadis & Papageorgiou, 2024), and their environmental awareness is not high (Özonur, 2021). In students' opinion, the study program should include experiential learning, practical activities, the analysis of real educational situations, and clear methodological recommendations on how to integrate environmental topics into the pre-school education process. It can be argued that, although the study program provides a theoretical basis, it is not sufficiently systematic in its focus on developing environmental education competencies. This is also consistent with systematic research showing that the integration of environmental education into pre-service teachers' training programs at universities is problematic and should be critically assessed (the place of environmental education in teacher education programs is extremely uncertain) (Crim et al., 2017; Damoah & Omodan, 2023). Environmental issues are often not sufficiently integrated into current programs; therefore, many pre-service pre-school teachers report that their coverage is fragmented and insufficient (Dolenc Orbanić & Kovač, 2021; Sönmez Eryaşar & Özel, 2025; Spiteri, 2022; Tran, 2024).

Pre-service teachers attach the greatest importance to continuous professional development. The importance of training, seminars, courses, and other professional development events is emphasized to deepen environmental knowledge and strengthen pedagogical skills. Methodological and didactic support, including clear educational guidelines, examples of activities, and practical methods adapted for pre-school children, is also considered an important need. Thus, to effectively implement environmental education, it is necessary not only to strengthen teacher training programs but also to create conditions for continuous professional growth and methodological support. For the effective implementation of environmental education, it is not enough to only strengthen teacher training programs (Corpuz et al., 2022) but also to create conditions that would promote continuous professional development and methodological support (Guevara-Herrero et al., 2025).

Limitations

The limitations of this study are primarily determined by the characteristics of the sample and the applied design. Empirical data were collected from a relatively small, geographically limited sample of 64 pre-service pre-school teachers studying at two Lithuanian universities. Although students from various courses were included in the study, second-year students objectively dominated in the sample; therefore, the results obtained cannot be generalized to the wider population of pre-service teachers. The chosen quantitative content analysis method is also marked by methodological limitations: although the creation of categories and the calculation of their frequencies enabled the identification of prevailing trends, this approach did not reveal deeper causal relationships between subjects' characteristics and their positions, nor did it allow substantiation of the results' contextuality. Since the study was cross-sectional, it did not capture the possible trajectory of changes in pre-service teachers' attitudes and knowledge, which could be revealed through long-term observations.

Despite the above limitations, the study is considered significant because it provides an empirically grounded and relevant framework for pre-service preschool teachers' positions regarding environmental education. The significance of the study is also increased by the fact that it diagnoses strategic gaps in the training of pre-service teachers: a tendency to rely on theoretical principles is evident, but there is a lack of practical vision of problems; a reactive, rather than preventive, position towards environmental challenges prevails. This allows not only the recording of the current situation but also the provision of guidelines for improving teacher training.

CONCLUSIONS AND IMPLICATIONS

The study examined the readiness of pre-service pre-school teachers to implement environmental education in practice. It was found that when planning environmental education, students prioritize experiential and practical activities in nature, such as outdoor activities, growing plants, or sorting waste. Also important are informational, play, experimental, and creative activities, which would help children understand environmental topics in an accessible form. At the same time, several key challenges emerged: limited parental involvement, lack of material and organizational resources, children's developmental characteristics, and insufficient professional teacher preparation. It was found that environmental content in study programs is often fragmented, and there is a significant lack of practical methodological examples. In addition, a strong need for additional training, methodological assistance, and professional support was expressed.

The results of the study show that pre-service teachers are aware of the importance of environmental education at an early age, but their professional preparation in this area is not yet sufficiently consistent and systematic. This suggests that teacher training programs need a more focused integration of environmental education, greater attention to experiential learning, practical methods, and analysis of real educational situations. The results show the importance of methodological and didactic support, as teachers need clear guidelines, activity examples, and specialized teaching aids. From a practical point of view, this can contribute to the more effective implementation of environmental education in pre-school institutions and help lay the foundations for sustainable behavior in children.

In further research, it would be appropriate to more broadly analyze the models of environmental education integration in teacher training programs and their impact on pre-service teachers' competencies. It is also valuable to study real environmental education practices in pre-school institutions and their effectiveness in developing children's environmental awareness. Additional research could include an analysis of the role of parents and the community in shaping children's environmental habits. It is appropriate to supplement the current qualitative content analysis with broader mixed-methods studies.

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