TRAINING TEACHERS FOR OUTDOOR EDUCATION: AN ONLINE COURSE ON NEEDS ANALYSIS AND CO-DESIGN OF INCLUSIVE PROTOCOLS

FORMARE I DOCENTI ALL'EDUCAZIONE IN NATURA: UN CORSO ONLINE PER L'ANALISI DEI BISOGNI E LA CO-PROGETTAZIONE DI PROTOCOLLI INCLUSIVI

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ABSTRACT

The study describes a 20-hour online training program, funded by the National Plan for the Prevention and Rehabilitation of Urban Development (PNRR), aimed at teachers on Outdoor Education (OE). Through a needs analysis, the adoption of pre- and post-tests, and the co-design of inclusive protocols, significant increases in self-efficacy in outdoor design and sustainable integration were observed. The developed protocols propose accessible solutions, inclusive adaptations, and connections to the Sustainable Development Goals (SDGs), constituting a model that can be replicated in urban contexts

Lo studio descrive un programma di formazione online della durata di 20 ore, finanziato dal Piano Nazionale per la Prevenzione e la Riqualificazione dello Sviluppo Urbano (PNRR), rivolto agli insegnanti e incentrato sull'Educazione all'Aperto (Outdoor Education, OE). Attraverso un'analisi dei bisogni, l'adozione di test pre e post intervento e la co-progettazione di protocolli inclusivi, sono stati osservati incrementi significativi nell'autoefficacia relativa alla progettazione di attività all'aperto e all'integrazione sostenibile. I protocolli sviluppati propongono soluzioni accessibili, adattamenti inclusivi e connessioni con gli Obiettivi di Sviluppo Sostenibile (SDGs), costituendo un modello replicabile in contesti urbani.

Introduction

Outdoor education (OE) is increasingly important as a pedagogical strategy capable of promoting well-being, motivation, inclusion, sustainability skills, and greater awareness of environmental issues, as highlighted by recent literature (Diamond, 2013; Louv, 2016). This educational approach, which involves the systematic use of open spaces as learning environments, represents a pedagogical response to the growing need for personalized teaching and connection with the natural environment, particularly urgent in the post-pandemic era. Scientific evidence demonstrates how outdoor learning promotes not only the development of transversal disciplinary skills, but also the enhancement of socio-emotional abilities and the reduction of stress in students.

Despite alignment with national and international regulatory guidelines, including the National Curriculum Guidelines and the 2030 Agenda, teacher training in outdoor practices remains fragmented and unsystematic, especially in urban contexts and in distance learning. This training gap is particularly critical considering that the National Recovery and Resilience Plan (PNRR) identifies ecological transition and educational innovation as two strategic priorities for the Italian education system (Ministero dell'Istruzione, 2021).

This study aims to fill this gap through the analysis of training needs and the co-design of inclusive teaching protocols within an online training program funded by the PNRR. It also aims to improve teachers' design awareness of Outdoor Education (EO) to develop their ability to design contextualized and accessible teaching units. The collaborative approach adopted aims to move beyond traditional teaching methods, promoting a participatory approach that leverages teachers' professional experience as a resource for the shared construction of innovative teaching knowledge.

The analyzed data come from a 20-hour course delivered to a group of teachers at a comprehensive school and include quantitative measures of self-efficacy and collaboratively developed project materials. Adopting a mixed-method design, the study integrates pre- and post-test analyses of validated scales (e.g., TSES and EETEBI) with a qualitative thematic analysis of the co-designed protocols (Braun & Clarke, 2006).

This paper aims to provide empirical evidence on how brief, normatively supported, instructional-design-oriented training interventions can enhance teachers' planning skills and foster flexible adaptations. Finally, the findings and implications for professional practice aimed at integrating Outdoor Education (EO) into school curricula will be discussed.

Methods and Materials

The study was based on a single-group pre-post design with a mixed methodological approach, aimed at evaluating the impact of a 20-hour online training program for primary and lower secondary school teachers at the "Via Pietro Nenni" Comprehensive Institute in Torremaggiore (FG). The course, funded under the National Recovery and Resilience Plan (PNRR, Ministerial Decree 66/2023, Investment 2.1), integrated synchronous lessons, guided reflection activities, and collaborative co-design sessions, with the aim of fostering the development of inclusive teaching protocols for outdoor education. The modular structure of the program included: an introduction to the fundamentals of Outdoor Education (EO) and national and international regulatory frameworks (National Curriculum Guidelines, Law 92/2019, Agenda 2030); in-depth study of educational neuroscience and constructivist pedagogy; fundamentals of sustainable teaching design; and a co-design laboratory based on a specially developed canvas. This methodological approach is consistent with recent evidence demonstrating the effectiveness of short, targeted teacher professional development programs, especially when focused on collaborative and project-based activities (Darling-Hammond et al., 2017; Voogt et al., 2015).

The intervention was evaluated using pre- and post-intervention questionnaires administered on Google Forms, adapted from internationally validated instruments. Specifically, the following were used: the 9-item version of the Teachers' Sense of Efficacy Scale (TSES; Tschannen-Moran & Woolfolk Hoy, 2001) to measure perceived self-efficacy in relation to student motivation and planning outdoor activities; the 6-point Likert-scale Environmental Education Teaching Efficacy Belief Instrument (EETEBI; Moseley et al., 2016) to assess self-efficacy beliefs regarding integrating environmental education; and the 7-point scale of the Teachers' Self-Efficacy Scale for Education for Sustainable Development (TSESESD; Handtke & Bögeholz, 2019) to measure perceived ability to promote sustainability practices and ecological responsibility. Alongside the quantitative scales, the pre-

test included open-ended questions aimed at exploring perceived obstacles and training needs, while the post-test collected qualitative feedback and assessments of the course's usefulness.

Quantitative data were analyzed using Jamovi (version 2.4), calculating descriptive statistics, internal reliability indices (Cronbach's α), and pre-post comparisons with paired-sample t-tests and nonparametric Wilcoxon tests, also reporting effect sizes (Cohen's der). Furthermore, Spearman correlations between positive attitudes towards nature education, previous practice, and perceived barriers were explored. Open-ended responses were examined using thematic analysis according to Braun and Clarke (2006), with subsequent quantification of the frequencies of the themes that emerged to integrate the qualitative and quantitative perspectives. The choice of a mixed and multilevel design responds to the need to investigate both changes in perceived self-efficacy and the design practices actually produced, in line with the literature on the effectiveness of teacher professional development programs for sustainability education (Handtke & Bögeholz, 2019; Moseley et al., 2016).

The open-ended responses were analyzed using a qualitative-inductive approach according to Braun and Clarke's (2006) criteria. Coding was conducted using the open-source software Taguette, which allowed us to highlight and organize the textual data into thematic categories. From the responses, an inductive codebook was constructed, divided into two macro-areas: (a) perceived obstacles and resources in the pre-test, and (b) positive aspects and areas for improvement that emerged in the post-test. Each response was associated with a prevalent tag, and the occurrence counts (highlights) for each category were subsequently calculated.

At the same time, the texts were subjected to lexicometric analysis using Voyant Tools, with the aim of complementing manual coding with an automatic analysis of word frequencies and co-occurrences. This triangulation allowed us to validate emerging themes, demonstrating the consistency between the high frequency of terms such as space, organization, and time in the pre- and practice sections, and planning and strategies in the post-section, and the thematic coding results.

The combination of manual and automatic analysis therefore guaranteed a multilevel approach, capable of restoring both the quantitative dimension of the occurrences and the qualitative richness of the exemplary citations, in line with the

methodological recommendations for studies on sustainability education (Creswell & Plano Clark, 2018).

Results:

Variable	Category	N	%
School order	Primary	14	51.9%
	Lower secondary school	13	48.1%
Years of teaching	6–10 years	3	11.1%
	11–20 years	10	37.0%
	> 20 years	14	51.9%
Previous outdoor practice	Never	12	44.4%
	Some time	13	48.1%
	Often	2	7.4%

Table 1.   **S**ample characteristics by school level, years of teaching and previous outdoor experience (N = 24).

The final sample consisted of 24 primary school teachers (51.9%) and lower secondary school teachers (48.1%), distributed primarily between those with over twenty years of teaching experience (51.9%) and those with between 11 and 20 years of service (37.0%), while only 11.1% had between 6 and 10 years of service. Previous experience with outdoor education was limited: 44.4% of participants stated they had never experienced it, 48.1% stated they had only occasionally done it, and just 7.4% indicated they had offered it regularly. These descriptive data contextualize a sample that was generally experienced in teaching but with limited familiarity with Outdoor Education (EO), a factor that makes evaluating the effectiveness of the training program particularly relevant.

Stairs	Cronbach's alpha
Self-Efficacy Outdoor	.815
EETEBI	.728
TSESESD	.012 (bass)

Table 2. Internal reliability (Cronbach's α) of the scales used.

The internal reliability of the scales used showed varying values: the Self-Efficacy Outdoor scale yielded a Cronbach's α of .815, indicating good internal consistency and therefore score reliability; the Environmental Education Teaching Efficacy Belief Instrument (EETEBI) achieved an α = .728, considered acceptable in the educational psychology field and in line with the original validation (Moseley et al., 2016); the Teachers' Self-Efficacy for Education for Sustainable Development (TSESESD) scale, however, yielded much lower values, suggesting caution in interpretation and making analysis at the individual item level more appropriate.

Stairs	Pre M (DS)	Pre Median	Post M (DS)	Post Median
Motivate students (TSES item)	6.92 (1.41)	7	7.72 (0.94)	8
Curriculum Design (TSES)	6.08 (2.02)	7	7.20 (1.35)	7
EETEBI	4.64 (1.08)	5	5.36 (0.76)	5
TSESESD	5.68 (1.18)	6	6.12 (0.97)	6

Table 3. Descriptive statistics (mean, median, standard deviation) pre- and post-intervention.
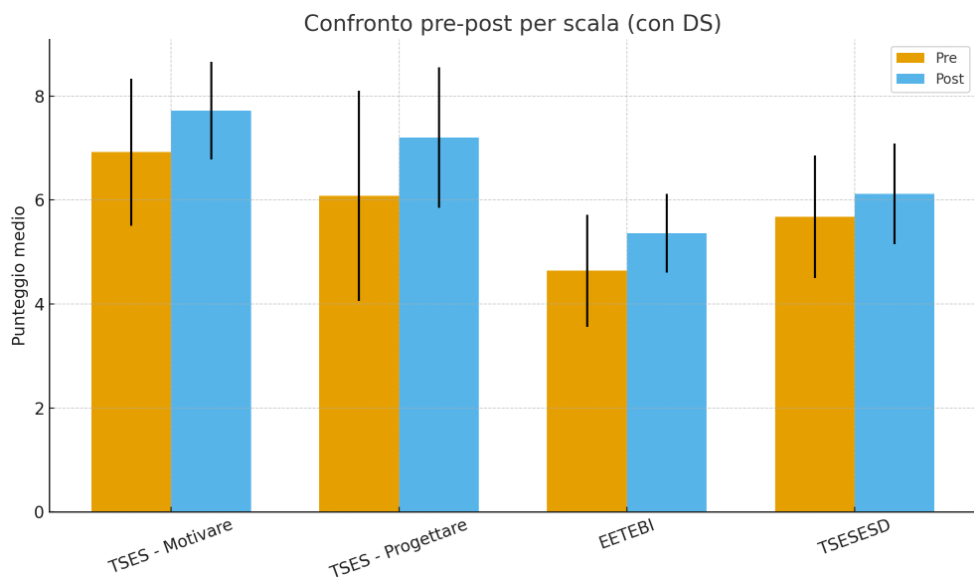
Figure 1. Pre-post comparison of self-efficacy scales (TSES motivate, TSES plan, EETEBI, TSESESD).

Pre- and post-test descriptive statistics confirm improvement in all areas. Regarding self-efficacy in motivating students to participate in outdoor activities, the mean increased from 6.92 (Median = 7; SD = 1.41; range 5–9) in the pre-test to 7.72 (Median = 8; SD = 0.94; range 6–9) in the post-test. The perceived ability to plan activities consistent with the curriculum increased from M = 6.08 (Median = 7; SD = 2.02; range 2–9) to M = 7.20 (Median = 7; SD = 1.35; range 5–9). Environmental education integration (EETEBI) increased from M = 4.64 (Median = 5; SD = 1.08; range 3–6) to M = 5.36 (Median = 5; SD = 0.76; range 4–6). Finally, perceived effectiveness in promoting sustainability and ecological responsibility (TSESESD) showed a more modest increase, from M = 5.68 (Median = 6; SD = 1.18; range 3–7) to M = 6.12 (Median = 6; SD = 0.97; range 4–7).

Stairs	Test	t / W (gdl)	p	Cohen's d
Motivate students (TSES item)	t coupled	−3.36 (24)	.003	0.67

Curriculum Design (TSES)	t coupled	−3.71 (24)	.001	0.74
EETEBI	t coupled	−4.27 (24)	<.001	0.85
TSESESD	t coupled	−2.29 (24)	.031	0.46

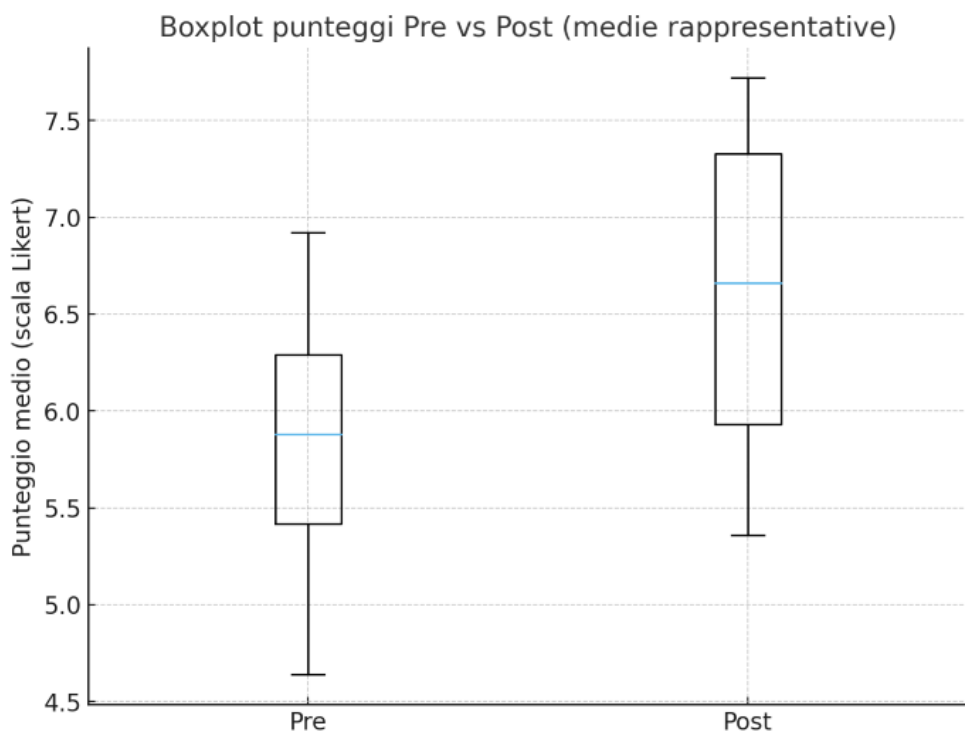**Table 4.** Results of paired t-tests/Wilcoxon for pre-post comparison on self-efficacy scales.

Figure 2. Boxplot of pre- and post-scores for the main scales.

Inferential tests confirm the significance of these improvements. For student motivation, the pre–post difference was significant (t(24) = −3.36, p = .003), with a medium effect size (Cohen's d = .67), a result confirmed by the Wilcoxon test (p =

.004). Similarly, curriculum design skills showed a significant increase (t(24) = –3.71, p = .001; d = .74; Wilcoxon p = .001). The EETEBI also showed a marked improvement (t(24) = –4.27, p < .001; d = .85; Wilcoxon p = .001). Finally, for the TSESESD, the increase, although more limited, was significant (t(24) = –2.29, p = .031; d = .46; Wilcoxon p = .040). Overall, therefore, the training program determined a medium-large increase in the perception of self-efficacy in the areas related to student motivation, curricular planning and the integration of environmental education, while it produced a more moderate but still significant impact in the area of sustainability.

In addition to these analyses, the post-test included additional exploratory items that allowed us to evaluate qualitative aspects of the training. Teachers stated that the training provided useful tools for planning activities in nature, with mean scores ranging from 7.50 to 8.50 on a 9-point scale (SD ranging from .71 to 1.81 depending on the subgroups). They also showed an increase in motivation to integrate outdoor experiences into teaching (M = 5.50–5.86 on a 6-point scale), with SD between .38 and .83, and an overall positive evaluation of the online learning modality adopted, considered effective for preparing for the planning of activities in nature (M = 4.17–5.14 on a 6-point scale, SD between .98 and 1.21).

Main theme	Category	N. highlights	Exemplary quotes
Obstacles	Space	26	"Lack of adequate space"; "Lack of suitable and safe spaces"; "Finding a suitable location within the country"
	Organizati on	10	"Difficulty in proposing activities in adverse weather conditions"; "Organization, material and financial resources, and skills"; "Logistical problems primarily related to organizing with other disciplines."
	Student distractio n	1	"Students can get distracted easily"
Resources	Economic resources	5	"I believe in economic resources"; "Organization, both material and economic resources, and skills."
	Time	5	"Weather conditions" "Difficulty in proposing activities in adverse weather conditions"

Table 5. Macro-categories, frequencies, and exemplary quotes emerged from the analysis of the open-ended responses in the pre-test (perceived obstacles and necessary resources), through thematic coding in Taguette.

The open-ended responses confirm and deepen the quantitative data, offering insight into teachers' perceptions and needs.

In the pre-test, the main obstacles identified were the lack of adequate space (26 highlights: "lack of adequate space," "suitable and safe spaces"), organization (10 highlights: "difficulty in organizing activities in adverse weather conditions," "logistical problems related primarily to organizing with other subjects"), and, to a lesser extent, student distraction. Among the necessary resources, teachers cited financial resources (5 highlights: "I believe financial resources") and time (5 highlights: "weather conditions"). These data underscore how logistical and structural constraints still represent a significant barrier to the implementation of Outdoor Education practices.

Main theme	Category	N. highlights	Exemplary quotes
Positive aspects	Practice	18	"Practice"; "Transferring theory into practice"; "Exercises and outdoor activities"
	Training	14	"Information Received and Discussion with Colleagues"; "Training Educators"
	Comparison	7	"Comparing different points of view"; "Exchanging ideas and work

			experiences"; "Planning activities and sharing ideas with other colleagues"
	Teaching strategies	8	"Strategies for Outdoor Teaching"; "Wiggins and McTighe's Methodological Approach"
Areas to improve	Design	17	"Spatial design"; "A deeper understanding of the structure of activities"; "The ability to design and implement in reality"
	Other/none	7	"No one"; "I don't know"

Table 6. Macro-categories, frequencies, and exemplary quotes emerged from the analysis of the open-ended post-test responses (positive aspects and areas for improvement), through thematic coding in Taguette.

In the post-test, the positive aspects of the training emerge above all. The most recurring category is practice (18 highlights: "practice," "translating theory into practice," "exercises"), followed by planning (17 highlights: "space design," "exploring the structure of activities more deeply"), which, however, is ambivalent: on the one hand, it is perceived as useful, on the other, as an area for improvement. Theoretical training (14 highlights) and teaching strategies (8 highlights) are also rated positively, including Wiggins and McTighe's backward design (2005) and specific outdoor methodologies. Discussion with colleagues (7 highlights) is recognized as an enriching element for exchanging experiences and building professional communities. However, the analysis highlights significant areas for improvement. Teachers call for improved detailed design skills and the organization of outdoor spaces, as well as more structured forms of active student engagement.

Some also emphasized that although the online modality was perceived as effective, some participants would have preferred in-person training, which would have encouraged greater direct interaction and hands-on experience.

These results, taken together, demonstrate how the training was appreciated primarily for its practical and collaborative component, but at the same time highlighted ongoing needs in terms of project support, resources, and organisation.

Figure 3. Word cloud generated with Voyant Tools from the open-ended pre- and post-test responses, highlighting the most frequently recurring terms.

Lexicometric analysis conducted with Voyant Tools helped strengthen the interpretation of the qualitative data. The word cloud (Figure 1) shows the recurrence of key terms such as "space," "practice," "design," and "organization," which match the categories emerging from manual coding.
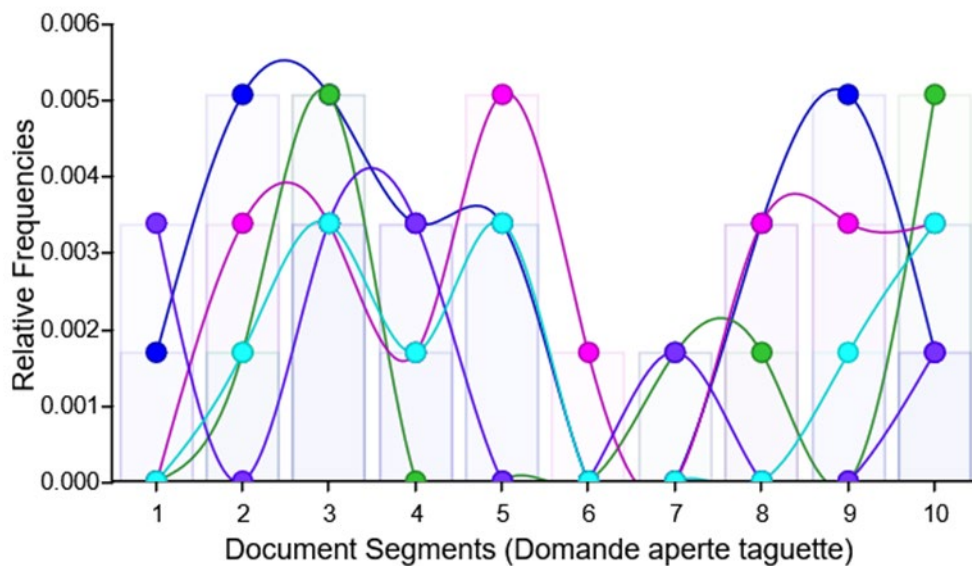
Figure 4. Absolute frequency of the most common words in open-ended responses (Voyant Tools output), consistent with the categories emerged from manual thematic analysis.

At the same time, the frequency table (Figure 2) highlights the greater incidence of words referring to logistical constraints in the pre-test (space, time, weather) and concepts related to experiential learning in the post-test (practice, planning, strategies). These results confirm the coherence between the inductive qualitative approach and automatic text analysis, strengthening the reliability of the collected evidence.
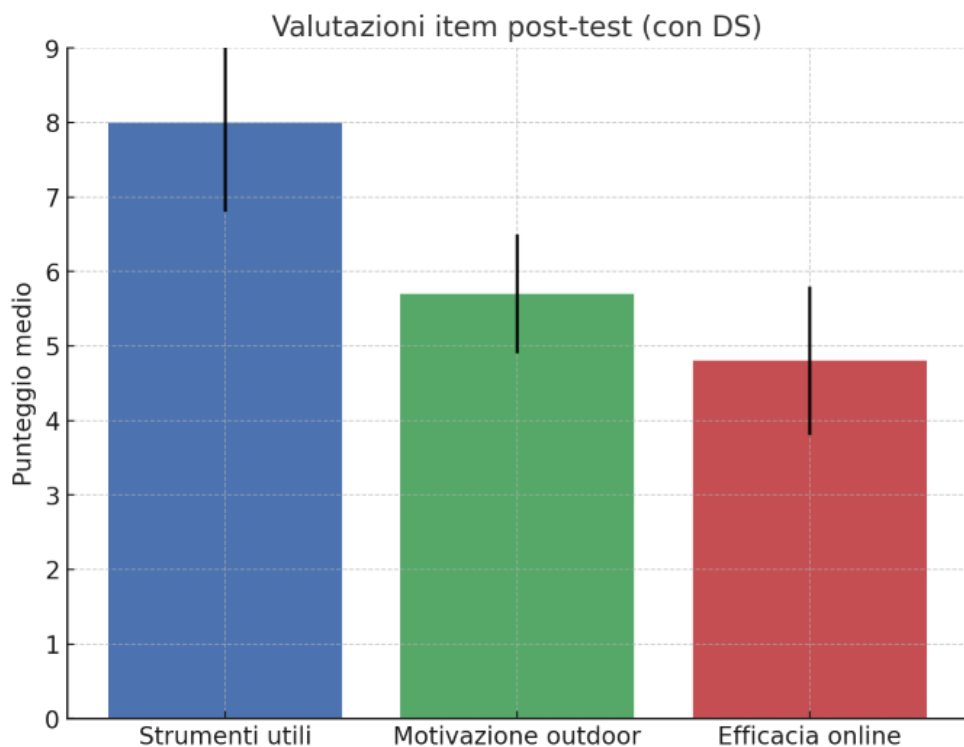
Figure 3. Evaluations of additional items in the post-test: useful tools, outdoor motivation, effectiveness of the online modality.

Discussion:

The study results highlight a significant increase in teachers' perceived self-efficacy in the areas of student motivation ($d = 0.67$), planning curricular activities in nature ($d = 0.74$), and integrating environmental education ($d = 0.85$), with a smaller but still significant improvement in promoting sustainability ($d = 0.46$). These data are particularly relevant when contextualized within the national and European regulatory framework: the National Curriculum Guidelines (2012) and Law 92/2019 on civic education emphasize the importance of integrating environmental and civic dimensions into school curricula, while the National Plan for Regional and Regional Development (PNRR) (Ministerial Decree 66/2023, Investment 2.1) identifies continuing teacher training as a strategic lever for methodological innovation and ecological transition. At the European level, the GreenComp framework (2022) identifies systemic vision, critical thinking, and ecological responsibility as key skills for sustainability education, fully consistent with the Sustainable Development

Goals of the 2030 Agenda, in particular ODS 4 (quality education), ODS 10 (reducing inequalities), and ODS 15 (life on land). The qualitative analysis of the open-ended responses confirms and deepens these quantitative data through a significant thematic transition between the pre-test and post-test: in the pre-test, the thematic analysis identified mainly logistical obstacles, while in the post-test, a fundamental qualitative shift emerges, with teachers identifying practice and planning as central elements of the training received.

From a theoretical perspective, the results align with Bandura's (1997) model, according to which self-efficacy represents a central psychological construct in determining motivation, resilience, and willingness to adopt innovative practices. In schools, greater self-efficacy translates into a greater propensity to experiment with new methodologies, to translate theoretical knowledge into contextualized teaching practices, and to persevere in adapting tasks to students' needs (Tschannen-Moran & Woolfolk Hoy, 2001). An innovative element concerns the positive evaluation of the online modality: although Outdoor Education (OE) is traditionally conceived as an experiential experience carried out in natural spaces, data show that digital training, designed in an interactive and collaborative way, can be effective in providing motivation and methodological awareness, in line with the most recent evidence on e-learning applied to professional development (Rapanta et al., 2021).

Equally relevant is the theme of inclusion, which constitutes a fundamental normative and pedagogical guideline. The literature highlights that outdoor practices can foster participation, well-being, and socio-emotional regulation in students with special educational needs, including those with autism spectrum disorders and learning difficulties, thanks to sensory variety, task flexibility, and the cooperative dimension (Becker et al., 2017; Mygind et al., 2019). In this sense, the strengthening of planning self-efficacy observed in our sample represents an essential prerequisite for teachers to translate the principles of universality and accessibility into truly inclusive outdoor teaching activities, in line with the goals of the 2030 Agenda and European policies to reduce inequalities.

The barriers teachers reported in their open-ended responses, such as the lack of adequate space and material resources, are consistent with findings in the literature (Barrable & Arvanitis, 2021), and confirm that enhancing professional skills must necessarily be accompanied by organizational and infrastructural

interventions to ensure the feasibility of outdoor practices. Despite the limitations of the small sample (n = 24), the lack of follow-up, the exclusive use of self-report measures, and the limited reliability of the TSESESD scale (α = .012), the data collected underscore the effectiveness of an innovative, replicable, and regulatory-compliant training model capable of integrating Outdoor Education into curricula even in urban contexts. From an applied perspective, the convergence between quantitative increases in self-efficacy and qualitative shifts in perceived priorities (from logistical concerns to methodological focus) suggests that short, targeted courses can produce significant transformations in teachers' professional skills, even in online settings, to ensure the integration of environmental education into school curricula and in line with the goals of the 2030 Agenda.

Conclusion:

The study analyzed the impact of an online training program on nature education, with the aim of identifying teachers' training needs and strengthening their capacity for inclusive and sustainable planning. Pre- and post-test results show a significant increase in perceived self-efficacy, particularly in student motivation, curriculum planning, and the integration of environmental education. Sustainability showed more limited but still significant progress. The items added in the post-test also confirmed the perceived usefulness of the program and a positive evaluation of the online approach.

From a scientific perspective, the data confirm the link between self-efficacy and planning capacity: teachers who perceive themselves as more competent appear more inclined to experiment with innovative approaches, to translate normative and theoretical principles into accessible curricular practices, and to imagine inclusive and sustainable solutions. From an applicative perspective, the study proposes a replicable and scalable model, consistent with European and international guidelines (GreenComp, Agenda 2030), which can support schools and education systems in integrating environmental education even in urban or resource-constrained contexts.

Despite the limitations of a small sample, limited to a single school and analyzed through self-report measures, the study offers useful insights for developing future paths: the validation of co-designed protocols, the extension to more diverse school contexts, the implementation of longitudinal follow-ups, and the deepening

of the role of outdoor education as a lever for the inclusion of students with special educational needs.

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