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Development of the NEST program: Nature Education for Sustainable Teaching: a training course to foster knowledge, self-efficacy, and willingness to teach outdoors

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Outdoor education (OE) is increasingly recognized as a key pedagogical approach to foster holistic child development, wellbeing, and sustainable attitudes. While well established in Northern European educational systems, its adoption in Southern Europe remains limited, often due to cultural and institutional barriers and insufficient teacher preparation. This study presents the design and development of the NEST program (Nature Education for Sustainable Teaching), a structured training course aimed at enhancing student teachers' and educators' knowledge, self-efficacy, and willingness to teach outdoors in early childhood education. The program was developed through a participatory co-creation process that actively involved national and international experts in pedagogy and OE, from both academic and professional practice contexts. Through this collaborative process, the experts contributed to identifying priority themes and shaping the overall structure of the curriculum. The outcome is a four-module program that combines theoretical input, experiential activities, and reflective practices, and is grounded in experiential, transformative, and sociocultural learning theories. The NEST program represents an innovative and evidence-based framework for integrating OE into teacher education. By overcoming the methodological gaps of earlier initiatives, it lays the groundwork for targeted training pathways that advance a pedagogical culture more responsive to the interconnections between education and the natural environment.

KEYWORDS

outdoor education, student teachers, early childhood education, teacher training program, curriculum development, sustainability education

1 Introduction

Educational and pedagogical research has recognized the importance of outdoor experiences as key opportunities for children's holistic learning and development, identifying outdoor education (OE) as a key element (Dahlgren and Szczepanski, 1998; Higgins, 1995). OE is a pedagogical approach valuing direct contact with nature, fostering meaningful and creative learning processes (Guerra et al., 2020), and studies have documented its benefits on motor, cognitive, and relational development in childhood (Yıldırım and Akamca, 2017; Kiviranta et al., 2024). Nature promotes physical, psychological, and social wellbeing in childhood, meeting developmental needs through a redesign of environments and practices (Antonietti et al., 2022; Pirchio et al., 2021). However, the diffusion and integration of OE into the educational systems of European countries remains uneven: while it is a practice often established as an integral part of curricula in Northern Europe, in many areas of Southern Europe, cultural and institutional barriers remain that limit its adoption (Sandseter et al., 2020). To promote real change, the focus must be on teacher training, who are the true protagonists of educational innovation. Only through targeted investment in their skills and awareness will it be possible to effectively disseminate OE, promoting children's wellbeing and fostering ecological citizenship.

The role of teachers as key players in educational innovation in OE is central, as their preparation and ability to lead active learning experiences are crucial for its success (Higgins and Nicol, 2013). In fact, the dissemination and effectiveness of OE are highly dependent on educators' attitudes and their level of self-efficacy; elements that can be enhanced through targeted training (Borsos et al., 2022; Barrable and Lakin, 2020). However, several international studies highlight how teachers and student teachers have difficulties and low confidence in delivering OE, mainly due to inadequate initial training (Ihmeideh and Al-Qaryouti, 2016; Tuuling et al., 2019). Even in Northern European countries such as Finland and Norway, where OE is an established approach, one of the critical issues reported by student teachers is the lack of specific training, which generates insecurity in group management and teaching content (Sjöblom et al., 2023).

1.1 OE training programs

The need to develop specific professional pathways for OE educators was emphasized as early as the 1950s (Vinal, 1953), highlighting their relevance in initial teacher training (Jaffe, 1955). However, to date, only a few studies have examined the effects of OE training programs, and many focus on physical education or science, using mainly qualitative methodologies (Wolf et al., 2022). Among the earliest contributions, Zacharious and Valanides's (2006) study of a small sample of student teachers showed how participation in an outdoor program focused on Education for Sustainable Development (ESD) strengthened a sense of self-efficacy, enriched knowledge, and fostered more conscious attitudes and motivations toward ESD. Subsequently, Gray and Colucci-Gray (2019), through a mixed-method approach, investigated the experiences of student teachers in a university outdoor learning course. The authors (Gray and Colucci-Gray, 2019) indicated that the emergence of moments that were experienced as being meaningful and as learning episodes that were perceived as personally relevant and emotionally engaging, promoted deeper ecological awareness with spillovers into environmental education. More recently, Wineberg (2023), in a qualitative study with a group of eight student teachers, showed that after participating in a training course on the benefits of OE in early childhood, there was an increase in understanding of the benefits of OE and confidence in knowing how to implement it effectively in educational practice. Finally, Sekula et al. (2024) conducted a quantitative design study in this field by involving 56 early childhood professionals in a short training course on OE, and showed significant improvements in attitudes, beliefs, and intentions to use OE practices.

However, one limitation shared by several of the studies published is unclear descriptions of training pathways (Wolf et al., 2022). A recent meta-analysis conducted by Wolf et al. (2022) found that many studies do not provide detailed information about the content covered, how the courses were conducted, or the instruments used to assess their effectiveness, making the replicability of interventions and comparison between research difficult. In addition, the populations involved and the educational target contexts are often unclear, limiting the generalizability (Wolf et al., 2022). Another issue is a small sample size, often only a few dozen participants, reducing data robustness and generalizability of any conclusions reached (Zacharious and Valanides, 2006; Sekula et al., 2024). Therefore, it is essential to promote studies that accurately and systematically describe the characteristics of participants, the structure of training programs, and the evaluation methodologies adopted, to develop effective and replicable training practices for OE educators.

1.2 Nature Education for Sustainable Teaching–the NEST program

In recent years, growing attention to global sustainability challenges has highlighted the need for integrated educational approaches that promote awareness and action for Sustainable Development (European Commission, 2022). This perspective is fully in line with the principles outlined in the 2030 Agenda for Sustainable Development, adopted by all United Nations member states, which provides a shared roadmap to guide global action toward a more equitable and sustainable future (United Nations, 2015). The Agenda identifies 17 Sustainable Development Goals (SDGs) that address key global issues and, in this context, OE represents an effective educational approach to contribute to the achievement of several goals of the 2030 Agenda (Hu and Mou, 2025). For example, OE promotes quality education [Sustainable Development Goal (SDG) 4], stimulates climate awareness and action (SDG 13), and strengthens the links to life on Earth (SDG 15). Moreover, in the aftermath of the COVID-19 pandemic, several authors have stressed the importance of returning to the outdoors, emphasizing the beneficial psycho-physical effects of contact with nature (Slater et al., 2020). It is because of studies like this (Slater et al., 2020) and the growing awareness of the benefits of being outdoors that the importance of OE practices has found new momentum and recognition in the wake of the COVID-19 pandemic (Chistolini, 2022). Despite this, however, especially

in those countries where OE is not considered a mainstream educational element, it is often relegated to episodic, local, or private initiatives and is not considered an integral part of the educational and school curriculum (Giunti and Schenetti, 2024). In recognizing OE's benefits in terms of a child's psychological and physical wellbeing (Weeland et al., 2019) and in the development of sustainable attitudes (Valentini et al., 2017), a cultural change must be promoted that fosters the adoption of OE in educational settings with teachers, student teachers, and educators representing the key agents (Zdybel et al., 2024). Studies show that although many student teachers have positive attitudes toward OE, practical application is hindered by low competence and a lack of structured training (Sjöblom et al., 2023). In response to these critical issues, the current program is presented as an innovative course, developed and implemented in the Italian context, aimed at student teachers and educators. Its design was informed by the characteristics of the Italian educational framework, considering national curricular guidelines that emphasize experiential and holistic learning (Ministero dell'Istruzione, 2012). Moreover, since OE in Italy is not yet formally integrated into national curricula or teacher education programs participants may have limited previous experience in this field. For this reason, the course was designed as an introductory training aimed at building foundational knowledge, skills, and confidence in implementing outdoor practices.

The program's goal is twofold: to increase knowledge about OE (history, benefits, and methodologies) and to promote a real sense of self-efficacy and foster a willingness to teach outdoors. The NEST program is the first scientifically documented national program describing the genesis, methodology, and implementation of training experience in OE aimed at future teachers of services for children aged 0 to 6 years, laying the groundwork for the subsequent evaluation of its effectiveness and replicability.

2 Pedagogical framework(s), pedagogical principles, and competencies/standards underlying the activity

The NEST program's pedagogical framework integrates major learning theories including experiential, transformative, and sociocultural, to support the development of future outdoor educators and enhance the competencies for outdoor learning in early childhood settings (Dewey, 1916; Kolb, 1984; Mezirow, 1991, 2000; Vygotsky, 1978). Learning is conceived as an active, reflective, and socially grounded process in which students are invited to connect theory with practical experience. Drawing on some of the principles of Knowles (1984), the program was structured to ensure that the content covered was immediately relevant to the professional future of student teachers and educators, encouraging their active participation and offering activities with a clear link to the educational challenges they might face in working with children. The NEST program, like OE, was inspired by Dewey's (1916) *Learning by Doing* approach and by Kolb's (1984) experiential learning cycle by integrating concrete experiences, in-depth reflection, conceptual elaboration, and active experimentation. This dynamic process has been enriched by critical reflection, which, as outlined in Mezirow's (1991, 2000) transformative learning theory, fosters the development of broader and more inclusive perspectives. Within the program, particular importance is given to the group dimension: on several occasions, moments of group work and sharing are provided, which, consistent with Vygotsky's (1978) sociocultural approach, foster social interaction by promoting collaborative learning and pedagogical reflection. In addition, as highlighted by Brookfield (1995) and Brookfield and Preskill (2005), group discussions promote the analysis and questioning of personal beliefs through exposure to diverse perspectives, fostering self-critique, collective awareness, and more informed, reflective action that underscores the key role of collaborative learning in educator development. This is particularly important in contexts where OE is not a homogeneously widespread practice and there are many obstacles and barriers (Sandseter et al., 2020; Pipero, 2024). Furthermore, in line with Bandura's (1989) social cognitive theory, which describes the importance of self-efficacy in determining behavior and learning, the program aims to strengthen students' confidence in their own ability to adopt OE practices by providing hands-on OE design experiences, peer moments, feedback, and direct engagement with nature and natural elements. In line with place-based learning principles (Sobel, 2004) and embodied learning perspectives (Wilson, 2002), the NEST program also emphasizes the role of the body, the environment, and sensory experience as integral to the learning process.

The program is aligned with National Directions related to *Orientamenti* 0–3 years (Commissione Nazionale, 2017/2022), the *Campi di Esperienza* 3–6 years (Ministero dell'Istruzione, 2012). It also draws from recent Italian initiatives, such as INDIRE's 2021 and 2024 guidelines on OE (Avanguardie Educative). Lastly, the program reflects and integrates the importance of holistic, inclusive, and experiential approaches to early childhood education, also shared internationally (UNESCO and UNICEF, 2024).

3 The present study

This study illustrates the development process of the NEST program. Inspired by the models of Research-Practice Partnerships (RPPs; Coburn and Penuel, 2016) and participatory curriculum design (Makrakis and Kostoulas-Makrakis, 2023), the construction of the NEST program involved national and international professionals from academic and operational/practical backgrounds, and aimed to ensure the pedagogical soundness and formative relevance of the proposed activities. Specifically, professors, educators, and pedagogists known as experts in the field of teaching and OE were interviewed and involved in a co-creation process to evaluate the preliminary framework, validate the relevance of proposed topics, and suggest additional content to strengthen the training of future teachers and educators. A four-step process was adopted to determine expert consensus on the curriculum through sequential surveys. The practical knowledge and experiences from these consultations were used to design the curriculum materials. The involvement of stakeholders in the design of services is essential to build practical knowledge and

foster the effectiveness of instructional innovations (Irgens et al., 2023).

3.1 Learning environment; learning objectives; pedagogical format

The NEST program is an educational course aimed at student teachers and educators enrolled in university courses in Primary Education Sciences, Education Sciences, and Social and Educational Services Design and Management. The program's goal is to foster greater awareness of the benefits of OE, to strengthen pedagogical competencies for designing and implementing outdoor learning activities, and to enhance willingness and confidence to integrate OE in educational settings 0–6. The program consists of four teaching units lasting two hours each, to be presented weekly over a month. In each meeting, key themes identified during the construction phases described in this study are addressed. Specifically, the program aims to achieve the following learning objectives:

- Increase knowledge about OE and its benefits for child development
- Develop practical skills in designing and implementing outdoor educational experiences
- Strengthen the perceived sense of self-efficacy in teaching outdoors
- Increase the willingness of student teachers and educators to integrate outdoor practices into 0–6 educational settings.

Pedagogically, the program adopts an active and reflective approach, based on methodologies such as cooperative learning, guided reflection, case analysis, and experiential learning. For example, during the second session, participants work in small groups to experiment with outdoor activities that could later be proposed to children. One of the tasks involves creating artistic compositions using natural materials collected outdoors, followed by a guided discussion on which developmental areas and learning domains ("campi di esperienza") each activity might stimulate. Alternating the theoretical content, hands-on practice, and moments of individual and collective reflection is intended to support transformative learning rooted in the students' personal experiences (Brookfield, 1995; Dewey, 1916; Kolb, 1984; Mezirow, 1991, 2000). The structure and content of the NEST program were defined through a participatory and interactive process that included a literature review and the involvement of experts through multiple stages. The following sections detail the method adopted to construct the program and the results related to each phase of the study.

4 Methodology

4.1 Participants

We followed principles of the Delphi method, a well-established technique for reaching expert consensus through iterative rounds of input and feedback to structure the expert panel for the NEST program (Sinha et al., 2011). Regarding the panel, Sinha et al. (2011) and Okoli and Pawlowski (2004) consider a panel of between 10 and 18 experts to be adequate and specify how the panel composition is influenced primarily by the quality of interactions among contributors, rather than by statistical considerations. In line with the above, a panel of 15 participants was formed that included professionals from Italy (80%), Spain (6.67%), Germany (6.67%), and Sweden (6.67%). Panel members were selected for their expertise in OE. Academic experts, including professors, pedagogists, and researchers engaged in OE research, and practitioners, such as principals, teachers, and educators active in schools adopting OE practices, were involved. The sample consisted of 15 professionals (3 men, 12 women), with a mean age of 46.1 years (SD = 12.1). The average experience in the field of OE was 17.3 years (SD = 10.2; range: 5–40 years). Enrollment was performed through convenience sampling because of the highly specialized nature of the criteria required. Inclusion criteria were aged over 18 years and having established experience in OE and designing instructional and curricular units. All participants provided informed consent electronically before the start of the first round of the survey. The entire research process received approval from the Ethics Review Committee of LUMSA. University (approval: 10/2023) on 23rd May, 2023 and was conducted in accordance with relevant ethical guidelines.

4.2 Study phases

Four study phases were undertaken to create the final version of the NEST program (Figure 1).

4.2.1 Phase one: literature review and identification of key topics

In this first phase, an exploratory analysis of the literature was conducted to identify key themes deemed relevant to the design of an educational intervention geared toward improving the preparedness of student teachers and educators with respect to OE in 0–6-year-old contexts. The exploration focused on several areas, including historical backgrounds and theoretical frameworks related to OE, psychological and physical benefits of OE, the role of connecting with nature in promoting the wellbeing of teachers and children, obstacles and facilitators in implementing OE in educational settings, the importance of OE in teacher training, and ways of integrating OE into school curricula. Academic articles, theoretical contributions, empirical research, and descriptions of already implemented training programs published in national and international journals sourced through searches of scientific databases (e.g., Scopus, ERIC, EBSCO) were consulted. The literature review led to the construction of a preliminary list of topics that were significant to address as part of an initial training course for OE educators.

4.2.2 Phase two: involvement of experts

At this stage, the list of identified topics was submitted to a panel of experts to assess their perceived importance through semi-structured interviews. Specifically, the first authors interviewed each expert individually, in-person or online, for approximately 30 min. To facilitate the evaluation, the topics

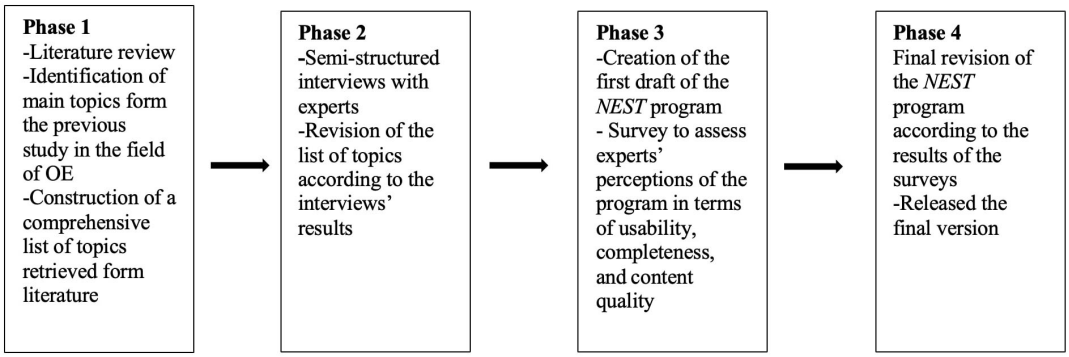

FIGURE 1
Phases of the NEST program development. NEST, Nature Education for Sustainable Teaching; OE, outdoor education.

retrieved from the literature were grouped into five thematic areas (historical background and theoretical framework of OE; benefits of OE for child development; OE and sustainability; integration between OE and the school curriculum; designing OE experiences). This organization provided a clear and coherent structure that allowed experts to reflect on the completeness, relevance, and interconnections among the proposed contents. During the interviews, this list was presented (Table 1), and the experts were asked whether they considered this content relevant to the construction of the NEST training program. In addition, the experts were asked to propose new topics that they thought were important to consider and include in the training. At the end of the interviews, the list of topics that emerged from the literature was revised based on the suggestions provided by the professionals.

4.2.3 Phase three: curriculum construction and assessment

A first draft of the NEST program was developed from the revised list of topics that emerged from the previous stages. This preliminary version was subjected to a new phase of qualitative evaluation, involving a smaller number of experts ($n = 7$), through individual semi-structured interviews. The reduced number of participants was due to the unavailability of some experts from the previous phase to take part in a second round of interviews. During the interviews, the program was presented, and the experts were asked to give their opinions on the perceived importance of the topics included, assessing whether each content item could be considered essential in relation to the objectives of the modules and their own professional skills. In line with previous research (Powe et al., 2022; Sinha et al., 2011), which shows that keeping participants blind to the responses of others can reduce the influence of the more dominant members of the group, the interviews were conducted individually to ensure greater independence of judgment.

4.2.4 Phase four

Finally, in phase four, the percentage of agreement among the participants was quantified with respect to the entire course presented to assess the need for revisions to the NEST program based on the results that emerged from the interviews. At the end of this phase, the final version of the NEST program was released for testing in a future pilot study.

5 Results

5.1 Phase one: retrieval of information from the literature and creation of a list of possible topics to be included in the training course

After analyzing the literature, key contributions were identified for designing a training course on OE for student teachers and educators in the 0–6 educational sector. Publications providing theoretical and historical frameworks were selected (e.g., Antonietti et al., 2022; Dahlgren and Szczepanski, 1998; Fang et al., 2022; Weyland and Galletti, 2018). Next, studies highlighting OE's benefits for child development (e.g., Dillon et al., 2004; Pirchio et al., 2021; Yıldırım and Akamca, 2017; Weeland et al., 2019) and its role in fostering sustainable attitudes (e.g., Valentini et al., 2017; Wells and Kristi, 2006) were also included. Several studies on teachers' and student teachers' attitudes toward adopting OE were examined (e.g., Barrable and Lakin, 2020; Barrable et al., 2022; Borsos et al., 2022; Sjöblom et al., 2023; Tuuling et al., 2019). We examined interventions where the effects of OE training were explored (e.g., Cevher Kalburan, 2022; Gray and Colucci-Gray, 2019; Sekula et al., 2024; Wineberg, 2023; Zacharious and Valanides, 2006). The review by Wolf et al. (2022), synthesizing 46 empirical studies worldwide and focusing on competencies, content areas, and pedagogical strategies for OE preparation, was particularly relevant. Finally, publications containing valuable guidelines for OE pathway design and teacher preparation were also considered (e.g., Higgins and Nicol, 2002; INDIRE et al., 2024). These topics are detailed in Table 1.

5.2 Phase two: semi-structured interviews with experts

During the one-on-one interviews, the professionals were asked to express their opinions on the issues identified and to suggest any additions. The results of the semi-structured interviews showed that all professionals considered it essential to include several

TABLE 1 Topics retrieved from literature and shared with professionals.

Topic 1: Historical background and theoretical framework of OE What is outdoor education (OE) Historical and theoretical background: from the 17th century to the present day OE in the Italian context
Topic 2: Benefits of OE for child development Benefits of OE on: interpersonal and social area, affective area, cognitive area, physical and behavioral area. OE and emotional regulation in childhood
Topic 3: OE and sustainability Importance of promoting green and sustainable skills in educational context (European Commission and GreenComp) Link between OE and Agenda 2030 Exposure to nature at an early age and development of sustainable attitudes
Topic 4: Integration between OE and school curriculum Link between OE and National Guidelines related to *Orientamenti* 0–3 years (Commissione Nazionale, 2017/2022), the *Campi di Esperienza* 3–6 years (Ministero dell'Istruzione, 2012). Presentation of resources for activities to be proposed that link OE to the school curriculum + experiential workshop with natural elements
Topic 5: Designing OE experiences The space between indoor and outdoor Sobel's (2004) design principles Designing an OE experience (group work and templates as a guide)

topics as listed in Table 1. 86.67% of the professionals interviewed considered it important to cover the historical background of OE within the learning course for prospective teachers. The professionals emphasized the importance of contextualizing OE through its historical roots by considering established pedagogical theories.

93.33% of respondents agreed that it was important to include a unit dedicated to the benefits of OE for child development. The experts indicated how an intervention on this topic would allow them to highlight the value of this approach in promoting children's wellbeing and healthy child development, contributing, in a broader sense, to holistic personality development.

Regarding the possibility of including a unit dedicated to the link between OE and sustainability, 66.67% of respondents regarded it as important to address this issue, considering the link to Agenda 2030.

93.33% of respondents considered it important to devote a lesson to the topic of integrating OE and school curriculum/fields of experience and identified this link as crucial to ensure the coherence and effectiveness of educational programs. The experts emphasized that OE should not be seen as a separate activity, but as an opportunity to enrich the school curriculum, fostering children's development and promoting the acquisition of soft skills.

> "*How outdoor education integrates with the school curriculum—this is key to spreading the practice. If you explain to a teacher that outdoor education not only brings benefits but also allows them to meet curriculum goals, it's a perfect match!*"

In addition, 86.67% of participants find it useful to share resources with student teachers and educators regarding possible experiences to be carried out with children in OE settings (e.g., treasure hunts, pre-writing exercises on mud, categorization with leaves, creativity with art-nature).

Regarding the possibility of including additional topics not considered in the list, professionals expressed the need to add two fundamental aspects:

Evaluation, i.e., the enhancement and documentation of OE experiences (46.67%).

> "*It is important that they know this can be evaluated[.] They also need to think about how to evaluate a certain activity, how to record it with pictures, notes, or whatever.*"

Safety, risk, and the pedagogical design of OE experiences (60%).

> "*I would recommend safety and risk management [.] and then design the themes of pedagogical design of outdoor education experiences.*"

Finally, considering that the course would be offered within a university setting, the experts stressed the importance of including experiential activities: 66.67% recommended using natural materials in the classroom to stimulate sensory exploration and encourage direct contact with nature.

> "*Bringing natural materials, such as leaves, stones, or flowers, into the classroom can stimulate sensory exploration, giving students a taste of the outdoors indoors.*"

In addition, 80% believed it was important to provide at least one meeting in an outdoor space.

5.3 Phase three: the first draft of the curriculum

From the phase one and two results, we created the first draft of the NEST program, drawing on the identified and co-constructed content. The structure and main content of the training course are presented in Table 2, which illustrates its organization into four weekly sessions designed to move from conceptual understanding to practical implementation. Each week combined theoretical

input, collaborative work, and reflective discussion, allowing participants to progressively link OE principles to early childhood educational practice. The first unit introduced the theoretical foundations of OE, its historical development, and its links with sustainability and child development. The second focused on integrating OE into the national curriculum and designing related educational activities. The third involved planning and conducting outdoor experiences, emphasizing design principles and risk management. Finally, the fourth unit addressed documentation and evaluation, encouraging participants to critically reflect on how outdoor experiences can be assessed and enhanced within educational contexts.

5.4 Phase four: release of the final version of the NEST program

Of the 15 experts involved in phase two, seven also participated in the fourth and final phase of the study. In this phase, the NEST program was presented in its entirety, and the experts were asked to give an overall assessment regarding its coherence, relevance, and training usefulness. A qualitative analysis of the responses that emerged during the semi-structured interviews revealed a general convergence of opinions. Teaching units were frequently described as "important" and/or "essential" for the training of future teachers. Based on this feedback, the development team proceeded with finalizing the curriculum, maintaining the structure and content of the initial draft presented to the experts (Table 2).

6 Discussion

This study's main objective was to describe the selection process of themes and content considered crucial for the construction of the NEST program, an educational curriculum on OE topics designed to prepare future educators in early childhood education services (0–6 years). The study illustrated the results of a four-stage structured process that led to the co-creation of the curriculum in collaboration with national and international professionals from academic and operational educational settings. The active involvement of experts made it possible to define a solid theoretical framework strongly anchored in the needs of professional practice. This approach, which is rooted in the Research-Practice Partnerships (RPP; Coburn and Penuel, 2016) model, favored the relevance, practicability, and adherence of the content to the reality of educational services. In addition, the iterative nature of the construction process allowed the curriculum to be progressively refined, ensuring greater internal consistency and perceived validity before implementation. As highlighted by recent studies (Irgens et al., 2023; Makrakis and Kostoulas-Makrakis, 2023), co-construction with stakeholders in the field is an effective strategy to promote innovation and quality by considering the real needs of target users. Collaboration between academic and operational professionals enabled the development of a training course that was centered, essential, and tailored to the needs of student teachers and educators, strengthening its relevance and usefulness for future educational practice.

6.1 The NEST program

Based on our study's findings, the experts agreed that the topics identified in the literature were essential to include in the course and suggested additional topics to enrich the content. First, the experts felt it was essential to include a unit dedicated to outdoor design that included risk assessment and securing spaces. This element reflects the increased attention on the quality of outdoor educational spaces (Antonietti et al., 2022) and the principles of place-based education, which value situated learning in local and natural contexts (Sobel, 2004, 2025). The design of outdoor environments concerns logistical aspects and involves pedagogical choices that can foster autonomy, exploration, and relationships with the environment. From this perspective, the issue of risky play has also emerged as relevant: calibrated risk experiences, if well managed, can support children's motor, social-emotional, and self-confidence development and overall wellbeing (Sandseter, 2007; Spencer et al., 2021).

An additional aspect recognized as fundamental by the experts was related to the evaluation, enhancement, and documentation of OE experiences. Evaluation was understood as verification and a formative and reflective process capable of enhancing individual and collective learning times, activities, and processes (INDIRE et al., 2024). A valuable pedagogical tool through which the teachers could improve their educational practice by offering feedback regarding the achievement of the proposed learning objectives (INDIRE et al., 2024; Singh, 2023). In addition, documentation through photos, videos, collections of materials, and narratives takes on a central function in representing progress and lived experiences, facilitating children's active involvement and sharing the educational journey with families and other stakeholders (Guerra, 2014; INDIRE et al., 2024).

6.2 Implications of the study

Our results fill a significant gap in the international literature on the training of OE educators. We offer a theoretical and operational model for the implementation of specific training pathways for future professionals in early childhood education services (0–6 years). Indeed, the NEST program represents a structured, evidence-based proposal that addresses the need to define initial preparation for future teachers in OE (Wolf et al., 2022).

At the educational level, the curriculum is a tool to promote a greater knowledge and understanding of the benefits of OE on child development for future educators, while providing practical skills for designing and implementing outdoor educational experiences. Integrating reflective moments, experiential activities, and theoretical content aims to strengthen the perception of self-efficacy in OE and increase the willingness of student teachers and educators to adopt these practices in future professional activities. In this sense, implementing the NEST program may be a first step in the wider dissemination of educational approaches based on contact with nature, with potential benefits for children's holistic development and the renewal of pedagogical practices in educational services.

TABLE 2 The NEST program.

Week 1. Introduction to outdoor education What is outdoor education (OE) Historical background and theoretical foundations of OE OE in the Italian context Link between OE and sustainability Benefits of OE on child development
Week 2: Integration between OE and school curriculum. Identity elements of OE Link between OE and National Pedagogical Guidelines related to *Orientamenti* 0–3 years (Commissione Nazionale, 2017/2022); and the *Campi di Esperienza* 3–6 years: the self and the other, the body and movement, images sounds and colors, discourses and words, knowledge of the world (Ministero dell'Istruzione, 2012) OE and STEAM approach Presentation of resources for activities to be proposed that link OE to the school curriculum + experiential workshop with natural elements
Week 3: Designing in OE contexts–educational outing Space: between indoor and outdoor (learning landscape, intelligent contexts, risk assessment and management). David Sobel's design principles: adventure and exploration, fantasy and imagination, contact with the animal world, maps and orientation, special places, small worlds, hunting and gathering (Sobel, 2004). Designing an OE experience in outdoor setting through group work using a template.
Week 4: Evaluate, document and enhance the OE experience. Evaluation as valorization Assessment tools Documenting OE experiences Examples of documenting and enhancing OE experiences (video projections of successful experiences).

From a research perspective, the study responds to some critical methodological issues highlighted in the existing literature (Wolf et al., 2022) by offering a detailed and systematic description of the curriculum development process, the content covered, and how experts are involved. This methodological transparency is a relevant Contribution To The Field, allowing for greater replicability and comparability with future studies. Moreover, the program provides an empirically grounded foundation on which to build future evaluations of effectiveness that will allow the impact of the curriculum to be further explored.

6.3 Limitations and future perspectives

This study has some limitations. The sample of experts, although heterogeneous in terms of geographic origin (including professionals from different Italian regions and Spain, Germany, and Sweden), was numerically small and predominantly composed of Italians, which may have influenced the variety of perspectives that emerged. The curriculum development relied exclusively on a qualitative methodology, which enabled the collection of rich and contextualized data, but which may have limited the generalizability and objectivity of the conclusions. In addition, only half of the initial participants took part in phase four of the co-creation process, and this may have reduced the variety of views gathered during the final validation phase, even though there was a general convergence in the qualitative assessments provided by the experts involved. Furthermore, although the course emphasizes an experiential approach, it could not be implemented entirely in outdoor settings due to logistical constraints related to the university environment. Finally, the curriculum requires systematic empirical evaluation to verify its effectiveness in promoting higher-quality educational delivery. Future research should therefore include a structured evaluation phase aimed at assessing both learning outcomes and perceived impact on participants. In particular, the success of the program could be measured through pre- and post-course assessments of knowledge, self-efficacy, and willingness to implement OE practices, combined with qualitative reflections on participants' experiences. Future studies could involve the use of exploratory, quasi-experimental, or experimental designs to evaluate the effectiveness of the program.

7 Conclusion

The NEST program responds to the need to integrate OE into undergraduate education for educators, where OE is recognized as a promising educational approach to child development but still lacks a shared training framework. Its modular structure, based on active and reflective pedagogical principles (e.g., Dewey, 1916; Kolb, 1984; Mezirow, 1991, 2000), aims to enhance the awareness, self-efficacy, and willingness of student teachers and educators to integrate outdoor practices into 0–6 years teaching. Considering recent studies that emphasize the relevance of OE for overall child development (Kiviranta et al., 2024) and for learning and inclusion in atypical developmental contexts, such as autism spectrum disorder (Morsanuto et al., 2023) and attention deficit hyperactivity disorder or learning disabilities (Natalini and Savastano, 2024), its implementation in contemporary educational settings becomes even more crucial. Therefore, the NEST program provides a significant starting point to promote targeted educational pathways on OE to support the construction of a high-quality pedagogical culture more in tune with the relationship between education and nature.

Data availability statement

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

Ethics statement

The studies involving humans were approved by the Ethics Review Committee of LUMSA University. The studies were conducted in accordance with the local legislation and institutional requirements. The participants provided their written informed consent to participate in this study.

Author contributions

DP: Writing – original draft, Conceptualization, Writing – review & editing. BR: Writing – review & editing, Conceptualization, Writing – original draft. NR: Writing – review & editing. MC: Writing – review & editing. DC: Writing – review & editing. CB: Writing – review & editing. SD: Writing – review & editing, Conceptualization, Supervision, Writing – original draft.

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Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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