

Article

Outdoor Natural Science and Biology Education in Lower Secondary Schools: Teachers' Practices and Perceived Obstacles

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Abstract

Outdoor education (OE) represents an established approach to connecting learning with real-world contexts and supporting sustainability-related competencies. The aim of this study was to examine how Slovenian lower secondary natural science and biology teachers perceive and implement OE, as well as which factors influence its use in school practice. In Slovenia, natural science is taught as an integrated subject in grades 6–7, while biology is taught as a separate subject from grade 8 onwards; this study therefore included teachers from both instructional contexts. Data were collected using an online questionnaire completed by 108 teachers and analysed using descriptive statistics, correlations analyses, and Principal Component Analysis (PCA). The results indicate that teachers generally perceive OE as highly beneficial for students, particularly regarding engagement, experiential learning, and environmental awareness, but report obstacles such as limited time, curriculum overload, and large class sizes. These findings provide empirical insight into the gap between curricular intension and classroom practice and may inform policy measures and teacher education programmes aimed at strengthening the systematic integration of OE in Slovenian science teaching.

Keywords: biology education; lower secondary school; outdoor education; science teachers; sustainability education

1. Introduction

Outdoor education (OE) encompasses structured learning experiences that occur outside traditional classrooms, typically in natural or semi-natural environments, with the aim of fostering experiential, inquiry-based, and place-based learning (Becker et al., 2017; Waite et al., 2015). Classic conceptualisations, such as Ford's (1986) "education in, about and for nature", emphasise the importance of direct interaction with natural environments, while contemporary approaches broaden this understanding to include pedagogical goals, experiential processes, and the organisation of curriculum-based activities outside the classroom. In Slovenian science and biology education, OE is recommended in the national curricula and is recognised as an important approach for promoting observation, inquiry, and environmental understanding.

In this study, OE refers specifically to curriculum-related teaching activities conducted outside the classroom, such as fieldwork, outdoor experiments, excursions, and visits to environmental education centres, while non-curricular outdoor activities are not the primary focus. Outdoor activities may take place in nearby environments, cultural or scientific



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facilities, or more distant locations requiring transport. Such learning settings offer diverse affordances compared to classrooms, including richer environmental cues, such as direct sensory experiences, spatial variability, and authentic interaction with natural phenomena. These cues are particularly relevant for natural sciences and biology, where learning is closely linked to observing living systems and ecological processes. Participation in outdoor activities provides students with concrete experiences (Bølling et al., 2018), fosters self-confidence and risk management (Beames & Brown, 2021), strengthens emotional connections to nature (Barrable & Booth, 2020), and promotes environmental responsibility. OE also develops collaboration and communication skills (Price, 2019), enhances academic engagement and curiosity (Mann et al., 2022), and supports mental health and emotional regulation (Kuo et al., 2019). These diverse benefits underline the relevance of OE for contemporary science education.

Despite these recognised advantages, OE remains less frequently implemented in school practice than recommended in policy documents. International studies identify a range of systemic limitations, including time constraints, curriculum overload, organisational barriers, and teacher concerns related to confidence or safety (e.g., Patchen et al., 2022; Guardino et al., 2019; O'Brien & Murray, 2007). Studies from Europe and beyond, including research conducted in Hungary, Czechia, Serbia, and Kosovo, highlight how geographical, cultural, and policy contexts influence teachers' opportunities to implement OE (Borsos et al., 2018, 2022, 2023; Svobodová et al., 2020; Sibthorp et al., 2018; McKenna, 2025). These findings, based on studies among pre-service and in-service teachers, provide an important comparative framework for examining the Slovenia context, where similar curricular intentions exist but empirical evidence is limited. Slovenia's favourable access to natural areas and cultural tradition of outdoor activities may help reduce some logistical challenges, yet research suggests that implementation in schools is still inconsistent.

Given these gaps, there is a need for empirical insight into how Slovenian natural science and biology teachers perceive OE, which obstacles they encounter, and which practices they employ. Understanding these aspects is essential for aligning curricular intentions with classroom practice and for supporting teachers in the meaningful and systematic use of outdoor learning.

1.1. Benefits of Outdoor Education as a Promising Teaching Practice

This section summarises key findings from previous research on the benefits of outdoor education, highlighting why OE is considered a promising and pedagogically valuable teaching practice.

1.1.1. Educational, Cognitive, and Social Benefits

Well-designed outdoor activities that are safely guided and adapted to each child's needs can improve academic achievement and cognitive growth, promote diverse skills and independence, strengthen community engagement, and deepen understanding of the environment and sustainable development. They also encourage creativity, support informal learning through play, reduce behavioural problems, increase motivation and participation, strengthen resilience in the face of uncertainty, and promote a positive attitude towards learning (Department for Education and Skills, 2006).

Miller et al. (2021) reviewed the existing research and grouped the outcomes of nature-based learning into five domains: physical activity, mental health and well-being, educational outcomes, engagement, and social outcomes. These findings underpin the broad and diverse benefits of OE, further supporting its inclusion in the school curriculum.

Taken together, existing research consistently highlights OE as a highly valued and pedagogically effective approach, particularly in science and biology education. Teachers

across different contexts report strong beliefs in its educational, social, and motivational benefits. At the same time, despite these positive perceptions, teachers often face practical and organisational constraints, which may limit the translation of favourable attitudes into everyday teaching practice. It is precisely this tension that provides the rationale for the present study.

1.1.2. Teachers' Perceptions of the Effectiveness of OE

In a study conducted by [Borsos et al. \(2022\)](#), 551 trainee teachers from five European countries, all at the end of their degree programmes, were surveyed to explore their views on OE. One of the central research questions addressed was whether the participants considered OE to be important and effective. The findings revealed that the majority of respondents from all five countries regarded OE as both effective and valuable, and most expressed a clear intention to incorporate OE into their future teaching practice while also recognising its complexity and the need for adequate professional preparation.

Further research suggests that teachers' perceptions of the effectiveness of OE are closely linked to their professional competence and ability to manage outdoor learning situations. [Gherasim \(2024\)](#) emphasised that the success of outdoor education largely depends on teachers' capacity to ensure student safety, promote active learning, and maximise the educational value of field-based experiences. This highlights the importance of teacher preparedness and pedagogical confidence as key factors shaping both the perceived and actual effectiveness of OE.

1.2. Obstacles to the Implementing of Outdoor Education

Based on the categorization by [Rickinson et al. \(2004\)](#), which synthesises key empirical findings on barriers to OE across multiple education contexts, the following categorization of obstacles is used as an analytical framework.

1.2.1. Concern for the Health and Safety of Students

Teachers who organise activities outside the classroom enrich young people's education, but their contribution often goes unnoticed until something goes wrong. Due to strict health and safety regulations, many teachers feel that the risks outweigh the benefits of the knowledge and experience students gain outside the classroom ([Barker et al., 2002](#)). Concerns about health and safety and fear of legal action in the event of an accident or injury can influence the frequency of outdoor teaching. It is necessary to find a balance between protecting children and allowing them to develop freely ([Office for Standards in Education, Children's Services and Skills, 2008](#)).

1.2.2. Teacher Confidence and Motivation in Outdoor Education

Teacher enthusiasm is often a key factor in how often OE is delivered. A lack of knowledge is not as limiting as concerns about a lack of confidence in teaching in a natural environment ([Scott et al., 2015](#)). In addition to teachers' professional knowledge, natural science and biology teachers need to acquire the specific skills required for OE and recognise its importance. OE can only be effective if the teacher fully understands the purpose of going outdoors, is familiar with the natural environment and prepares appropriate activities to guide students through the learning process. If teachers follow these principles, they can successfully promote active outdoor learning. Otherwise, outdoor lessons may resemble traditional classroom lessons, lose their appeal, and miss the motivating opportunities that natural settings provide. Without this approach, students miss out on acquiring new experiences, knowledge, adventures ([Borsos et al., 2018](#)), hands-on activities, and situational adaptability. In addition, outdoor activities are considered important to cultivate environmental awareness and foster sustainable behaviours ([Vasilaki et al., 2025](#)). Some

schools have a long tradition of outdoor teaching due to highly motivated individuals, while other teachers find it difficult to leave the framework of the traditional classroom routine, the so-called “comfort zone” (e.g., [Dyment, 2005](#); [Glackin, 2017](#)). Some are also concerned about losing control of students outdoors ([Dyment, 2005](#)), especially as dealing with problematic student behaviour in the classroom is already a challenge for many teachers ([Wink et al., 2021](#)). [Glackin \(2017\)](#) analysed the expectations and practises of secondary school teachers in relation to OE. Regardless of the type of school, the availability of outdoor spaces, or previous experience with outdoor teaching, all participating teachers expressed discomfort with delivering outdoor lessons and specifically expressed concerns about effectively managing student behaviour.

The role of the teacher in OE is multifaceted. Teachers are expected to set realistic expectations appropriate to the developmental level of the students and guide them to take responsibility for their own work. They must provide a safe learning environment with activities that involve an appropriate level of risk, while continually evaluating their teaching by identifying deficiencies and seeking improvements. Effective outdoor educators also integrate interdisciplinary connections, monitor student understanding, and provide consistent feedback to support knowledge growth ([Rickinson et al., 2004](#)). At the same time, they encourage both independent learning and collaborative work, fostering students’ independence and social skills ([Office for Standards in Education, 2004](#)).

1.2.3. The Impact of Class Size on Outdoor Education

In the 2020/21 school year, the average class size in Slovenian lower secondary education was 19.2 students ([Statistical Office of the Republic of Slovenia, 2022](#)). While this number is relatively low compared with many European countries, where average class sizes in lower secondary education often exceed approximately 23 students ([OECD, 2023](#)), class size remains a relevant factor in the context of OE. According to the Regulation of Norms Implementation of the School Programme for Primary and Lower Secondary Education in Slovenia ([Ministry of Education, 2024](#)), the supervision ratio for excursions, activity days, and other organised forms of educational work conducted outside the school premises is 15 students per accompanying adult. This means that even classes of moderate size often require additional staff to ensure safety and supervision. As a result, organisational constraints related to staffing and scheduling may limit the feasibility of outdoor activities, despite a comparatively smaller class size.

Similar challenges have been reported in other European contexts. In Kosovo, for example, large class sizes have been identified as a significant barrier to implementing outdoor education ([Hyseni Spahiu et al., 2014](#)). With average class sizes of around 30 students, and in some cases up to 50, combined with limited instructional time for environmental topics, it becomes increasingly difficult to use pupil-centred outdoor approaches. Consequently, this limits both the feasibility and effectiveness of outdoor education activities.

1.2.4. Curricular Constraints and Time-Related Limitations of OE

Curricular limitations of OE are closely linked to organisational conditions within the school system, especially lesson duration and timetable structure. [Rickinson et al. \(2004\)](#), in their review of research on outdoor teaching, highlighted that the English national curriculum neither mandated nor sufficiently facilitated the use of the school environment for teaching purposes. Participating teachers reported that a 45 min lesson is not sufficient for outdoor activities ([Rickinson et al., 2004](#)). The Slovenian biology curriculum for the 8th and 9th grades of the lower secondary school programme ([Ambrožič Avguštin et al., 2025](#)) also recommends cross-curricular integration, but teachers often find it difficult to achieve

cross-curricular goals. As a result, traditional classroom teaching predominates due to the time constraints (Hyseni Spahiu et al., 2014; Štemberger, 2012).

1.2.5. Financial Aspects of Outdoor Education

Outdoor activities conducted in the vicinity of the school may not incur additional costs, while others may require a financial contribution. When organising outdoor learning, the resources and motivation of the teachers are often more crucial than the financial means (Štemberger, 2012). One strategy to reduce the financial burden on students' families is to finance the activities through the school budget or through fundraising (municipal funds, school funds, sponsorships, donations) (Office for Standards in Education, Children's Services and Skills, 2008).

1.2.6. Other Obstacles to Outdoor Education

Unlike the previously discussed obstacles, which relate mainly to structural, curricular, or teacher-related factors, the following challenges reflect situational and context-specific conditions that affect the implementation of OE and are not included in Rickinson et al.'s (2004) categorization. These include increased teacher workload, weather conditions, students' equipment (tools, clothing, footwear), students' expectations of what school should be like, and their lack of interest in acquiring new knowledge. Other challenges involve rigid timetables, student absence, large class sizes, remoteness of suitable locations for fieldwork, and extensive administrative documentation. Furthermore, difficulties in finding suitable personnel, costs associated with updating provider qualifications, required staff-to-student ratios, and restrictive school regulations have also been reported (Barfod & Bentsen, 2018; Scott et al., 2015; Zink & Boyes, 2006).

Štemberger (2012) argues that there are no obstacles to outdoor teaching if teachers understand the importance of changing the learning environment and recognise that these potential limitations can be overcome with good organisation.

1.3. Research Aim and Research Questions

Although OE is widely recognised as an effective approach to developing scientific understanding, environmental awareness, and key 21st century skills, its implementation in formal school education is limited. In Slovenia, outdoor activities are promoted in the national curricula for natural science and biology. Nevertheless, there is evidence that lessons still take place predominantly indoors and many teachers rarely use natural environments in an authentic learning context. The reasons for this may be organisational obstacles, inadequate training, and uncertainty about the educational value of outdoor work. This discrepancy between the intentions of the curriculum and everyday practise raises questions about teachers' perceptions of OE and the conditions that influence their use. Addressing these issues is important to align educational policy with classroom reality and to support teachers in providing meaningful outdoor learning experiences. Against this background, the present study focuses on OE in Slovenian lower secondary science and biology teaching. In the Slovenian lower secondary school system, natural science is taught as an integrated subject in grades 6 and 7, while biology is taught as a separate subject in grades 8 and 9. In this study, both groups are collectively referred to as natural science and biology teachers, as they work within the same institutional context and encounter similar opportunities and challenges when implementing OE. The analysis therefore focuses on shared patterns rather than subject-specific comparisons.

The aim of this study is to examine how Slovenian lower secondary natural science and biology teachers perceive and implement outdoor education (OE), and which factors influence its use in school practice. To address this aim, the following research questions were formulated:

- RQ1. Which types of outdoor activities, as captured by the questionnaire, do these teachers report using in regular lessons, and do the types of activities differ according to age group and teaching experience?
This question focuses on teachers' actual practices in implementing OE. Examining the types and frequency of outdoor activities provides insight into how OE is implemented in everyday teaching and whether patterns differ across career stages.
- RQ2. What obstacles do natural science and/or biology teachers perceive as limiting the implementation of outdoor lessons?
Identifying perceived obstacles is essential to understanding why OE is not more widely implemented, despite its recognised benefits. This question builds on previous research highlighting structural, organisational, and personal barriers to outdoor teaching.
- RQ3. To what extent do natural science and/or biology teachers have access to natural environments and infrastructure for OE?
Access to suitable outdoor environments is a key precondition for implementing OE. This question explores contextual factors that may enable or constrain teachers' opportunities to teach outside the classroom.
- RQ4. How confident do the teachers feel when conducting OE, and do they take part in appropriate further training programmes?
Teachers' confidence and professional training are closely linked to the quality and frequency of OE. This question addresses the role of teacher competence and lifelong learning in supporting outdoor teaching practices.
- RQ5. How do natural science and/or biology teachers evaluate the perceived benefits of OE for students?
Understanding teachers' perceptions of the benefits of OE is important, as positive attitudes are known to influence instructional decisions. This question provides insight into how teachers value OE in relation to students' learning, well-being, and sustainability competences.

The methodological rationale for the selected analytical approach is provided in the Section 2. Materials and Methods.

2. Materials and Methods

2.1. Context of the Study

This study adopts an exploratory approach, as empirical research on the implementation of OE in Slovenian natural science and biology classrooms is still limited. Therefore, the primary aim was to obtain a comprehensive descriptive overview of teachers' practices, perceptions, and perceived obstacles. Descriptive analyses provide a necessary foundation for understanding the current state of OE implementation and for identifying key patterns that warrant further investigation. Given the heterogeneity of the sample and the uneven sizes of specific subgroups, focusing on descriptive data was considered more appropriate than modelling interactions between individual aspects. The findings thus serve as a baseline for future research, which may employ more complex analytical approaches once a clearer empirical basis has been established.

This study employed a quantitative, descriptive survey design to explore how Slovenian lower secondary biology and natural science teachers perceive and implement OE. The research was based on the theoretical understanding that teachers' attitudes, confidence, and access to resources are important factors in the practise of outdoor teaching, as emphasised in previous studies on science education and experiential learning. Data was collected between May and July 2021 using an anonymous online questionnaire. The target population consisted of biology and natural science teachers working in Slovenian

lower secondary schools, with the aim of obtaining a national overview rather than a representative sample. Accordingly, participating teachers in this study taught natural science in grades 6–7, biology in grades 8–9, or both subjects across these grade levels. All participating teachers hold a degree in biology and may additionally complete supplementary qualifications that enable them to teach parts of the natural science curriculum, such as selected physics or chemistry topics. Consequently, the sample includes teachers with different teaching assignments but a comparable educational background. The findings therefore reflect the perspectives of biology-trained teachers who teach natural science and/or biology at the lower secondary level.

2.2. Participants

In Slovenia, research that involves anonymous questionnaires with adult participants and does not collect personally identifiable data does not require formal approval from a national or institutional ethics committee. Participation in this study was entirely voluntary. Before starting the online survey, all potential respondents were informed of the purpose of the study, the voluntary nature of participation, and the data protection measures. By completing and submitting the questionnaire, participants provided their consent. No personal identifiers were collected, and the data were only analysed in aggregated form to ensure complete anonymity. Teachers were only asked to indicate the region in which their school is located. The validity of the responses depended on the honesty of the respondents, with the assumption that no one completed the same questionnaire more than once.

The invitation to the survey was sent to all Slovenian lower secondary schools offering natural science and/or biology, which were identified via the official register of the Ministry of Education, Science and Sport of the Republic of Slovenia ([Ministrstvo za Izobraževanje, Znanost in Šport, 2021](#)). All teachers of these subjects in these schools were eligible to participate in the survey, so the sample size was not calculated in advance. In total, 445 teachers accessed the survey link, and 108 completed the questionnaire in full; these 108 responses formed the dataset for the statistical analysis. Participants were categorised according to the characteristics in Table 1. In Table A1 in Appendix A, participants are categorised into three age groups: A = under 30 years, B = 30–59 years, and C = 60 years or older. In Table A3 in Appendix A, participants are categorised according to years of teaching experience: D = 1–10 years, E = 11–20 years, and F = more than 20 years. These labels are used consistently throughout Appendix A to facilitate the comparison of response patterns. The age intervals were defined to reflect meaningful stages in teachers' professional development rather than to achieve perfectly balanced group sizes. These intervals roughly correspond to early-career, mid-career, and more experienced teachers, allowing for a more interpretable comparison of perceptions and practices related to OE. Although alternative or smaller intervals might have resulted in more evenly distributed groups, the selected categorization was considered more appropriate for addressing the research questions.

In Slovenian lower secondary schools, the school subject “biology” is taught in the 8th and 9th grades, while the subject “natural science” is taught in the 6th and 7th grades. Natural science combines basic topics from biology, chemistry, and physics and serves as an introduction to school subjects taught in the upper 8th and 9th grades and later in high school. In addition to biology and/or natural science, the participating teachers also teach other school subjects (e.g., chemistry, mathematics, home economics, geography).

Table 1. Characteristics of participants ($N = 108$).

Characteristic	Category	Number
Gender	Women	103
	Men	5
Age ¹	A = under 30 years	8
	B = 30–59 years	93
	C = 60 years or older	7
Teaching experience ²	D = 1–10 years	28
	E = 11–20 years	25
	F = more than 20 years	55

Note: ¹ the age of the teacher is seen as a proxy for teaching experience. It is assumed that younger teachers have less teaching experience than older teachers. ² The teachers were divided into three categories based on their years of teaching experience, as the teachers' experience increases with the number of years, while methods, approaches, and forms of teaching also change, which could pose a challenge in implementing outdoor education for the teachers based on their years of teaching experience.

2.3. Instrument

The 1KA online survey tool was used for data collection. The survey was first published on 11 May and remained active until 30 July 2021. In the initial phase, 63 Slovenian biology and/or natural science teachers fully completed the questionnaire. Due to the relatively low number of responses, the survey was subsequently distributed by e-mail on 17 June 2021 to all Slovenian lower secondary schools offering natural science and/or biology ($N = 445$).

The questionnaire was developed by the authors and informed by existing research on OE. It consisted of 31 questions divided into seven thematic sections and was designed to provide a comprehensive overview of teachers' practices and perspectives regarding OE. To address the research questions and examine factors influencing the implementation of OE in the Slovenian context, a subset of 14 key questions from six sections of the author-developed questionnaire was selected for analysis (Appendix A).

The first five sections focused on outdoor teaching practises and addressed the following: (1) the type and frequency of outdoor activities conducted during regular lessons, (2) perceived obstacles to implementing OE, (3) access to suitable natural areas and infrastructure, (4) teachers' participation in OE training, and (5) teachers' attitudes toward OE. These sections included a combination of predefined response options and open-ended questions that allowed participants to further elaborate on their responses. Teachers' attitudes were measured using statements rated on a five-point Likert scale ranging from 1 (not restrictive) to 5 (very restrictive) (Appendix A, Table A3). An overview of all analysed items and response formats is provided in Appendix A. Demographic data, including gender, age, teaching experience, and subjects taught, were collected in a separated section.

The selection of these 14 questions was guided by their direct relevance to the research questions and the exploratory aim of the study. This approach enabled a focused analysis of teachers' practices, perceived obstacles, and contextual factors related to OE, while reducing respondent burden and ensuring sufficient response completion. The instrument was designed to describe patterns in teachers' responses rather than to measure latent constructs. Individual items are described in more detail in the Results section, where relevant for interpreting the findings.

2.4. Data Analysis

Data were analysed using IBM SPSS Statistic for Windows, Version 25 (IBM Corp., 2017). Descriptive statistics were used to summarise teachers' responses and are presented in the

form of tables. The analysis included frequencies and proportions of responses, as well as mean values (M) and standard deviations (SD).

The internal consistency of the questionnaire was assessed using the Cronbach's α coefficient. For the entire questionnaire (31 questions), Cronbach's α was 0.80, indicating acceptable internal consistency. The subset of 14 items was selected for their direct relevance to the research questions addressed in this article, with particular focus on teachers' practices, perceived obstacles, and attitudes towards OE. These items represent the core thematic dimensions of interest and were included to enable focused statistical analysis aligned with the study aims. Additionally, the selected items demonstrated sufficient variability and inter-item correlations to justify their inclusion in subsequent exploratory analyses. For the subset, Cronbach's α was 0.92, indicating high internal consistency and supporting further statistical analyses. Although the 14 items address different aspects of OE, they were analysed together to provide an overall, exploratory indication of internal consistency. Reliability analyses of conceptually coherent item groups were additionally conducted and are reported in Section 3.6 (PCA), where internal consistency is presented separately for the extracted components.

To examine differences in responses across age groups and years of teaching experiences, non-parametric statistical methods were applied. The Kruskal–Wallis test was used due to small and uneven subgroup sizes and the lack of normal distribution in some variables. Where appropriate, Chi-Square (χ^2) tests were conducted to further explore differences between groups. Statistical significance was set at $p < 0.05$.

Relationships between selected items were examined using Pearson's correlation coefficient. This parametric method was applied to continuous variables where approximate normality and linear relationships could be assumed. Correlation coefficients were interpreted at significance levels of $p < 0.05$ and $p < 0.01$. Analyses by gender were not performed due to the highly unequal group sizes (women: 103, 95.4%, men: 5, 4.6%).

Principal Component Analysis (PCA) with Direct Oblimin rotation was conducted to explore the underlying structure of teachers' attitude items and to identify broader dimensions of attitudes towards OE, thereby supporting a more parsimonious and conceptually meaningful interpretation of the results. Prior to PCA, sampling adequacy was assessed using the Kaiser–Meyer–Olkin (KMO) measure and Barlett's test of sphericity. Components with eigenvalues greater than 1 and item loadings above 0.40 were retained for interpretation (Field, 2013).

3. Results

For clarity, individual questionnaire items are described in more detail in this section when their wording is directly relevant to the interpretation of the results, while a general overview of the instrument is provided in the Instrument section and Appendix A.

3.1. Outdoor Education Activities (RQ1: Which Types of Outdoor Activities, as Captured by the Questionnaire, Do Teachers Report Using in Regular Lessons, and Do These Activities Differ According to Age Group and Teaching Experience?)

Table 2 presents an overview of the types of OE activities implemented by teachers as part of their regular biology and/or natural science lessons. One-day science excursions and short-duration fieldwork activities (1–2 h), conducted either within the school environment or at nearby off-site locations, were the most frequently reported forms of outdoor education. Longer forms of outdoor learning, such as one-week outdoor school programmes, were implemented by fewer respondents, while teaching regular curriculum content outdoors or in outdoor classrooms was reported less frequently.

Table 2. Types of OE activities implemented by teachers (RQ1).

Type of OE	<i>n</i>	%
One-day science excursion	71	65.7
Fieldwork (1–2 h) off-site near the school	59	54.6
Fieldwork (1–2 h) within the school environment	57	52.8
One-week outdoor school programme	49	45.4
Teaching regular curriculum content outdoors	30	27.8
Teaching regular curriculum content in an outdoor classroom	20	18.5
Other (extended fieldwork 3–5 h)	1	0.9

Note: multiple responses were permitted.

Additionally, 75 respondents (69.4%) indicated that they would like to teach more hours in the natural environment than they currently do. A small but statistically significant positive correlation was found between teachers' desire to increase outdoor teaching in the past 24 months and their length of teaching experience ($r = 0.21$, $p = 0.03$). The highest proportion of teachers wishing to increase outdoor teaching time was observed among those with 1–10 years (78.6%) and 11–20 years (84.0%) of teaching experience, whereas a smaller proportion of teachers with more than 20 years of experience (58.2%) expressed the same intention. Differences in the use of activity types by age group and teaching experience were analysed using the Kruskal–Wallis test; the results did not indicate statistically significant differences ($p > 0.05$).

3.2. Obstacles for the Implementation of OE (RQ2: What Obstacles Hinder the Implementation of OE?)

Table 3 presents the obstacles most frequently perceived as restrictive or very restrictive by teachers when implementing OE. A detailed breakdown of responses by age group, including responses frequencies and Chi-square test results for all analysed items, is provided in Appendix A (Table A1).

Table 3. Teachers' perceived obstacles to implementing OE (RQ2).

Obstacle	% Restrictive or Very Restrictive (4–5)
Too extensive curriculum	80
Lack of time	70
Lack of accompanying staff	70
Too many students to teach outside the classroom	70
Inflexible school schedule	65
Additional travelling time to the location	56
Adaptation to weather conditions	55

Note: the table presents obstacles most frequently rated as restrictive or very restrictive (4–5 on a five-point Likert scale). Less frequently endorsed obstacles are reported in Appendix A (Table A1).

Overall, organisational and structural constraints were perceived as the most limiting factors for implementing OE. Teachers most frequently identified an overly extensive curriculum, lack of time, insufficient accompanying staff, and large class sizes as key barriers. These obstacles were particularly salient among teachers under 60, whereas respondents aged 60 and over most often selected the “cannot answer” option for these items.

Statistically significant age-related differences were identified for the perceived insufficient integration of curriculum content for effective OE and for teachers' lack of interest. Younger teachers perceived insufficient curricular integration and lack of interest as more restrictive than older teachers, who tended to rate these obstacles as only slightly restrictive

or not restrictive. In contrast, lack of interest and low levels of qualification for OE were generally perceived as among the least significant obstacles to implementing OE.

3.3. External Collaboration and Outdoor Learning Environment (RQ3: To What Extent Do Teachers Have Access to Natural Environments and Infrastructure for OE?)

Tables 4 and 5 provide an overview of external collaborators involved in OE and the availability of outdoor learning environments and infrastructure. Laboratory technicians and other biology or natural science teachers emerged as the most frequently involved external collaborators, while volunteer organisation and individual volunteer were the least commonly involved.

Table 4. External collaborators involved in OE (RQ3).

External Collaborator	Frequently (%)	Occasionally (%)	Rarely or Never (%)
Laboratory technician	13.9	44.4	41.7
Another biology / natural sciences teacher	8.3	51.9	39.8
Education centre	2.8	44.4	52.8
Local community	2.8	36.1	61.1
External organisation	0.9	50.9	48.1
Volunteer organisation	0.9	28.7	70.4
Individual volunteer	0.9	36.1	63.0

Table 5. Availability of outdoor learning environments and infrastructure (RQ3).

Variable	<i>n</i>	%
School location—rural	53	49.1
School location—urban	36	33.3
School location—suburban	19	17.6
Forest habitat nearby	43	39.8
Grassland nearby	29	26.9
Rocky terrain nearby	18	16.7
Other habitat types (e.g., freshwater, inland waters, bogs, scrubland)	9	8.3
Access to outdoor classroom	37	34.3

Approximately one third of respondents reported access to an outdoor classroom, although its use remained relatively limited.

3.4. Training of Teachers for OE (RQ4: How Confident Are Teachers in Implementing OE, and to What Extent Do They Participate in Relevant Professional Development Programmes?)

Table 6 shows the degree of influence of the participating activities on the change in the teachers' teaching approach. The data are sorted in descending order based on the frequency values and the percentage of responses for the item "I attended".

According to the results presented in Table 6, the highest percentage of respondents participated in outdoor teaching courses/workshops (51.9%) and educational conferences or seminars (51.9%), which were identified as the activities that had the greatest impact on changing their teaching style.

The data shows that there is a statistically significant negative correlation between the item "Courses/workshops on OE" and both the age group of respondents ($r = -0.26$; $p = 0.01$) and the years of professional experience ($r = -0.20$; $p = 0.04$) (Appendix A, Table A2). In particular, a higher proportion of teachers with 11–20 years (68.0%) or more than 20 years of professional experience (60.0%) attended courses/workshops on OE compared to teachers with 1–10 years of experience (21.4%). Furthermore, a statistically significant negative

correlation was found between the item “Educational conferences or seminars (where teachers and/or researchers present the results of their research and discuss educational problems)” and respondents’ years of experience ($r = -0.22$; $p = 0.02$). Participation in such conferences or seminars was reported more frequently by teachers with 11–20 years (56.0%) and more than 20 years (58.2%) of experience than by teachers with 1–10 years (35.7%). Only 15.7% of participants were proactive and participated in independent or group research related to OE. There were no suggestions for the answer option “Other”.

Table 6. Levels of influence of the activities involved on changing the teachers’ teaching style.

Type of Activity	Response Frequency (N) and Percentage (%)								
	1 ■	2 ■	3 ■	4 ■	A ○	B ○	C ○	D ○	E ○
Course/workshop on OE	56 (51.9%)	47 (43.5%)	5 (4.6%)	41 (38.0%)	5 (4.6%)	3 (2.8%)	29 (26.9%)	17 (15.7%)	13 (12.0%)
Conferences/seminars (on research and discussions on OE)	56 (51.9%)	47 (43.5%)	5 (4.6%)	36 (33.3%)	4 (3.7%)	8 (7.4%)	30 (27.8%)	18 (16.7%)	12 (11.1%)
Study groups (organised by National Institute of Education of the Republic of Slovenia; focused on outdoor teaching)	54 (50.0%)	49 (45.4%)	5 (4.6%)	36 (33.3%)	6 (5.6%)	9 (8.3%)	28 (25.9%)	12 (11.1%)	17 (15.7%)
Professional training programmes related to OE	47 (43.5%)	55 (50.9%)	6 (5.6%)	43 (39.8%)	4 (3.7%)	8 (7.4%)	27 (25.0%)	14 (13.0%)	12 (11.1%)
Participation in a teacher network (e.g., SIO portal) focused on outdoor teaching	47 (43.5%)	55 (50.9%)	6 (5.6%)	43 (39.8%)	5 (4.6%)	16 (14.8%)	21 (19.4%)	10 (9.3%)	13 (12.0%)
School visits (lesson observation)	31 (28.7%)	72 (66.7%)	5 (4.6%)	57 (52.8%)	6 (5.6%)	8 (7.4%)	15 (13.9%)	8 (7.4%)	14 (13.0%)
Mentoring and/or peer observing and mentoring	26 (24.1%)	78 (72.2%)	4 (3.7%)	59 (54.6%)	3 (2.8%)	5 (4.6%)	14 (13.0%)	13 (12.0%)	14 (13.0%)
Independent or group research related to OE	17 (15.7%)	86 (79.6%)	5 (4.6%)	66 (61.1%)	3 (2.8%)	2 (1.9%)	10 (9.3%)	12 (11.1%)	15 (13.9%)

Note: response scale: ■ 1 = I attended; 2 = I did not attend; 3 = no answer; 4 = cannot answer due to non-participation; ○ A = no influence; B = slight influence; C = moderate influence; D = strong influence; E = no answer.

3.5. Teachers’ Attitudes Towards OE (RQ5: How Do Teachers Define the Benefits of OE for Students?)

Table A3 (Appendix A) presents teachers attitudes towards OE according to years of teaching experience. Respondents rated their agreement with attitude statements on a five-point Likert scale. Mean values are reported for three experience groups: teachers with up to 10 years of experience, 11–20 years, and more than 20 years. Items are ordered by ascending p -values.

Across all experience groups, respondents expressed the lowest agreement with negative statements about OE. In particular, teachers strongly disagreed with the statement “OE seems unimportant to me” (M values ranging from 1.35 to 1.46), which are reported for descriptive purposes, while group differences were examined using the Kruskal–Wallis test and were found to be non-significant. Similarly, when considering the overall sample, the majority of respondents disagreed with the statements “OE is a waste of time” ($M = 1.48$, $SD = 0.68$) and “I doubt my own confidence in OE” ($M = 1.60$, $SD = 0.81$). A statistically significant difference between experience groups was found for the statement “I doubt my own confidence in OE” ($\chi^2_{(2)} = 16.99$, $p < 0.03$). Teachers with fewer years of experience expressed higher levels of doubt compared to those with more than 20 years of teaching experience. Similarly, respondents with fewer years of experience were more likely to agree

with statements reflecting concerns about professional competence, although mean values for all groups remained below the midpoint of the scale.

Regardless of teaching experience, respondents generally disagreed with the statement “I am not professionally qualified enough to teach outside the classroom” and “I am afraid of teaching biology and/or natural science in nature” with mean values below 2.0 across all groups.

Correlation analyses (Table 7) revealed statistically significant positive correlations between several attitude items. Doubts about teaching outdoors were positively correlated with perceived knowledge of the local environment ($r = 0.35$; $p = 0.001$) and insufficient integration of curriculum content ($r = 0.25$; $p = 0.01$). In addition, lack of experience with OE was strongly associated with doubts about its usefulness, effectiveness, and meaningfulness, as well as with lower motivation to teach outdoors (r values ranging from 0.39 to 0.63, $p < 0.001$).

Table 7. Pearson correlations of the question about the obstacles for the implementation of lessons in nature.

Item		<i>r</i>	<i>p</i>
Lack of knowledge of the local environment (plant and animal species and environmental issues).	Insufficient integration of curriculum content for effective OE.	0.39	<0.001
	I am afraid of teaching biology and/or natural science in nature.	0.35	<0.001
	OE is a waste of time.	0.30	<0.001
	I doubt the effectiveness of OE.	0.25	0.01
Lack of experience in OE.	Lack of knowledge of the local environment (plant and animal species and environmental issues).	0.63	<0.001
	OE is a waste of time.	0.49	<0.001
	I doubt the meaningfulness of OE.	0.49	<0.001
	Insufficient integration of curriculum content for effective OE.	0.47	<0.001
	I doubt the effectiveness of OE.	0.47	<0.001
	I am afraid of teaching biology and/or natural science in nature.	0.43	<0.001
	I am not motivated to teach biology and/or natural science in nature.	0.39	<0.001
Insufficient integration of curriculum content for effective OE.	OE is a waste of time.	0.32	<0.001
	I doubt the effectiveness of OE.	0.30	<0.001
	I am afraid of teaching biology and/or natural science in nature.	0.25	0.01

Overall, teachers’ responses indicated a consistently positive evaluation of OE. Mean values for all attitudes remained well below the midpoint of the scale, suggesting that teachers overwhelmingly reject negative perceptions of OE and recognise its value for teaching and learning.

3.6. Underlying Dimensions of Teachers’ Attitudes Towards OE (Principal Component Analysis)

While Section 3.5 focused on descriptive statistics and bivariate relationships between individual attitude items, a PCA was conducted to explore whether teachers’ attitudes towards OE could be grouped into broader underlying dimensions. This analysis aimed to identify latent structures within the attitude items and provide a more integrative understanding of teachers’ perceptions of OE. The purpose of the PCA was to identify broader underlying dimensions that structure teachers’ attitudes towards OE and to reduce the number of individual attitude items into conceptually meaningful categories. This approach allows for a more concise interpretation of teachers’ attitudes and helps reveal overarching patterns that may not be evident when analysing single items in isolation.

The KMO measure of sampling adequacy was 0.85, and Barlett’s test of sphericity was significant ($\chi^2_{(4,5)} = 689.5$, $p < 0.001$), indicating that the data were suitable for PCA.

PCA was conducted on the data set of participants' attitudes towards OE. In this study, 10 items from the questionnaire were loaded into two components (Table 8), which were retained based on the Eigenvalue > 1 criteria. The two extracted components can be interpreted as overarching attitudinal dimensions reflecting (1) teachers' perceived value and effectiveness of OE and (2) perceived personal and organisational constraints related to its implementation. These two components together explain 67.52% of the total variance. Both components have good internal consistency, as indicated by Cronbach's α . All 10 items loaded above the value of 0.40 and were therefore included in the analysis.

Table 8. Rotated PCA matrix of the participants' opinions towards OE.

Items	Component	
	1	2
I doubt my own confidence in OE.	0.89	
I am not professionally qualified enough to teach outside the classroom.	0.87	
I am afraid of teaching biology and/or natural science in nature.	0.76	
In nature, I have no control over the students, so I don't do this type of teaching.	0.69	
I am not motivated to teach biology and/or natural science in nature.	0.53	
I doubt the practicality of OE.		0.84
OE is a waste of time.		0.81
I doubt the meaningfulness of OE.		0.79
I doubt the effectiveness of OE.		0.78
OE seems unimportant to me.		0.65
Explained variance	53.64	13.88
Eigenvalue	5.36	1.39
Cronbach's α	0.85	0.88

The first component, which comprises five items, explains 53.64% of the variance (Cronbach's $\alpha = 0.85$). This component reflects personal doubts and lack of confidence in teaching outdoors. It includes items such as "I doubt my own confidence in OE" and "I am not professionally qualified enough to teach outside the classroom", indicating a perceived lack of competence to teach outdoors. Other items reflect concerns about classroom management and fears of unpredictable outdoor situations. These findings suggest that some teachers perceive several personal and professional obstacles that hinder their engagement in OE.

The second component (Cronbach's $\alpha = 0.88$), which explains 13.88% of the variance, also comprises five items. It represents negative attitudes towards the value and effectiveness of OE. These include items such as "OE is a waste of time" and "I doubt the practicality of OE", which reflect a general scepticism about the educational benefits of OE. The internal consistency of this component is high, which indicates that the participants' attitudes towards the usefulness and relevance of OE are relatively stable. These overarching categories may provide a useful framework for future research aiming to develop more concise measurement instruments, compare teacher attitudes across contexts, or examine how different dimensions of attitudes relate to actual teaching practice.

4. Discussion

The study aims to explore how Slovenian lower secondary school teachers of biology and natural science perceive and implement outdoor education (OE), and to identify the main challenges they face in the process, based on collected data.

Regarding the first research question (RQ1: Which types of outdoor activities, as captured by the questionnaire, do natural science and/or biology teachers report using in

regular lessons, and do these activities differ according to age group and teaching experience?), this study aimed to examine teachers' reported practices and potential differences related to age group and teaching experience. Most natural science and/or biology teachers who participated in our study reported organising one-day science excursions and short fieldwork sessions (1–2 h) outside the school grounds. In contrast, the smallest proportion of participants (18.5%) used an outdoor classroom to teach regular curriculum content. The majority of teachers expressed a desire to conduct more lessons outdoors, particularly those with 11–20 years of teaching experience. Although no statistically significant differences were found in the implementation of outdoor activities according to teachers' age or teaching experience, the results suggest a strong recognition of the educational value of OE among teachers. This aligns with previous research indicating that teachers associate learning in nature with higher student engagement, enhanced well-being, and the development of environmental awareness (Mann et al., 2022; Miller et al., 2021; Vasilaki et al., 2025). Similar findings were reported by Borsos et al. (2023), whose study involving teachers from Serbia, Croatia, and Hungary showed a shared intention to increase the use of outdoor teaching in the future.

The second question (RQ2: What obstacles stand in the way of natural science and/or biology teachers implementing outdoor lessons?) focused on teachers' perceptions of structural, organisational, and personal obstacles that may limit the use of OE in practice. Teachers in this study cited a lack of time, a lack of support staff, a curriculum that was too extensive, and student groups that were too large as the main obstacles (Appendix A, Table A1). Teachers' perceptions varied somewhat by age. In line with the categorization of obstacles proposed by Rickinson et al. (2004), our results indicate that limited time for outdoor activities remains a major constraint. However, in contrast to Rickinson et al. (2004), concerns about student safety and lack of financial support were not seen as major obstacles. Similar patterns, where time constraints were the main challenge, were also reported by Borsos et al. (2023) and Cengeli (2013).

Some international studies have a different focus. For example, Tanik Onal and Ezberci Cevik (2022) found that maintaining control in the classroom and ensuring students' safety were the main focus, while Palavan et al. (2016) emphasised the difficulty of managing large groups outdoors. These differences may reflect the specific educational and geographical context of Slovenia. In the Slovenian national curriculum, outdoor work is explicitly integrated into science subjects, which may normalise field activities and provide teachers with established organisational procedures, reducing anxieties about safety and classroom management. In addition, the relatively small school sizes in Slovenia and easy access to natural areas—forests, rivers, and protected parks that are often within short walking distance of schools—can reduce the perceived risk and logistical burden compared to more urbanised or densely populated countries. Strong cultural traditions of hiking and outdoor recreation may also contribute to teachers' confidence in supervising students outdoors. Taken together, these factors may partly contribute to Slovenian teachers placing less emphasis on safety concerns and financial constraints than on structural aspects such as the burden of the curriculum and the lack of additional staff.

Teachers under the age of 30 were more likely to identify insufficient integration of curriculum content as a major obstacle to effective outdoor teaching—a finding consistent with that of Waite (2020), who reported similar perceptions among teachers in other countries. In our sample, this curricular limitation was also positively correlated with a lack of familiarity with the local natural environment (plant and animal species and environmental issues).

The distribution of respondents across different school locations—rural, urban, and suburban—provides an important context for understanding the accessibility of natural

habitats for OE. Almost half of the teachers surveyed (49.1%) work in rural schools, where proximity to diverse natural environments may facilitate outdoor learning. This is reflected in the availability of nearby habitats, with forests being mentioned most frequently (39.8%). Grassland (26.9%) and rocky terrain (16.7%) were also mentioned relatively frequently, while more specialised habitats such as freshwater inland waters, coastal areas, bogs, scrubland, and swamps were mentioned less frequently. These results from RQ3 (To what extent do natural science and/or biology teachers have access to natural environments and infrastructure for OE?) suggest that while many teachers have access to suitable environments for OE, the diversity and type of habitats available may influence the specific content and frequency of outdoor teaching activities. The strong presence of forested and grassland areas indicates a potential for curriculum focus on local ecosystems, particularly in rural areas. This preference for forested areas is consistent with the findings of Borsos et al. (2022), whose study included trainee teachers from five European countries (Hungary, Czechia, Serbia, Romania, and Slovakia). Participants from Hungary and Slovakia most commonly selected forests as preferred locations for OE, while participants from the remaining countries more frequently favoured parks, zoos, and fields. These differences may reflect variations in geographical characteristics, land use, and educational traditions across countries. The similarity between the Slovenian context and countries with extensive forested landscapes suggests that geographical accessibility may play an important role in shaping teachers' choices of outdoor learning environments. Future research could further examine how national and regional contexts influence the selection of outdoor learning settings.

Most respondents reported that they had access to suitable natural areas in their school environment or local neighbourhood for educational purposes (RQ3). It was found that 34% of respondents have the opportunity to use an outdoor classroom; however, this is rarely used (only 5–10 times per year). The reason for this limited use was not explored in our study, which presents an opportunity for further research. Interestingly, one respondent stated that they had access to an outdoor classroom but did not hold lessons there. Future studies could further examine relationships between specific forms of outdoor education (e.g., one-day excursions) and the use of particular learning environments or external providers (e.g., education centres), which may provide additional insight into how and why certain activities are combined in school practice.

Most respondents in this survey did not consider themselves less competent in OE. However, younger teachers reported significantly lower levels of perceived competence compared to their more experienced colleagues (Appendix A, Table A3). This finding should be interpreted with caution, as the youngest age group was represented by a relatively small number of participants, which may limit the robustness of age-related comparisons.

These findings may be related to the lack of systematic training in OE during their initial teacher education. According to Mann et al. (2022), greater emphasis should be placed on equipping both pre-service and in-service teachers with the skills needed to effectively use the natural environments for learning. Integrating outdoor pedagogy methods into university-level teacher education programmes could help address this gap and better prepare future educators to confidently apply outdoor teaching approaches. This interpretation aligns with our findings related to the statement "I am not professionally qualified enough to teach outside the classroom".

The fourth research question (RQ4: How confident do natural science and/or biology teachers feel when conducting outdoor education, and to what extent do they participate in relevant professional development?) examined teachers' self-reported confidence in implementing OE and their engagement in training programmes related to outdoor teaching. Approximately half of the surveyed teachers reported having participated in OE-related

training programmes during their careers (Table 6). Participation most commonly involved courses, workshops, and professional conferences focused on outdoor teaching practices. Teachers with more than 11 years of teaching experience were statistically significantly more likely to attend such professional development activities than those with fewer years of experience (Appendix A, Table A2).

Although younger and less experienced teachers more frequently reported lower confidence in implementing OE, they also participated less often in OE-related training. This pattern points to the importance of targeted professional development opportunities, particularly for early-career teachers, to support confidence and competence in OE. Despite the absence of formal university-level courses dedicated to OE, the majority of respondents feeling sufficiently confident to implement outdoor teaching, attributing their competence primarily to ongoing professional development and the exchange of practical experiences with colleagues (Appendix A, Table A2).

Our final research question (RQ5: How do natural science and biology teachers evaluate the perceived benefits of outdoor education for students?) examined teachers' attitudes towards the educational value of OE. The results (Appendix A, Table A3) indicate that respondents consistently perceive OE as highly advantageous. The very low level of agreement with negative statements such as "OE is a waste of time" or "I doubt the effectiveness of OE" provides strong quantitative support for the interpretation that teachers view OE as educationally valuable. These findings are in line with previous research reporting a generally positive attitude towards outdoor learning among teachers (Becker et al., 2017; Svobodová et al., 2020). The predominately positive evaluation of OE among Slovenian teachers may be partly explained by the educational and geographical context. The natural science and biology curricula explicitly promote outdoor learning and include fieldwork components which may enhance teachers' familiarity with and acceptance of outdoor methods. In addition, Slovenia's compact size and dense network of accessible natural areas, such as forests, rivers, and protected parks within short distance of most schools, may reduce some of the logistical barriers frequently reported in more urbanised or geographically extensive contexts.

In contrast, the Czech context described by Svobodová et al. (2020) shows that outdoor geography education remains uncommon despite its inclusion in the curriculum, mainly due to organisational constraints, administrative requirements, and limited methodological support. In comparison, Slovenia benefits from a strong tradition of hiking and environmental education, as well as policies that explicitly promote outdoor activities, which together may help explain why Slovenian teachers in our study expressed a particularly positive attitude towards OE and reported fewer structural obstacles than in the Czech study. Like the findings of a Czech study (Svobodová et al., 2020) on outdoor geography education, the teachers in our study emphasised the benefits of OE, especially in promoting skill development, strengthening interpersonal relationships, and enhancing knowledge acquisition. This is in line with numerous studies that highlight the positive impact of OE in various educational areas (Department for Education and Skills, 2006; Office for Standards in Education, Children's Services and Skills, 2008; Štemberger, 2012). The majority of participating teachers expressed a strong motivation to teach in natural environments and considered this method to be important, meaningful, and useful. Concerns about the practicality or effectiveness of outdoor teaching approaches were generally considered negligible or unfounded by respondents.

The findings of this study point to several issues that may help to explain why OE is not more widely implemented in Slovenian lower secondary biology and natural science teaching, despite its well-documented benefits. Teachers most frequently referred to limited time, lack of accompanying staff, curriculum overload, large students group, inflexible

school schedule, insufficient experience with OE, and, to a lesser extent, additional costs as constraining factors. These perceived obstacles suggest that structural and organisational conditions play a substantial role in shaping teachers' opportunities to implement outdoor teaching. Consequently, students may have fewer opportunities to benefit from outdoor learning experiences that are associated with the development of subject understanding, self-confidence, risk management skills, social cooperation, and a stronger connection to the natural environment. From this perspective, limited engagement with OE may represent a missed educational opportunity, with potential long-term consequences for students' personal development and environmental awareness.

The teachers mentioned that they would have liked to implement more outdoor activities, but they highlighted the need for targeted support and professional development opportunities for less experienced teachers who often feel less competent and face more obstacles when implementing OE. Ministry of Education and school leaders should consider integrating OE more systematically into university teacher training and lifelong teacher education programmes. In addition, schools should be encouraged to develop partnerships with local institutions or create accessible outdoor learning places to overcome location-based limitations. The results of this study also suggest that mid-career teachers (aged 30–60) who are professionally stable but not yet close to retirement could be the most promising group for implementing and expanding OE if they are adequately supported (e.g., financially, through flexibility in the timetable, more time, smaller student groups, etc.). Finally, this study contributes to a body of research advocating outdoor learning as an educational strategy that promotes environmental awareness, sustainability and student well-being—areas that are increasingly important in today's educational and social context.

Findings from non-European countries provide further insight into the factors that influence teachers' opportunities for OE. In US elementary schools, [Patchen et al. \(2022\)](#) found a wide range of systemic obstacles—tight schedules, administrative expectations, and resource constraints—that limit children's time outdoors. These concerns reflect the “lack of time” and “curriculum overload” most frequently cited by Slovenian teachers in our study. At the same time, [Subocz \(2022\)](#) found that in Seattle public middle schools, the availability of policy support and grant programmes could significantly increase teachers' ability to organise regular outdoor experiential learning, suggesting that targeted national or district policies can offset some of these structural obstacles.

[Guardino et al. \(2019\)](#) showed that outdoor classrooms can be particularly beneficial for students with special educational needs, as they increase engagement and reduce distractions while also highlighting the additional planning and safety considerations required in such environments. Although inclusive education legislation is in place in Slovenia, specific training for inclusive outdoor practise remains limited, which may help explain why Slovenian teachers in our sample reported fewer safety-related concerns than teachers in many US-based studies.

Overall, these comparisons suggest that Slovenia's compact geographic location, relatively easy access to natural environments, and strong cultural tradition of hiking and environmental stewardship may help to alleviate some logistical barriers that are frequently highlighted in studies conducted in more urbanised contexts, including parts of the United States. At the same time, the absence of dedicated funding programmes in the Slovenian context may contribute to teachers' greater emphasis on time-related rather than financial obstacles. These findings underline the importance of considering national policy frameworks, cultural attitudes towards nature, and geographical characteristics when interpreting teachers' perceptions and practices related to outdoor education. Similar challenges have also been reported in non-European contexts; however, the present study deliberately focuses on Slovenia and comparable educational systems to ensure contextual relevance.

5. Conclusions and Implications

This study provides insight into how OE is perceived and implemented by Slovenian lower secondary biology and natural science teachers, as well as the conditions that shape its use in school practice. The findings indicate that teachers clearly recognise the educational, social, and emotional value of OE, particularly regarding student engagement, well-being, and environmental awareness. Despite this positive perception, outdoor teaching remains only moderately integrated into regular instruction, with one-day excursions and short fieldwork activities being the most commonly used forms.

The results suggest that the implementation of OE is influenced less by teachers' attitudes and more by structural and organisational factors within the school system. Time constraints, curriculum demands, large student groups, and the limited availability of accompanying staff restrict teachers' opportunities to teach outdoors, even when suitable natural environments are accessible. At the same time, teachers' professional experience plays an important role; more experienced teachers tend to feel more confident and report fewer obstacles, while less experienced teachers more often perceive curricular integration and familiarity with local environments as challenging.

These findings have several implications for educational practice and policy. Strengthening outdoor pedagogy within initial teacher education and providing systematic, accessible professional development opportunities may help support teachers—particularly those early in their careers—in developing confidence and practical strategies for outdoor teaching. At the school level, greater institutional support, including timetable flexibility and organisational assistance, could help reduce some of the barriers identified. Given the generally positive attitudes toward OE, such measures may enable teachers to translate their intentions into more frequent and sustained outdoor learning practices.

Overall, this study contributes to a growing body of research highlighting OE as a valuable pedagogical approach that supports both subject learning and broader educational goals related to well-being and environmental responsibility, while providing context-specific empirical evidence from the Slovenian lower secondary education system. By addressing the structural conditions under which OE is implemented, educational stakeholders may better support teachers in making use of the educational potential offered by learning in natural environments.

6. Limitations

Several limitations of this study should be acknowledged. First, this study relied on self-reported data, which may be influenced by respondents' subjective perceptions and social desirability bias. Second, although the overall sample size was adequate for descriptive and exploratory analyses, some subgroup sizes—particularly within age categories and school location types—were relatively small. This includes the youngest age group (teachers under 30 years), which limits the statistical power, robustness, and the generalisability of subgroup comparisons.

In addition, the categorisation of schools as rural, urban, or suburban is a theoretical simplification and may not fully reflect the diversity of school environments and access to natural resources. Finally, the cross-sectional design of this study does not allow for causal interpretations or insights into changes over time.

An additional limitation concerns the time gap between data collection and publication. Although the data were collected several years before publication, this study primarily addresses structural, organisational, and curricular factors influencing OE, which tend to change gradually rather than rapidly. However, changes in educational policy or professional development opportunities since data collection may have affected current practices.

Future research could therefore examine whether similar patterns persist over time, using longitudinal designs, larger and more balanced samples, and mixed-methods approaches.

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Institutional Review Board Statement: In our study, we sought the opinions of teachers, and in the survey all participants gave their consent to be fully informed about anonymity, the research, the use of their data, and the risks associated with participation. No national ethical approval is legally required for the collection of teachers' opinions.

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Data Availability Statement: The data used in this study are available on request from the corresponding author. The data have been anonymized but are not publicly available because of the privacy issues related to the quantitative nature of it.

Conflicts of Interest: The authors declare no conflicts of interest.

Abbreviations

The following abbreviations are used in this manuscript:

OE	Outdoor Education
ICAP	Interactive–Constructive–Active–Passive
ESD	Education for Sustainable Development
PCA	Principal Component Analysis
KMO	Kaiser–Meyer–Olkin

Appendix A

Table A1. Levels of obstacles for the implementation of outdoor lessons according to the age group of the participants.

Obstacle	Age Group **	Response Frequency (N) and Percentage (%)					M	SD	χ^2	p
		1 *	2 *	3 *	4 *	5 *				
Lack of suitable green areas.	A	5 (62.5%)	0	0	2 (25.0%)	1 (12.5%)	2.25	1.75	31.88	<0.01
	B	53 (57.6%)	18 (19.6%)	2 (2.2%)	14 (15.2%)	5 (5.4%)	1.91	1.31		
	C	3 (42.9%)	2 (28.6%)	2 (28.6%)	0	0	1.86	0.90		
Lack of equipment for pupils (clothing and footwear).	A	4 (50.0%)	2 (25.0%)	0	2 (25.0%)	0	2.00	1.31	32.09	<0.01
	B	38 (41.3%)	27 (29.3%)	8 (8.7%)	16 (17.4%)	3 (3.3%)	2.12	1.22		
	C	5 (71.4%)	0	0	2 (28.6%)	0	1.86	1.46		

Table A1. Cont.

Obstacle	Age Group **	Response Frequency (N) and Percentage (%)					M	SD	χ^2	p
		1 *	2 *	3 *	4 *	5 *				
Insufficient integration of curriculum content for effective OE.	A	1 (12.5%)	1 (12.5%)	0	5 (62.5%)	1 (12.5%)	3.50	1.31	32.29	<0.01
	B	34 (37.0%)	33 (35.9%)	3 (3.3%)	18 (19.6%)	4 (4.3%)	2.18	1.25		
	C	2 (28.6%)	4 (57.1%)	1 (14.3%)	0	0	1.86	0.69		
Lack of students' interest.	A	2 (25.0%)	4 (50.0%)	1 (12.5%)	1 (12.5%)	0	2.13	0.99	43.41	<0.01
	B	49 (53.3%)	25 (27.2%)	10 (10.9%)	6 (6.5%)	2 (2.2%)	1.77	1.03		
	C	4 (57.1%)	1 (14.3%)	0	2 (28.6%)	0	2.00	1.41		
Non-cooperation of owners or managers of nature-based facilities.	A	3 (37.3%)	2 (25.0%)	2 (25.0%)	1 (12.5%)	0	2.13	1.13	49.41	<0.01
	B	46 (50.0%)	16 (17.4%)	26 (28.3%)	2 (2.2%)	2 (2.2%)	1.89	1.03		
	C	3 (42.9%)	2 (28.6%)	0	2 (28.6%)	0	2.14	1.35		
Lack of experience with OE.	A	2 (25.0%)	1 (12.5%)	1 (12.5%)	3 (37.5%)	1 (12.5%)	3.00	1.51	55.28	<0.01
	B	45 (48.9%)	36 (39.1%)	6 (6.5%)	4 (4.3%)	1 (1.1%)	1.70	0.86		
	C	4 (57.1%)	2 (28.6%)	1 (14.3%)	0	0	1.57	0.79		
Doubts about the effectiveness of OE.	A	4 (50.0%)	2 (25.0%)	1 (12.5%)	1 (12.5%)	0	1.88	1.13	56.21	<0.01
	B	64 (69.6%)	16 (17.4%)	6 (6.5%)	5 (5.4%)	1 (1.1%)	1.51	0.92		
	C	5 (71.4%)	1 (14.3%)	1 (14.3%)	0	0	1.43	0.79		
Unfamiliarity with the local environment.	A	1 (12.5%)	3 (37.5%)	0	3 (37.5%)	1 (12.5%)	3.00	1.41	60.15	<0.01
	B	59 (64.1%)	22 (23.9%)	7 (7.6%)	3 (3.3%)	1 (1.1%)	1.53	0.86		
	C	5 (71.4%)	1 (14.3%)	1 (14.3%)	0	0	1.43	0.79		
Low level of qualification of teachers for OE.	A	3 (37.5%)	2 (25.0%)	0	3 (37.5%)	0	2.38	1.41	82.76	<0.01
	B	64 (69.6%)	20 (21.7%)	6 (6.5%)	1 (1.1%)	1 (1.1%)	1.42	0.76		
	C	5 (71.4%)	1 (14.3%)	1 (14.3%)	0	0	1.43	0.79		
Opposition from parents.	A	4 (50.0%)	3 (37.5%)	0	1 (12.5%)	0	1.75	1.04	117.39	<0.01
	B	55 (59.8%)	17 (18.5%)	17 (18.5%)	3 (3.3%)	0	1.65	0.90		
	C	6 (85.7%)	0	0	1 (14.3%)	0	1.43	1.13		

Table A1. Cont.

Obstacle	Age Group **	Response Frequency (N) and Percentage (%)					M	SD	χ^2	p
		1 *	2 *	3 *	4 *	5 *				
Lack of teacher's interest.	A	3 (37.5%)	2 (25.0%)	0	3 (37.5%)	0	2.38	1.41	130.65	<0.01
	B	65 (70.7%)	16 (17.4%)	9 (9.8%)	2 (2.2%)	0	1.43	0.76		
	C	5 (71.4%)	1 (14.3%)	1 (14.3%)	0	0	1.43	0.79		
Additional preparation time.	A	2 (25.0%)	1 (12.5%)	0	4 (50.0%)	1 (12.5%)	3.13	1.55	26.54	0.01
	B	25 (27.2%)	39 (42.4%)	4 (4.3%)	20 (21.7%)	4 (4.3%)	2.34	1.22		
	C	0	5 (71.4%)	0	2 (28.6%)	0	2.57	0.98		
Excessive distance from green areas.	A	6 (75.0%)	0	0	1 (12.5%)	1 (12.5%)	1.88	1.64	23.16	0.03
	B	49 (53.3%)	26 (28.2%)	2 (2.2%)	11 (12.0%)	4 (4.3%)	1.86	1.19		
	C	3 (42.9%)	2 (28.6%)	0	2 (28.6%)	0	2.14	1.35		
Search for financial support.	A	4 (50.0%)	2 (25.0%)	0	2 (25.0%)	0	2.00	1.31	18.62	0.10
	B	39 (42.4%)	22 (23.9%)	12 (13.0%)	13 (14.1%)	6 (6.5%)	2.18	1.30		
	C	4 (57.1%)	2 (28.6%)	1 (14.3%)	0	0	1.57	0.79		
Failure to achieve learning goals due to the specificity of OE.	A	2 (25.0%)	3 (37.5%)	1 (12.5%)	1 (12.5%)	1 (12.5%)	2.50	1.41	18.07	0.11
	B	31 (33.7%)	21 (22.8%)	13 (14.1%)	22 (23.9%)	5 (5.4%)	2.45	1.32		
	C	3 (42.9%)	2 (28.6%)	0	2 (28.6%)	0	2.14	1.35		
Adaptation to the weather.	A	0	1 (12.5%)	0	6 (75.0%)	1 (12.5%)	3.88	0.84	17.54	0.13
	B	6 (6.5%)	33 (35.9%)	7 (7.6%)	35 (38.0%)	11 (12.0%)	3.13	1.22		
	C	1 (14.3%)	2 (28.6%)	2 (28.6%)	2 (28.6%)	0	2.71	1.11		
Additional administration.	A	2 (25.0%)	3 (37.5%)	0	2 (25.0%)	1 (12.5%)	2.63	1.51	16.91	0.15
	B	35 (38.0%)	18 (19.6%)	10 (10.9%)	23 (25.0%)	6 (6.5%)	2.42	1.39		
	C	1 (14.3%)	3 (42.9%)	1 (14.3%)	1 (14.3%)	1 (14.3%)	2.71	1.38		
Lack of accompanying staff.	A	0	0	2 (25.0%)	3 (37.5%)	3 (37.5%)	4.13	0.84	16.06	0.19
	B	9 (9.8%)	18 (19.6%)	4 (4.3%)	27 (29.3%)	34 (37.0%)	3.64	1.40		
	C	2 (28.6%)	2 (28.6%)	0	3 (42.9%)	0	2.57	1.40		

Table A1. Cont.

Obstacle	Age Group **	Response Frequency (N) and Percentage (%)					M	SD	χ^2	p
		1 *	2 *	3 *	4 *	5 *				
Too many students to teach outside the classroom.	A	1 (12.5%)	0	0	5 (62.5%)	2 (25.0%)	3.88	1.25	14.41	0.28
	B	11 (12.0%)	19 (20.7%)	3 (3.3%)	22 (23.9%)	37 (40.2%)	3.60	1.48		
	C	2 (28.6%)	1 (14.3%)	0	4 (57.1%)	0	2.86	1.46		
Lack of time.	A	0	0	0	5 (62.5%)	3 (37.5%)	4.38	0.52	12.72	0.39
	B	9 (9.8%)	20 (21.7%)	3 (3.3%)	35 (38.0%)	25 (27.2%)	3.51	1.36		
	C	1 (14.3%)	4 (57.1%)	0	1 (14.3%)	1 (14.3%)	2.57	1.40		
Lack of equipment for outdoor lessons.	A	1 (12.5%)	4 (50.0%)	0	2 (25.0%)	1 (12.5%)	2.75	1.39	12.61	0.40
	B	13 (14.1%)	40 (43.5%)	6 (6.5%)	25 (27.2%)	8 (8.7%)	2.73	1.25		
	C	2 (28.6%)	3 (42.9%)	0	2 (28.6%)	0	2.29	1.25		
Inflexible school schedule.	A	1 (12.5%)	0	0	5 (62.5%)	2 (25.0%)	3.88	1.25	11.88	0.46
	B		20 (21.7%)	5 (5.4%)	34 (37.0%)	22 (23.9%)	3.39	1.37		
	C	2 (28.6%)	3 (42.9%)	0	2 (28.6%)	0	2.29	1.25		
Too extensive curriculum.	A	0	1 (12.5%)	0	5 (62.5%)	2 (25.0%)	4.00	0.93	11.49	0.49
	B	9 (9.8%)	18 (19.6%)	5 (5.4%)	34 (37.0%)	26 (28.3%)	3.54	1.35		
	C	0	4 (57.1%)	0	2 (28.6%)	1 (14.3%)	3.00	1.29		
Excessive or additional costs.	A	5 (62.5%)	0	0	2 (25.0%)	1 (12.5%)	2.25	1.75	11.29	0.50
	B	44 (47.8%)	19 (20.7%)	5 (5.4%)	9 (9.8%)	15 (16.3%)	2.26	1.53		
	C	4 (57.1%)	2 (28.6%)	0	1 (14.3%)	0	1.71	1.11		
Additional travelling time to the location.	A	1 (12.5%)	3 (37.5%)	0	2 (25.0%)	2 (25.0%)	3.13	1.55	9.58	0.65
	B	17 (18.5%)	23 (25.0%)	2 (2.2%)	34 (37.0%)	16 (17.4%)	3.10	1.44		
	C	3 (42.9%)	2 (28.6%)	0	2 (28.6%)	0	2.14	1.35		

Note: response scale: * 1 = Not restrictive; 2 = Slightly restrictive; 3 = Cannot answer; 4 = Restrictive; 5 = Very restrictive. Age group: ** A = under 29 years; B = 30–59 years; C = 60 years or older.

Table A2. Pearson correlations of question on the extent of the participants' influence on the change in the teachers' teaching style.

Type of Activity	Teachers	<i>r</i>	<i>p</i>
Courses/workshops on OE.	Age group	−0.26	0.01
	Years of teaching experience	−0.20	0.04
Professional training programmes related to OE.	Age group	−0.25	0.01
	Years of teaching experience	−0.21	0.03
Educational conferences or seminars (where teachers and/or researchers present the results of their research and discuss educational problems).	Age group	−0.22	0.02
	Years of teaching experience	0.28	<0.001
Study groups within the Institute for Education that study OE.	Age group	0.23	0.02
	Years of teaching experience	0.23	0.02

Note: correlations were calculated using item-level responses (Likert-scale data). Age and years of teaching experience were not entered as grouped categories in the correlation analyses.

Table A3. Frequencies and percentages of attitudes toward OE by respondents' years of experience.

Item	Years of Teaching Experience ****	Response Frequency (N) and Percentage (%)					<i>M</i>	<i>SD</i>	χ^2	<i>p</i>
		1 ***	2 ***	3 ***	4 ***	5 ***				
I doubt my own confidence in OE.	D	8 (28.6%)	12 (42.9%)	2 (7.1%)	5 (17.9%)	1 (3.6%)	2.25	1.18	16.99	0.03
	E	14 (56.0%)	5 (20.0%)	5 (20.0%)	1 (4.0%)	0	1.72	0.94		
	F	21 (38.2%)	27 (49.1%)	5 (9.1%)	2 (3.6%)	0	1.78	0.76		
	total	43 (39.8%)	44 (40.7%)	12 (11.1%)	8 (7.4%)	1 (.9%)	1.89	0.94		
I am not professionally qualified enough to teach outside the classroom.	D	6 (21.4%)	12 (42.9%)	4 (14.3%)	5 (17.9%)	1 (3.6%)	2.39	1.13	10.14	0.26
	E	13 (52.0%)	7 (28.0%)	2 (8.0%)	3 (12.0%)	0	1.80	1.04		
	F	19 (34.5%)	23 (41.8%)	9 (16.4%)	4 (7.3%)	0	1.96	0.90		
	total	38 (35.2%)	42 (38.9%)	15 (13.9%)	12 (11.1%)	1 (.9%)	2.04	1.01		
I doubt the meaningfulness of OE.	D	14 (50.0%)	11 (39.3%)	2 (7.1%)	1 (3.6%)	0	1.64	0.78	5.41	0.49
	E	17 (68.0%)	8 (32.0%)	0	0	0	1.32	0.48		
	F	32 (58.2%)	20 (36.4%)	3 (5.5%)	0	0	1.47	0.60		
	total	63 (58.3%)	39 (36.1%)	5 (4.6%)	1 (.9%)	0	1.48	0.63		

Table A3. Cont.

Item	Years of Teaching Experience ****	Response Frequency (N) and Percentage (%)					<i>M</i>	<i>SD</i>	χ^2	<i>p</i>
		1 ***	2 ***	3 ***	4 ***	5 ***				
I am afraid of teaching biology and/or natural science in nature.	D	16 (57.1%)	8 (28.6%)	1 (3.6%)	3 (10.7%)	0	1.68	0.98	5.35	0.50
	E	14 (56.0%)	8 (32.0%)	3 (12.0%)	0	0	1.56	0.71		
	F	34 (61.8%)	16 (29.1%)	2 (3.6%)	3 (5.5%)	0	1.53	0.81		
	total	64 (59.3%)	32 (29.6%)	6 (5.6%)	6 (5.6%)	0	1.57	0.83		
I am not motivated to teach biology and/or natural science in nature.	D	17 (60.7%)	7 (25.0%)	1 (3.6%)	1 (3.6%)	2 (7.1%)	1.71	1.18	7.28	0.51
	E	16 (64.0%)	7 (28.0%)	0	2 (8.0%)	0	1.52	0.87		
	F	29 (52.7%)	18 (32.7%)	5 (9.1%)	2 (3.6%)	1 (1.8%)	1.69	0.92		
	total	62 (57.4%)	32 (29.6%)	6 (5.6%)	5 (4.6%)	3 (2.8%)	1.66	0.99		
OE seems unimportant to me.	D	18 (64.3%)	9 (32.1%)	0	0	1 (3.6%)	1.46	0.84	5.01	0.54
	E	19 (76.0%)	5 (20.0%)	0	0	1 (4.0%)	1.36	0.86		
	F	38 (69.1%)	15 (27.3%)	2 (3.6%)	0	0	1.35	0.55		
	total	75 (69.4%)	29 (26.9%)	2 (1.9%)	0	2 (1.9%)	1.38	0.71		
I doubt the practicality of OE.	D	16 (57.1%)	9 (32.1%)	2 (7.1%)	1 (3.6%)	0	1.57	0.79	4.85	0.56
	E	16 (64.0%)	9 (36.0%)	0	0	0	1.36	0.49		
	F	32 (58.2%)	19 (34.5%)	4 (7.3%)	0	0	1.49	0.64		
	total	64 (59.3%)	37 (34.3%)	6 (5.6%)	1 (.9%)	0	1.48	0.65		
OE is a waste of time.	D	16 (57.1%)	9 (32.1%)	2 (7.1%)	1 (3.6%)	0	1.57	0.79	3.82	0.70
	E	17 (68.0%)	7 (28.0%)	1 (4.0%)	0	0	1.36	0.57		
	F	33 (60.0%)	17 (30.9%)	5 (9.1%)	0	0	1.49	0.66		
	total	66 (61.1%)	33 (30.6%)	8 (7.4%)	1 (.9%)	0	1.48	0.68		
I doubt the effectiveness of OE.	D	15 (53.6%)	11 (39.3%)	1 (3.6%)	1 (3.6%)	0	1.57	0.74	3.09	0.80
	E	15 (60.0%)	8 (32.0%)	2 (8.0%)	0	0	1.48	0.65		
	F	30 (54.5%)	17 (30.9%)	4 (7.3%)	4 (7.3%)	0	1.67	0.90		
	total	60 (55.6%)	36 (33.3%)	7 (6.5%)	5 (4.6%)	0	1.60	0.81		

Table A3. Cont.

Item	Years of Teaching Experience ****	Response Frequency (N) and Percentage (%)					M	SD	χ^2	p
		1 ***	2 ***	3 ***	4 ***	5 ***				
In nature, I have no control over the students, so I don't do this type of teaching.	D	11 (39.3%)	9 (32.1%)	3 (10.7%)	3 (10.7%)	2 (7.1%)	2.14	1.27	3.75	0.88
	E	12 (48.0%)	8 (32.0%)	2 (8.0%)	3 (12.0%)	0	1.84	1.03		
	F	20 (36.4%)	23 (41.8%)	6 (10.9%)	4 (7.3%)	2 (3.6%)	2.00	1.05		
	total	43 (39.8%)	40 (37.0%)	11 (10.2%)	10 (9.3%)	4 (3.7%)	2.00	1.10		

Note: response scale: *** 1 = I don't agree at all; 2 = I don't agree; 3 = I cannot answer; 4 = I agree, 5 = I totally agree. **** D = 1–10 years of teaching experience; E = 11–20 years of teaching experience; F = more than 20 years of teaching experience.

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