



ProBleu

**Promoting ocean and water literacy
in school communities**

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Deliverable D5.2

Monitoring and evaluation framework of ocean and water literacy, value understanding and toolkit

Lead Beneficiary: Kaunas University of Technology

Author/s: Egle Butkeviciene, Aiste Balzekiene, Ricardo González, Vaidas Morkevičius, Ineta Simonaite, Audrone Telesiene

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Preface

D5.2 Monitoring and evaluation framework of ocean and water literacy, value understanding and toolkit [m35]

D5.2 stems from the work that has been implemented under WP5 “*Assessment of learning outcomes and impacts*” and its tasks “T5.2 Creating a monitoring and evaluation framework and toolkit” and “T5.3 Monitoring the environmental literacy and the understanding of the value of oceans and waters among children and youth, teachers and schools”.

Task T5.2 is aimed at developing a comprehensive monitoring and evaluation framework and toolkit to assess learning outcomes, including knowledge acquisition and changes in the perception of the value of oceans and waters. Building on the results of Task T5.1 “Developing a methodology for the assessment of ocean and water literacy”, this task establishes a set of indicators and data-collection methods, including both qualitative and quantitative approaches tailored to different target groups such as primary and secondary school students, teachers, school administration, and the wider school community.

Task T5.3 focuses on the implementation of the monitoring approach developed in T5.2. It assesses and monitors changes in environmental literacy, attitudes towards oceans and waters, and learning outcomes of school projects. The monitoring is carried out in two stages: at the pre-implementation stage, where participants assess their initial knowledge, perceptions, and expectations, and at the post-implementation stage, where they evaluate the knowledge gained and reflect on their understanding of responsibilities towards oceans and waters.

This deliverable is public. As concerns the Horizon Europe Work Programme types of deliverables, it is classified as: Report.

Summary

This deliverable, **D5.2 – Monitoring and Evaluation Framework of Ocean and Water Literacy, Value Understanding and Toolkit**, presents a comprehensive framework designed to assess and monitor the learning outcomes and impacts of educational activities implemented within ProBleu project. It builds upon the methodological foundations established in Deliverable D5.1 and validates them to be used for evaluating ocean and water literacy across diverse target groups.

The main objective of this deliverable is to provide a structured and practical monitoring and evaluation framework that enables the systematic assessment of knowledge acquisition, changes in attitudes, and the development of values related to oceans and water systems. In addition, the framework aims to capture behavioural changes and engagement levels associated with environmental responsibility and sustainability.

The framework is developed based on the work carried out in Tasks T5.2 and T5.3 under Work Package 5. Task T5.2 focuses on the creation of the monitoring and evaluation framework and toolkit, including the definition of key indicators and the development of qualitative and quantitative data-collection methods. These methods are tailored to different target groups, including primary school children, secondary school students, teachers, school management, and the wider school community. The toolkit includes survey instruments, interview guidelines, and structured approaches for collecting and analysing data.

Task T5.3 complements this work by implementing the monitoring process and assessing the evolution of environmental literacy and value understanding among participants. The monitoring is carried out in two main stages: a pre-implementation phase, where baseline data on knowledge, perceptions, and expectations are collected, and a post-implementation phase, where learning outcomes, attitudinal changes, and behavioural shifts are evaluated. This approach allows for a comparative analysis of progress and the identification of the impact of educational interventions.

The proposed framework adopts a holistic perspective on ocean and water literacy. It also uses the inclusive principles, ensuring that the evaluation process is accessible and relevant to all stakeholder groups. By combining quantitative metrics of children surveys with qualitative insights from teachers and school administration interviews, the framework provides a robust and flexible tool for capturing both measurable outcomes and deeper learning processes.

Furthermore, the deliverable emphasises the importance of consistency and scalability in monitoring practices. The developed toolkit is designed to be adaptable across different educational contexts, supporting the broader uptake and replication of Project ProBleu methodologies. It also contributes to evidence-based decision-making, enabling project partners to refine activities and maximise impact.

List of Abbreviations

D - Deliverable

EU – European Union

M&E – Monitoring and Evaluation

WP – Work Package

1. Introduction

1.1 Purpose of Deliverable 5.2

The purpose of Deliverable 5.2 is to develop a comprehensive monitoring and evaluation (M&E) framework and testing a toolkit, presented in D5.1, to assess ocean and water literacy, as well as the understanding of environmental values among the target groups of Project ProBleu. Building on the methodological foundations established in Deliverable 5.1, this deliverable validates methodology for evaluating learning outcomes and project impacts.

Specifically, D5.2 aims to define a set of indicators and data-collection methods that enable the systematic assessment of knowledge acquisition, attitudinal change, value development, and behavioural outcomes related to oceans and waters. The framework is designed to support both qualitative and quantitative evaluation approaches, ensuring a comprehensive understanding of the learning process and its effects across different target groups, including students, teachers, schools, and the wider community.

Furthermore, this deliverable provides practical tools and guidelines to facilitate consistent data collection, analysis, and reporting across project activities. It supports the implementation of monitoring activities in both pre- and post-intervention stages, enabling the measurement of change over time and the evaluation of the effectiveness of educational interventions.

Overall, D5.2 aims to ensure a robust, scalable, and user-friendly approach to monitoring and evaluating ocean and water literacy initiatives, thereby contributing to evidence-based decision-making, continuous improvement of project activities, and the long-term impact of Project ProBleu to address Eu Mission “Restore our Ocean and Waters by 2030”.

1.2 Positioning of D5.2 in relation to D5.1

Deliverable D5.2 builds directly on the outcomes of Deliverable D5.1 and represents the next step in the development and implementation of the monitoring and evaluation approach within Work Package 5.

Deliverable D5.1 is focused on analysing best practices in assessing learning outcomes and adapting them to the context of ocean and water literacy. This work resulted in an initial methodology designed to measure ocean and water literacy in school settings, including both pre- and post-intervention assessments. The methodology provided a conceptual and practical foundation for understanding how changes in knowledge, attitudes, and values can be captured in the context of educational activities and tools for assessment as Annexes.

Building on this foundation, Deliverable D5.2 advances from methodological development to practical implementation and evaluation. It provides an analysis of the data collected through surveys and interviews conducted among participating schools and target groups. Based on this empirical evidence, D5.2 offers insights into the effectiveness of the applied methodology and presents recommendations for further monitoring and improvement.

In contrast to D5.1, which established the methodological framework, D5.2 focuses on the application, validation, and refinement of this framework in real project conditions. It reports on the evaluation of ocean and water literacy and the understanding of environmental values among participating schools, capturing changes observed throughout the implementation of project activities.

Together, Deliverables D5.1 and D5.2 form a coherent progression from methodological design to applied evaluation, supporting the overall objective of assessing and enhancing ocean and water literacy within Project ProBleu.

1.3 Overview of scope and structure of D5.2

D5.2 is conceived as a living document, that was continuously updated throughout the project duration to reflect ongoing data collection, analysis, and learning. This iterative approach ensured that the monitoring and evaluation framework remains relevant, responsive, and aligned with project developments.

The methodology and tools for schoolchildren were tested in **97 of 111 schools in total: 34 primary schools and 63 secondary schools**. The sample size in detail is presented in the Table 1 and provides the basis for understanding the scope of the data collection and the robustness of the analysis used to evaluate ocean and water literacy among schoolchildren. The more detailed explanation is provided in **Section 3.1** of this document.

Table 1: Validation of Methodology and Tools for schoolchildren: *Sample size*

Level	No. of schools (in total / pre-survey / post survey)	No. of responses (in total)	No. of respondents (pre-survey, in total)	No. of respondents (post-survey, in total)	Sample used to measure change (pre-survey), respondents	Sample used to measure change (post-survey), respondents
Primary school	34 /27/20	1882	1222	660	792	495
Secondary school	63 /49/48	3481	2180	1301	1668	1125
In total	97 /76/68	5363	3402	1961	2460	1620

Table 1 presents the sample size used for the validation of the methodology and tools applied to schoolchildren across primary and secondary education levels. It provides an overview of the number of participating schools and respondents, as well as the distribution of participants between pre- and post-survey stages.

At the **primary school level**, a total of 34 schools participated in the study. The total number of responses at this level is indicated as 1882, of which 1222 respondents completed the pre-survey and 660 respondents completed the post-survey. From these, a matched sample of 792 respondents (pre-survey) and 495 respondents (post-survey) was used to measure changes in ocean and water literacy over time.

At the **secondary school level**, 63 schools were involved. The total number of responses is 3481, including 2180 participants in the pre-survey and 1301 participants in the post-survey.

A subset of 1668 (pre-survey) and 1125 (post-survey) respondents was used to assess changes between the two stages.

In total, the validation process covered 97 schools, with an overall number of respondents indicated as **5363**. Among these, **3402** respondents participated in the pre-survey and **1961** in the post-survey. The final matched sample used to measure change consists of **2460** respondents for the pre-survey and **1620** respondents for the post-survey.

The methodology and tools for teachers and school administration were tested with **100 school representatives in total**: 38 representatives of school administration and 62 schoolteachers (see Table 2). The sample covers 24 countries in total. The more detailed explanation is provided in **Section 3.2** of this document.

Table 2: Validation of Methodology and Tools for school administration and teachers: *Sample size*

Level	No. of interviewees	No. of countries covered
School administration	38	21
School teachers	62	23
In total	100	24

Structure of the D5.2

D5.2 starts with Introduction, presents 4 content sections and ends with conclusions and recommendations. **The section “Operationalization of the Monitoring Framework”** presents the translation of the conceptual framework into measurable components. It begins with a recap of the core dimensions identified in D5.1, including knowledge, awareness, attitudes, behaviours, emotional connection, communication, and open schooling. The section further details the refinement of indicators, adjustments made during instrument development, and the alignment of measurement approaches across different age groups. It also discusses adaptations made for specific target groups and summarises key lessons learned during the development of the monitoring instruments, such as ensuring cognitive appropriateness, simplifying survey items, and addressing translation challenges. **The section “Methodology”** describes the applied research design, including both survey-based (quantitative) and qualitative methodologies. This section also addresses ethical considerations related to data collection and participation. **The section “Empirical Evaluation Results”** outlines the analytical purpose, sample, and strategy used in the study. It provides detailed results across all key dimensions, including knowledge and awareness, attitudes, behaviours, emotional connection, communication, and open schooling. Additional insights are presented regarding sources and preferences for information related to oceans and waters. This section also includes an evaluation of the measurement tools following their pre-post application, assessing their effectiveness across all dimensions, as well as an overall assessment of the methodology. The section concludes with a discussion of limitations. **The section “Qualitative Findings”** complements the quantitative analysis by presenting insights from interviews with teachers and school administration. It explores school project implementation, open schooling dynamics,

perceived learning outcomes, and broader impacts, as well as cross-cutting findings across interviews. Finally, **the section “Conclusions and Recommendations”** summarises the key findings of the deliverable and provides recommendations for improving monitoring and evaluation practices in future implementations.

2. Operationalization of the monitoring framework

2.1. Recap of core dimensions from D5.1

The core dimensions selected for the ProBleu monitoring framework are grounded in the conceptual work developed in Deliverable 5.1 “Best Practices for Assessing Ocean and Water Literacy” under WP5 “Assessment of learning outcomes and impacts”¹.

Ocean and water literacy is understood as a multidimensional construct encompassing interconnected cognitive, affective, and behavioral components. Although the broader literature identifies numerous dimensions—such as knowledge, awareness, attitudes, behavior, activism, emotions, access and experience, communication, adaptive capacity, trust, and transparency—the ProBleu framework prioritizes those most closely aligned with short-term school-based interventions and feasible for young respondents within a concise survey format (approximately 10 minutes).

Accordingly, the monitoring framework includes the following dimensions:

- Knowledge and awareness
- Attitude
- Behaviour
- Emotional Connection
- Communication

To better understand the teaching and learning methods in ProBleu project, the framework included also a dimension of Open Schooling.

Dimensions such as activism, trust, and transparency were excluded from the student surveys because they involve more abstract constructs and long-term commitments that are less suitable for short-duration, school-based interventions with children and adolescents.

2.1.1. Knowledge and awareness

Knowledge refers to what a person knows about ocean-related topics, their interconnections, and opportunities to engage in decision-making (McKinley et al., 2023). The ProBleu framework builds on the International Ocean Literacy Survey (IOLS) (Fauville et al., 2019) and the essential principles of ocean literacy defined by NOAA (2013), such as the existence of one global ocean and the ocean’s role in supporting biodiversity.

Awareness, while related to knowledge, captures recognition that environmental issues exist and includes understanding of possible solutions and actions (McKinley, 2023). Whereas

¹ See D5.1 at https://probleu.school/wp-content/uploads/2024/05/ProBleu_D5.1_BestPracticesforAssessingOceanandWaterLiteracy_vFINAL.pdf

knowledge items assess factual understanding, awareness items capture perceived relevance and recognition of environmental challenges.

Both dimensions are measured using multiple survey items, allowing analysis at the individual item level as well as aggregated dimension scores. Multi-item measurement supports reliability assessment and enables both descriptive and pre-post comparative analyses of learning outcomes.

2.1.2. Attitude

The attitude dimension measures the degree of agreement with or concern for ocean- and freshwater-related positions, including perceptions and values (McKinley et al., 2023).

Within the ProBleu framework, particular emphasis is placed on internal efficacy—defined as the belief in one’s own ability to contribute effectively to environmental preservation through individual actions. Survey items assess whether students feel capable of making a difference through small daily actions, thereby linking attitudinal orientations to perceived personal agency.

2.1.3. Behaviour

Behaviour refers to individual decisions, choices, actions, and habits related to ocean and freshwater issues in both private and public spheres (McKinley et al., 2023).

In the ProBleu student surveys, behavioural indicators are operationalized through concrete, observable actions relevant to young respondents, including:

- Turning off taps tightly after use
- Taking shorter showers to save water
- Picking up trash near water bodies
- Talking with friends or family about aquatic issues

Behavioural items use frequency scales adapted to age groups. Primary school students receive simplified scales (e.g., “Almost never,” “Sometimes,” “Almost always”), while secondary students are offered five-point scales ranging from “Never” to “Always.” These adaptations ensure clarity while allowing sufficient differentiation in responses.

Short reference periods (e.g., “past week,” “last month”) are used to facilitate recall and enhance response accuracy.

2.1.4. Emotional Connection

The emotional connection dimension captures affective responses when thinking about or experiencing aquatic environments (McKinley et al., 2023).

In the ProBleu surveys, this dimension is operationalized using selected items from the short version of the Positive and Negative Affect Schedule (PANAS) (Mackinnon et al., 1999). Only accessible and age-appropriate emotional descriptors were retained. Items such as

“determined” and “alert” were excluded to reduce conceptual difficulty, and the scale was shortened to maintain feasibility within the overall survey length.

Explanatory notes are provided where necessary to clarify abstract emotional concepts. D5.1 emphasizes that emotional foundations are critical for understanding motivational drivers behind pro-environmental attitudes and behaviours, highlighting the importance of nurturing positive emotional bonds with nature.

2.1.5. Communication

Communication is a cross-cutting dimension closely linked to knowledge, awareness, attitudes, and behaviours.

The ProBleu framework measures:

- Sources and means of information,
- Preferred ways of receiving information,
- Level of interest in receiving information about oceans and waters.

Identical communication items are included in both pre- and post-intervention surveys, with adjusted time references (“school year” in the pre-test and “three months” in the post-test) to reflect project duration while maintaining comparability.

Response categories are tailored to age groups, and this dimension supports identification of effective channels for strengthening ocean literacy through educational strategies.

2.1.6. Open schooling

Open Schooling reflects the pedagogical approach underpinning ProBleu-funded projects. It is conceptualized as a two-way process:

- Bringing stakeholders into the classroom
- Bringing students outside the classroom

Following established frameworks (e.g., Ecsite.eu), Open Schooling promotes collaboration with non-formal education providers, enterprises, research institutions, and civil society actors.

Survey items measure participation in activities such as museum visits, exhibitions, engagement with guest speakers, and collaboration with community actors, as well as students’ satisfaction with these methods. Including this dimension allows the monitoring framework to capture not only learning outcomes but also the educational processes that may drive those outcomes.

2.2. Indicator Refinement

Indicator refinement involved narrowing dimensions, clarifying conceptual definitions, and adapting response formats to ensure scientific robustness while remaining appropriate for young learners.

A central design principle was limiting total survey duration to approximately 10 minutes. Short instruments are particularly important in school settings, where attention span, class time

constraints, and digital engagement influence response quality. Reducing unnecessary length helps minimize response burden and maintain data reliability.

Item-level refinement included shortening scales, removing overly abstract or introspective adjectives in the Emotional Connection dimension, and prioritizing concise, direct wording.

2.2.1. Adjustments during Instrument Development

A central design principle of the monitoring framework was to ensure that the total survey duration remains under approximately 10 minutes in order to maintain the attention and cooperation of children and adolescents and to maximize data quality.

For this reason, although the broader ocean literacy literature identifies numerous dimensions—including activism, adaptive capacity, trust, and transparency—the ProBleu framework narrows the scope to dimensions that are:

- Directly aligned with the educational goals of school projects,
- Feasible within the cognitive capabilities of young learners, and
- Suitable for short-term educational interventions.

Accordingly, dimensions such as Activism and Trust and Transparency were excluded from the student surveys because they involve more abstract concepts and long-term commitments that are less suitable for short-duration, school-based projects with children and adolescents.

Within specific dimensions, refinement also occurred at the item level. For example, the Emotional Connection dimension draws on the short version of the Positive and Negative Affect Schedule (PANAS) (Mackinnon et al., 1999), but only selected emotions were retained. Adjectives such as “determined” and “alert” were excluded because they were considered more difficult to conceptualize, and items such as “scared” and “distressed” were omitted to shorten the scale while maintaining conceptual coverage. Explanatory notes were added where needed to enhance clarity for young respondents.

2.2.2. Alignment Across Age Groups

The framework differentiates between primary and secondary school students to ensure age-appropriate measurement while maintaining conceptual coherence across dimensions.

Response Formats

Primary students receive simplified frequency scales supported by visual markers (e.g., emojis) to facilitate comprehension. Secondary students are offered more differentiated five-point scales, allowing greater nuance while preserving clarity.

Language and Structure

Item wording is adapted to developmental level. Complex sentence structures and technical terminology are avoided. Where abstract terms are used (e.g., emotional descriptors), explanatory notes are included.

Conceptual Consistency

Despite differences in scale structure and wording, the same core dimensions are measured across age groups. This allows for conceptual comparability while accommodating developmental differences. Pre- and post-intervention surveys retain identical item content wherever possible to enable longitudinal comparison.

2.3. Adaptation for Target Groups

Data are collected via computer-assisted web interviewing (CAWI) from three groups: students, teachers, and school administrators. Student surveys focus on quantitative measurement of literacy dimensions. Teachers and administrators provide complementary contextual data regarding implementation and educational processes. Teachers complete online questionnaires including open-ended components capturing project implementation, student engagement, and perceived outcomes. Administrators complete structured information forms documenting school-level characteristics and implementation context. Together, these data sources allow triangulation between student-level outcomes and institutional-level processes.

2.4. Lessons from Instrument Development

The development of the ProBleu monitoring framework generated several methodological lessons regarding the design of survey instruments for young populations. These lessons concern three interrelated domains: cognitive appropriateness, item simplification, and translation adjustments. Together, they reflect the need to balance scientific robustness with developmental sensitivity in large-scale educational monitoring.

2.4.1. Cognitive Appropriateness

A central lesson from instrument development is that survey design must be aligned with the cognitive capabilities of children and adolescents. Deliverable D5.1 emphasizes that questionnaires targeting young learners should use clear, direct, and unambiguous language while avoiding complex sentence structures and excessive item length. In particular, questions should be concise—ideally under 20 words—to maintain attention and reduce processing demands.

The structure of response options is equally important. D5.1 recommends tailoring the number of response categories to the developmental stage of respondents, suggesting binary formats or scales with three to four options for younger participants to prevent cognitive overload. This principle is reflected in the ProBleu questionnaires, where primary school students receive simplified frequency scales and visually supported response categories, while secondary school students are offered more differentiated multi-point scales.

Insights from recent research on adolescent survey engagement further reinforce the importance of cognitively appropriate design. Empirical evidence demonstrates that question characteristics—such as wording complexity, response format, and sensitivity—strongly influence whether adolescents provide substantive answers or select non-substantive options

(González, Naber & Fuentes, 2025; Olson et al., 2019; Silber et al., 2021). The theoretical logic underlying these findings is consistent with the Question-and-Answer Process Model (Tourangeau et al., 2000), which emphasizes the cognitive steps involved in comprehension, retrieval, judgment, and response formulation, as well as with Satisficing Theory (Krosnick, 1991), which explains how increased task difficulty may lead to suboptimal responding.

Importantly, research suggests that adolescents may interact with surveys differently from adults. While adult respondents often exhibit fatigue effects as questionnaires progress (Gummer & Roßmann, 2015; Olson et al., 2019; Silber et al., 2021), evidence from adolescent samples indicates that non-substantive responding may decline across question order, suggesting a potential learning process as respondents become more familiar with the survey task (González, Naber & Fuentes, 2025). This pattern should be interpreted cautiously—selective attrition may also contribute—but it underscores the importance of structuring surveys in ways that gradually engage respondents without overwhelming them.

2.4.2. Item Simplification

A second major lesson concerns the systematic simplification of items to reduce cognitive burden and improve response reliability. D5.1 explicitly advises avoiding rare or technical terms, double-barrelled questions, hypothetical scenarios, and indirect formulations that increase processing complexity. These principles are reflected in the ProBleu questionnaires, where items are phrased in straightforward language and focus on concrete, observable behaviours.

Closed-ended formats are prioritized over open-ended questions for younger respondents. D5.1 notes that open-ended questions demand higher levels of communicative skill and cognitive effort and may increase item nonresponse or satisficing behaviours. Consequently, the ProBleu student instruments rely primarily on structured response formats, reserving open-ended components for teacher and administrative surveys.

Response scales were also refined to remain compact yet informative. Evidence from adolescent web surveys indicates that overly complex or lengthy response options can increase non-substantive responding (González, Naber & Fuentes, 2025). Accordingly, the ProBleu questionnaires use clearly labelled scales and, in the case of primary students, visual cues such as emojis to support comprehension.

Conceptual filtering is another component of simplification. Dimensions such as “Activism” and “Trust and Transparency,” though present in broader ocean literacy frameworks, were excluded from the student surveys because they were considered less suitable for short-term educational interventions targeting young learners. Similarly, within the Emotional Connection dimension, selected items from the Positive and Negative Affect Schedule (Mackinnon et al., 1999) were retained while others were removed to shorten the scale and avoid more difficult-to-conceptualize adjectives. The final set captures accessible affective reactions such as feeling inspired, excited, or upset.

Additionally, behavioural questions were framed using short reference periods (e.g., “past week,” “last month”), which reduces recall difficulty and enhances response accuracy.

2.4.3. Translation Adjustments

Given that ProBleu operates across multiple European and associated countries, translation constitutes not merely a linguistic exercise but a methodological necessity. Deliverable D5.1 specifies that while teacher and administrative instruments are provided in English as a working language, student questionnaires are translated into respondents' native languages to ensure accessibility and comprehension.

This decision reflects a core principle derived from both D5.1 and survey methodology research: linguistic complexity increases cognitive burden and may contribute to non-substantive responding. Evidence from adolescent web surveys shows that difficult wording and unfamiliar terminology are associated with higher rates of "don't know" and item nonresponse (González et al., 2025). Ensuring accurate and context-sensitive translation therefore reduces unnecessary cognitive strain and supports equitable participation across countries.

By prioritizing native-language administration and adapting wording to local linguistic contexts, the ProBleu monitoring framework enhances both validity and comparability across diverse educational settings.

3. Methodology

3.1 Survey methodology

The survey instruments were developed to operationalise the monitoring framework described in Section 2, capturing key dimensions including knowledge and awareness, attitudes, behaviours, emotional connection, and communication related to water literacy. Two age-adapted questionnaires were designed: one for primary school children and one for secondary school students.

Both instruments followed a modular structure comprising: (i) factual knowledge items, (ii) self-reported knowledge and awareness, (iii) attitudinal statements using Likert-type scales, (iv) emotional response items, (v) self-reported behaviours, and (vi) exposure to learning activities and information sources. Items were aligned across both instruments to ensure comparability, while allowing for age-appropriate adaptations in wording, scale granularity, and cognitive complexity.

The surveys were administered online using a computer-assisted web interviewing (CAWI) approach. Data collection for students, teachers, and school administrators was conducted through the SurveyMonkey platform. For student data collection, questionnaires were typically completed in the school setting under teacher supervision. Teachers were provided with survey links and administration instructions and were responsible for organising both the pre-intervention and post-intervention survey sessions with students. This online mode ensured standardised administration across participating countries, facilitated multilingual implementation, and enabled efficient consolidation of data across survey waves.

The study follows a **two-wave repeated cross-sectional pre-post design at the school level**. Surveys were administered at two time points:

- **Pre-intervention (baseline):** before the implementation of project activities
- **Post-intervention (endline):** after the completion of the intervention activities

The timing of the post-intervention survey was aligned across participating schools, with some flexibility to accommodate differences in school calendars and implementation timelines.

This design enables the assessment of changes in key dimensions of water literacy following participation in ProBleu-funded school projects. Because the questionnaires were anonymous and did not collect personally identifying information, responses cannot be linked at the individual level across waves. The analysis therefore relies on repeated cross-sectional comparisons, restricting the analytical sample to schools that obtained both pre-intervention and post-intervention student responses. As a result, observed differences reflect changes at the group level and may partly be influenced by differences in the composition of respondents across waves.

All data collection complied with relevant data protection and ethical standards. No personally identifiable information was collected. Data management procedures included:

- anonymisation of responses at the point of collection

- secure storage of data on password-protected servers
- controlled access limited to authorised project partners

A harmonised dataset was created to ensure comparability across countries, age groups, and survey waves. Variable coding schemes were standardised across instruments, with documented mappings between primary and secondary questionnaires where necessary.

Schools were recruited through project partner networks, including existing collaborations with educational institutions, outreach activities, and stakeholder engagement initiatives. Efforts were made to ensure diversity in the sample, including variation in geographical location, school type, and socio-economic context. Participation was voluntary, and schools provided institutional consent prior to data collection.

Within participating schools, students were selected based on their involvement in project-related activities or relevant classes. Where feasible, entire classes were invited to participate to minimise selection bias and facilitate administration. Inclusion criteria were defined based on age group alignment with the two survey instruments (primary and secondary levels). Student participation was voluntary, and appropriate consent procedures were followed in accordance with national regulations, including parental consent where required.

A total of **1882 primary school students** from 34 schools across 19 countries and **3481 secondary school students** from 63 schools across 24 countries participated in the surveys.

For the purposes of pre-post analysis, the analytical sample was restricted to schools that collected both baseline and endline data. This restriction was applied at the analysis stage to ensure comparability across time points. This resulted in:

- **Primary schools:** analytical sample of **1287 students** from 13 schools across 9 countries
- **Secondary schools:** analytical sample of **2793 students** from 34 schools across 17 countries

Within these analytical samples, the distribution of responses across survey waves was as follows:

- **Primary schools:**
 - Pre-intervention: 792 responses
 - Post-intervention: 495 responses
- **Secondary schools:**
 - Pre-intervention: 1668 responses
 - Post-intervention: 1125 responses

These figures represent the responses used for comparative analysis across time points.

A reduction in the number of responses is observed between the pre-intervention and post-intervention waves. This reflects differences in participation across time points rather than individual-level attrition, as the study does not follow the same students longitudinally.

These differences are likely driven by factors such as student absence during data collection, variation in school participation across waves, and differences in classroom-level implementation of the surveys.

To enhance comparability, analyses are restricted to schools with data available in both waves. Where relevant, results are interpreted with caution, acknowledging that changes over time may partly reflect differences in the composition of respondents rather than purely intervention effects.

3.2. Qualitative methodology

This section outlines the research design for the interviews conducted with school administration representatives and teachers from schools that received ProBleu funding for projects related to ocean and water literacy. The purpose of this empirical research was to complement the student survey and to assess the overall impact of the funded school projects on the ocean and water literacy of school communities, as well as the effectiveness of the educational interventions implemented by participating schools.

The study targeted primary (Table 3) and secondary (Table 4) schools in EU Member States and associated countries that had implemented ProBleu-funded projects. The sample included two key respondent groups: **school administration representatives and teachers** involved in project implementation. One representative of school administration from each school was invited to participate. A total of N = 38 responses were collected from school administration representatives. In the teacher group, several teachers from the same school could participate, resulting in N = 62 responses (some schools that implemented the projects, did not participate in the interviews, based on their own choice). The sampling strategy combined **purposive sampling**, as only schools that had implemented ProBleu-funded projects were included, with an **element of self-selection**, since the researchers had no influence over which individual teacher or administration representative ultimately completed the questionnaire.

Table 3. Primary schools: n of participants in different countries

Country	N	%
Albania	31	1.6
Belgium	9	0.5
Croatia	243	12.9
Czech Republic	34	1.8
Denmark	43	2.3
France	18	1.0
Greece	23	1.2
Italy	2	0.1
Kosovo	117	6.2
Latvia	25	1.3
Luxembourg	35	1.9
Malta	28	1.5
North Macedonia	5	0.3
Portugal	98	5.2
Serbia	1	0.1
Slovakia	184	9.8
Spain	789	41.9
Sweden	154	8.2

UK	24	1.3
Not available	19	1.0
Total	1882	100.0

Table 4. Secondary schools: n of participants in different countries

Country	N	%
Albania	1	0.0
Armenia	173	5.0
Belgium	77	2.2
Bulgaria	47	1.4
Croatia	10	0.3
Estonia	9	0.3
Germany	206	5.9
Greece	236	6.8
Italy	35	1.0
Kosovo	86	2.5
Latvia	80	2.3
Lithuania	153	4.4
Moldova	4	0.1
Morocco	2	0.1
North Macedonia	38	1.1
Poland	38	1.1
Portugal	484	13.9
Romania	124	3.6
Slovenia	1	0.0
Spain	1014	29.1
Sweden	259	7.4
Tunisia	244	7.0
Turkey	125	3.6
Ukraine	20	0.6
Not available	15	0.4
Total	3481	100.0

Data were collected using **computer-assisted web interviewing** (CAWI) through the SurveyMonkey platform. The data were collected from 2025 September to 2026 April.

Taken together, the school administration and teacher interviews came from 24 unique countries. The full non-repeating list: Albania, Armenia, Bosnia and Herzegovina, Bulgaria, Croatia, Germany, Greece, Kosovo, Latvia, Malta, Morocco, North Macedonia, the Netherlands, Poland, Portugal, Republic of Moldova, Romania, Serbia, Slovakia, Slovenia, Spain, Sweden, Turkey, and Ukraine.

The interviewed school administration representatives represented a geographically diverse sample spanning 21 countries. The largest numbers of responses came from Portugal (n=6) and Spain (n=6). They were followed by Greece (n=3). Armenia, Croatia, Kosovo, and Morocco each contributed 2 responses, while all other countries were represented by a single school administration respondent: Bulgaria, Germany, Latvia, Malta, the Netherlands, Poland, Republic of Moldova, Romania, Serbia, Slovakia, Slovenia, Sweden, Turkey, and Ukraine.

The interviewed teachers also represented a geographically diverse sample spanning 23 countries. The largest numbers of responses came from Portugal (n=9) and Spain (n=9). They were followed by Greece (n=8) and Slovakia (n=5). Latvia (n=3), Poland (n=3), and Slovenia

(n=3) also accounted for multiple respondents. Croatia, Malta, Morocco, and North Macedonia each contributed 2 responses. All other countries were represented by a single teacher respondent: Albania, Armenia, Bosnia and Herzegovina, Bulgaria, Germany, Kosovo, the Netherlands, Romania, Serbia, Sweden, Turkey, and Ukraine. Two entries could not be reliably assigned to a country and were therefore excluded from the geographic classification.

Overall, the distribution suggests that, while participation was strongest in Southern European countries already visibly active in ProBleu-related initiatives, the sample also includes a broad cross-national spread across EU Member States, candidate countries, neighbouring countries, and associated contexts.

In order to provide a basic profile of the teacher sample involved in project implementation, respondents were first asked to **indicate the subject or subjects they teach**, or alternatively their role within the school. The responses show that the teacher sample involved in ProBleu project implementation was professionally diverse, although it was clearly centred on staff teaching subjects most directly linked to environmental, ocean, and water literacy. The most frequently mentioned backgrounds were in the natural sciences, especially biology, chemistry, physics, science/natural science, and geography, confirming that project implementation was often led by teachers with subject expertise closely aligned to environmental education. Biology appeared particularly often (n=16), either alone or in combination with other subjects, while several respondents also combined science teaching with broader roles such as project coordination, sustainability leadership, Erasmus+ coordination, or school-level management of activities. Alongside this strong science profile, the sample also included teachers from a wider range of disciplines, including mathematics, history, English and foreign languages, ICT, art, technology, physical education, traffic education, and primary education. This suggests that, in many schools, ProBleu activities were approached in an interdisciplinary way, involving both specialist subject teachers and staff with broader pedagogical or coordination roles. A small number of entries were unclear or invalid, but the overall pattern indicates that project delivery typically relied on a combination of science-related expertise and cross-curricular involvement.

The instruments consisted of **semi-structured interview** questionnaires administered separately to school administrators and teachers. Both questionnaires were administered in English, which served as the working language for the management of ProBleu calls and school projects. The questionnaires are provided in D5.1. Prior to analysis, the data were checked to ensure that no personally identifiable information or other sensitive information about individuals or schools remained in the dataset.

The school administration questionnaire focused not on the respondent's own ocean and water literacy, but on project implementation, organisation, perceived results, and overall evaluation. It included a section on basic project information, a section on activities actually carried out in the school, and sections on project outcomes and general satisfaction. Collecting information on implemented activities directly from schools was important. The teacher questionnaire provided complementary insight into how the interventions functioned in practice. As the main coordinators of project activities, teachers were asked to reflect on student participation, project delivery, perceived results, challenges encountered, and overall satisfaction. Together, these two instruments made it possible to characterise the educational interventions more

accurately and to assess the results and impact of ProBleu-funded projects on children's and adolescents' ocean and water literacy.

For analysis, both **quantitative and qualitative content analysis** methods were applied. SurveyMonkey's built-in tools were used for initial processing and descriptive analysis, while MAXQDA was employed for the qualitative analysis of open-ended responses. The data from school administration and teachers' interviews should be seen as complementary to the student-focused monitoring tools described in other sections of the report: while student surveys capture learning-related outcomes more directly, interviews with school administrators and teachers provide essential evidence on how the interventions were organised, delivered, and experienced in practice.

3.3. Ethical Considerations

The research was approved by the Kaunas University of Technology Research Ethics Committee on 29 April 2024 (Protocol No. M6-2024-08). The ethical framework of the study addressed several key issues, including the handling of potentially sensitive information, informed consent procedures, the prevention of negative consequences for participants, and the management of any risks or adverse effects that might arise during the research process.

The study was designed to minimise data sensitivity. No personal or special-category data were collected. The only identifying information gathered was the name of the school, which was needed in order to link questionnaire responses with project-related contextual information, such as the type and themes of the activities implemented. The research team reviewed the data matrix for any potentially sensitive content, including open-ended responses, before any data sharing took place. ProBleu partners and schools received only links to the online questionnaires and did not have direct access to the raw data. The survey dataset was prepared following good metadata documentation practices based on the DDI standard, and, after removal of school-identifying responses, the student survey data will be prepared for deposit in the Lithuanian Data Archive for Social Sciences and Humanities (LiDA) as a trusted repository.

Participating schools were informed from the outset that the results of the study could be used in a separate results report, research publications, conference presentations, science communication activities, media dissemination, and an open data repository. It was clearly stated that only aggregated data would be used in reporting and dissemination, and that neither individuals nor specific schools would be identifiable in any publication or presentation of the findings. Information about the study was provided to schools as part of the documentation package sent to schools that had received ProBleu funding. The Research Information Form included the name, telephone number, and email address of the principal investigator, as well as the contact details of the Kaunas University of Technology Research Ethics Committee, so that participants could seek clarification or raise concerns if necessary. By implementing ProBleu-funded projects, schools agreed to participate in the research; however, participation remained voluntary, and schools as well as individual participants retained the right to withdraw without consequences.

Schools were informed that they could opt out of the study at any time and could also manage refusals from pupils or other community members. If an entire school chose not to participate, it simply did not complete the questionnaires. If an individual pupil or community member declined to participate, this refusal was handled by the school, and the person was not taking the survey or interview. Participants who chose to stop after beginning an online questionnaire could simply discontinue completion and close the browser window. Because SurveyMonkey had been configured not to collect IP addresses or other personal identifiers, researchers could not trace individual respondents. Once a questionnaire had been completed and submitted anonymously, withdrawal was no longer technically possible, as the completed response could not be linked to an identifiable person.

The study design did not present any tangible risks to participants. Schools were not expected to face any specific harm as a result of participation. At the same time, schools remained responsible for securing the necessary consent procedures required for implementing open schooling activities with pupils, in line with national and institutional practice in their own country. These consent arrangements typically formed part of the school's general educational procedures.

A potential practical risk identified by the research team was that some students might have difficulty understanding survey questions or completing the online questionnaire independently. To mitigate this, the Teacher's Guide stated that teachers could provide clarification where needed and, in cases where a pupil's individual needs prevented independent completion, could assist by entering the pupil's responses into the online survey. An additional mitigation measure was the translation of questionnaires into relevant national languages. The research team also considered the need to document any adverse events or unintended consequences observed during the project. For this reason, the questionnaires for school administration representatives and teachers included open-ended items allowing respondents to comment freely and to report any negative effects or concerns. These comments were not limited to issues arising from participation in the research itself, but also covered any adverse effects associated with the implementation of the educational projects.

4. Empirical Evaluation Results

4.1. Analytical Purpose and Scope

The primary objective of the analyses presented in this deliverable is to assess changes in students' ocean and water literacy following participation in ProBleu-supported educational activities. Building on the conceptual and measurement framework established in Deliverable 5.1, the analyses focus on key dimensions of literacy, including knowledge, awareness, attitudes, behavioural intentions, and emotional connection to aquatic environments. Also, it presents results on the open schooling methods, evaluating the open schooling methods before and after the intervention.

Given the structure of the data collection, the analytical strategy is designed to provide comparative evidence between pre-intervention and post-intervention measurements, rather than causal estimates of intervention effects at the individual level. The surveys were

administered in two waves—prior to and following the implementation of ProBleu activities—but responses are not linked at the individual level. As a result, it is not possible to track changes within the same students over time.

Instead, the analyses aim to capture aggregate differences between pre- and post-intervention samples within participating schools, offering an indication of potential shifts in literacy outcomes associated with exposure to the programme. This approach is consistent with a quasi-experimental one-group pre-post intervention design implemented under real-world conditions, where participation, timing, and response patterns vary across schools and countries.

Importantly, the results should be interpreted as differences between two cross-sectional samples collected at different time points, rather than as within-individual change. While this limits the strength of causal inference, the design allows for the examination of broad patterns of change across a large and diverse set of educational contexts, providing valuable insights into the potential impact of the ProBleu initiative. At the same time, it is important to acknowledge that participant recruitment was facilitated through existing school networks and institutional contacts, which may introduce elements of network clustering or a snowball-like access pattern. This has implications for the representativeness of the sample and is therefore taken into account when interpreting the findings.

The analyses are conducted at the level of individual survey items, with additional aggregation across items to reflect the broader dimensions of ocean and water literacy. This dual approach enables both fine-grained interpretation of specific indicators and a more general assessment of changes across key domains identified in Deliverable 5.1. Given the nature of the data, these observed differences should be understood as socially and institutionally situated patterns rather than purely individual-level shifts.

4.2. Sample and Analytical Strategy

The analytical sample consists of students from schools that provided responses in both the pre-intervention and post-intervention survey waves. This restriction ensures that comparisons are made within a consistent set of participating schools, thereby aligning the analytical sample with the intended evaluation framework of the project.

Across the available data, this results in a sample of schools that contributed at least one response in each wave. While the number of respondents varies across schools and between waves, all available student responses within these schools are included in the analyses. This approach maximizes the use of available information while maintaining a consistent institutional basis for comparison.

The analyses are conducted using pooled respondent-level data, comparing distributions of responses between pre-intervention and post-intervention samples. In practical terms, this involves treating the two waves as independent cross-sections and examining differences in proportions, means, or other relevant summary statistics for each item and dimension.

Given that different students may have responded in each wave, and that the number of respondents per school may be small in some cases, the results should be interpreted with

caution. Specifically, observed differences may reflect not only changes associated with the intervention, but also variation in sample composition across waves, including differences in the types of students who responded or in response rates across schools.

No additional restrictions based on country-level sample size are imposed in the analytical sample. While some countries contribute relatively small numbers of observations, all eligible schools are retained in order to reflect the full scope of participation in the project. Country-level results, where presented, should therefore be interpreted in light of these differences in sample size.

Descriptive statistics presented in this report are based on the same analytical sample used for the pre-post comparisons. This decision was taken to ensure consistency and clarity for the reader, avoiding the use of multiple samples within the same report. Analyses based on the full dataset—including schools that participated in only one wave—may be explored in future research outputs once data collection is complete.

Overall, the analytical strategy prioritizes transparency, consistency, and feasibility within the project timeline, while remaining closely aligned with the conceptual framework and evaluation objectives of the ProBleu initiative.

4.3. Results by Dimension

4.3.1. Knowledge and awareness

Questions of knowledge and awareness are aimed at measuring the basic understanding of the concepts related to oceans and fresh waters. Awareness also includes the knowledge about possible solutions and behaviours towards these solutions, and it might indicate the behavioural intentions; however, it is not necessarily transferred to environmental behaviours (Kollmuss and Agyeman, 2002).

Questions for primary and secondary school students (Table 5) included three wrong answers and one correct answer. The level of difficulty was adapted to the children's age group, and the questions assessed knowledge of different aspects of ocean and water literacy (for the full conceptualisation of the ProBleu questionnaires, please see Deliverable 5.1). At the end of the survey, children were introduced to the correct answers.

Table 5. Questions in the knowledge dimension

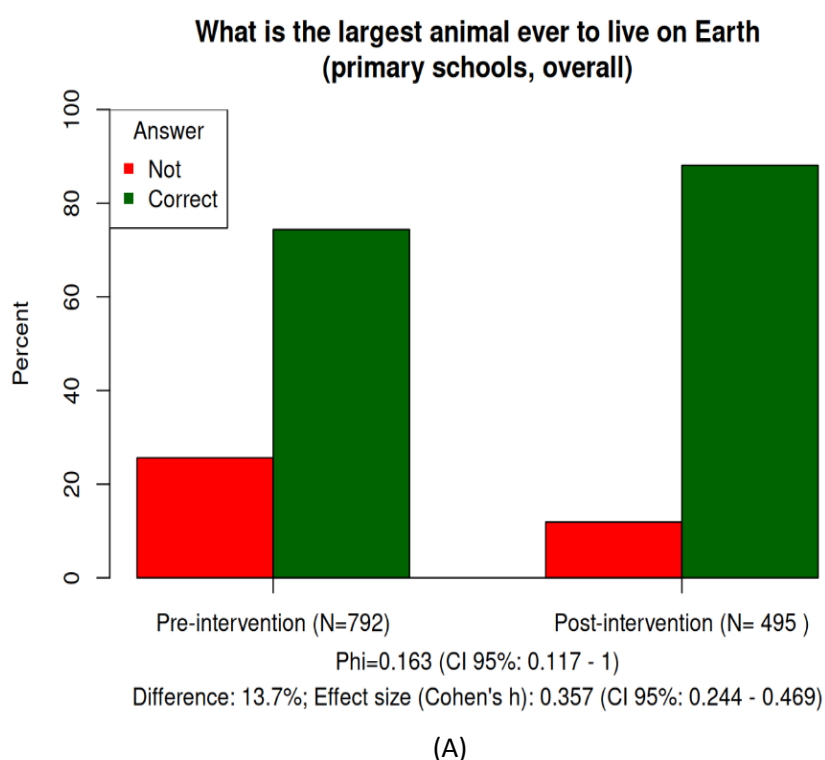
Primary School	Secondary School
Where is most of the water on Earth ☐ In the atmosphere ☐ In polar ice caps ☐ In rivers and lakes ☐ **In the ocean	Where is most of the water on Earth? ☐ In the atmosphere. ☐ In polar ice caps. ☐ In rivers and lakes. ☐ **In the ocean.
What is the largest animal ever to live on Earth? ☐ Giant squid ☐ Woolly mammoth ☐ **Blue whale ☐ Gigantosaurus	Both land and ocean provide space for organisms to live. How much of Earth's living space is found in the ocean? ☐ Only a little bit (less than 10%). ☐ About half (40–60%). ☐ More than half (60–80%).
What is the largest Ocean in the world? ☐ Atlantic Ocean	☐ **Nearly all (more than 90%).

☐ **Pacific Ocean ☐ Indian Ocean ☐ Arctic Ocean	How is climate change impacting the Arctic? ☐ The impact on the Arctic is the same as on the rest of the planet. ☐ **The Arctic is warming faster than the rest of the planet. ☐ Glaciers are melting in some parts of the Arctic and growing in other parts. ☐ Tropical ocean fishes are migrating to the Arctic.
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** correct answers

Primary School Knowledge

Primary schools demonstrated a strong knowledge trend across all three assessed categories, characterized by substantial increases in correct responses following the school projects. For the question concerning the location of most water on Earth, student performance improved from 85.2% pre-intervention to 91.3% post-intervention, which is a gain of 6.1 percentage points. Knowledge of the largest animal ever to live on Earth also showed significant improvement, as correct responses rose from 74.4% to 88.1%, reflecting a gain of 13.7 percentage points. The most significant growth occurred regarding the largest ocean in the world, where correct answers increased from 56.6% to 77.0%, resulting in a notable gain of 20.4 percentage points.



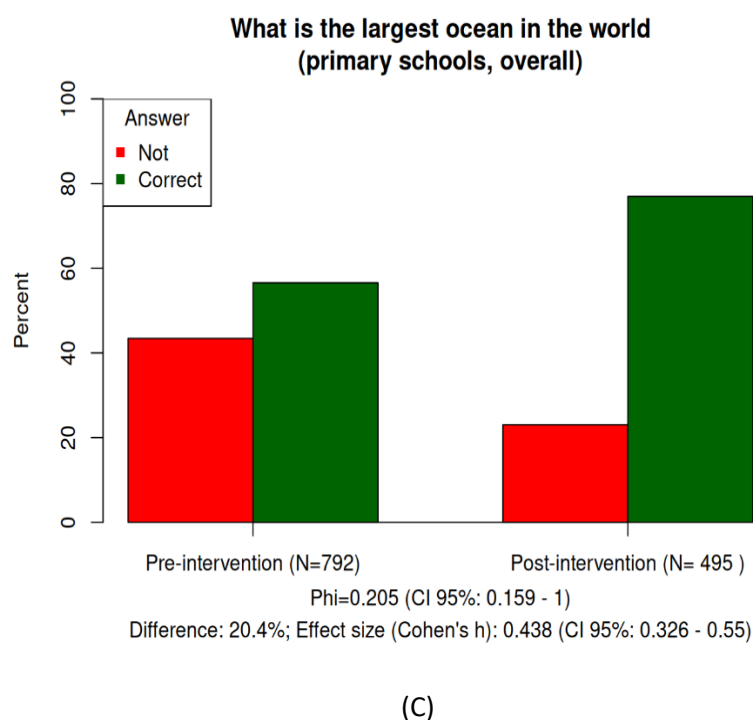
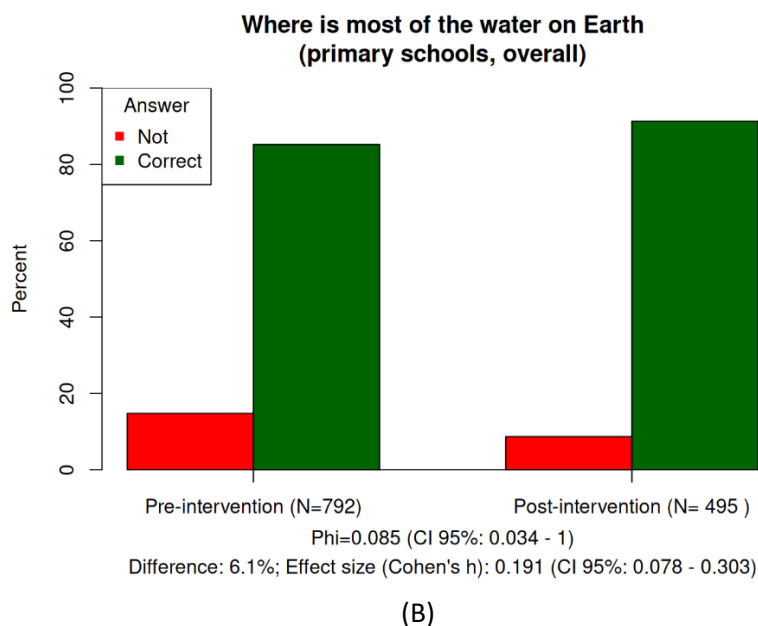


Figure 1 (a-c). Knowledge change in primary school samples, pre- and post- intervention

Secondary Schools

Secondary school students exhibited more modest improvements across the assessed categories, including one minor decline in performance. Specifically, for the question regarding where most of the water on Earth is located, correct answers saw a slight decrease from 87% pre-intervention to 86.7% post-intervention, representing a drop of 0.3 percentage points. In contrast, knowledge regarding how much of Earth's living space is found in the ocean improved from 31.2% to 38.0%, which is a gain of 6.8 percentage points. Finally, understanding of how

climate change is impacting the Arctic also increased, with correct responses rising from 47.7% to 52.8%, resulting in a gain of 5.1 percentage points.

Comparing the two groups (primary and secondary) reveals distinct patterns in how the intervention affected different age groups (Table 6):

- **Knowledge Baselines:** On the shared question regarding the location of Earth's water, secondary students initially had a higher percentage of correct answers (87%) compared to primary students at 85.2%.
- **Effectiveness of Intervention:** The intervention appeared more effective for primary school students, who achieved gains as high as 20.4 percentage points, whereas the highest gain for secondary students was 6.8 percentage points.
- **Final Outcomes:** By the post-intervention phase, primary students outperformed secondary students on the shared question about the location of Earth's water, reaching 91.3% correct compared to the secondary students' 86.7%.
- **Knowledge Difficulty:** Secondary school questions generally dealt with more complex topics, such as Arctic climate change and ocean living space, where initial correct response rates were lower (under 50%) than the questions posed to primary students.

Table 6. Comparison of impacts of intervention in primary and secondary schools

Knowledge Question	School Level	Pre-Intervention (in %)	Post-Intervention (in %)	Change (pp)
Where is most of the water on Earth?	Primary	85.2	91.3	+6.1
Where is most of the water on Earth?	Secondary	87.0	86.7	-0.3
Largest animal ever to live on Earth	Primary	74.4	88.1	+13.7
Largest ocean in the world	Primary	56.6	77.0	+20.4
Earth's living space in the ocean	Secondary	31.2	38.0	+6.8
Climate change impacts on the Arctic	Secondary	47.7	52.8	+5.1

Awareness

The dimension of awareness of ocean and water literacy includes items on biodiversity, the impact of humans on waters and actions to protect marine ecosystems (Table 7). It is important to note that surveys assess self-reported awareness, which can differ significantly from actual knowledge levels.

Table 7. Questions in Awareness dimension

Primary School	Secondary School
How much do you know about...? Animals and plants in the rivers, lakes, oceans, and seas ☐ Know a lot ☐ Know something ☐ Nothing	Please indicate, how much do you feel you know about: Biodiversity in rivers, lakes, oceans, and seas ☐ Nothing at all/ ☐ A little/ ☐ Quite a lot/ ☐ A great deal

☐ Not sure Pollution of the rivers, lakes, oceans, and seas ☐ Know a lot ☐ Know something ☐ Nothing ☐ Not sure What can be done by people to protect rivers, lakes, oceans, and seas ☐ Know a lot ☐ Know something ☐ Nothing ☐ Not sure	Impact of human activities on rivers, lakes, oceans, and seas ☐ Nothing at all/ ☐ A little / ☐ Quite a lot/ ☐ A great deal Actions to protect rivers, lakes, oceans, and seas ☐ Nothing at all/ ☐ A little / ☐ Quite a lot / ☐ A great deal
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The data indicate a significant positive trend in awareness across all measured dimensions for both primary and secondary school students following the intervention. In general, there is a clear shift from students knowing "something" or "a little" to knowing "a lot" or "a great deal."

Primary schools

The most substantial growth in primary schools occurred in the "A lot" category across all three topics (Figure 2 and 3 and Table 8). Awareness of biodiversity has positively increased. The percentage of students reporting they know "a lot" about aquatic plants and animals increased from 24.6% to 36.2%, representing a 11.6-percentage-point increase. On the contrary, those knowing only "something" decreased by 10.9 points. Awareness of Human Impacts was also impacted by school projects. Knowledge of water pollution increased significantly in the "a lot" category, rising from 27.9% to 42.2% (+14.3 percentage points). The most significant improvement can be seen in the awareness about water protection. Students who felt they knew "a lot" about protecting water bodies jumped from 38.9% to 56.4%, a substantial 17.5-percentage-point increase.

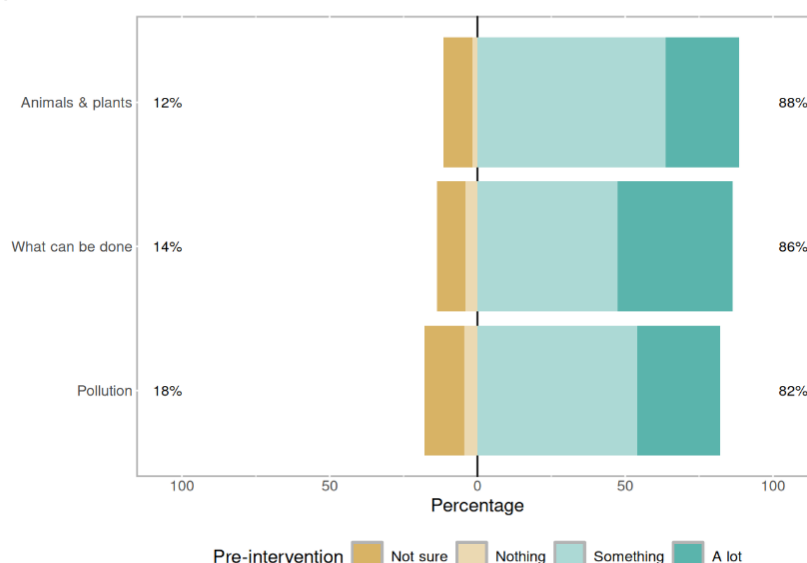


Figure 2. Awareness dimension. Pre-intervention results among students of primary schools

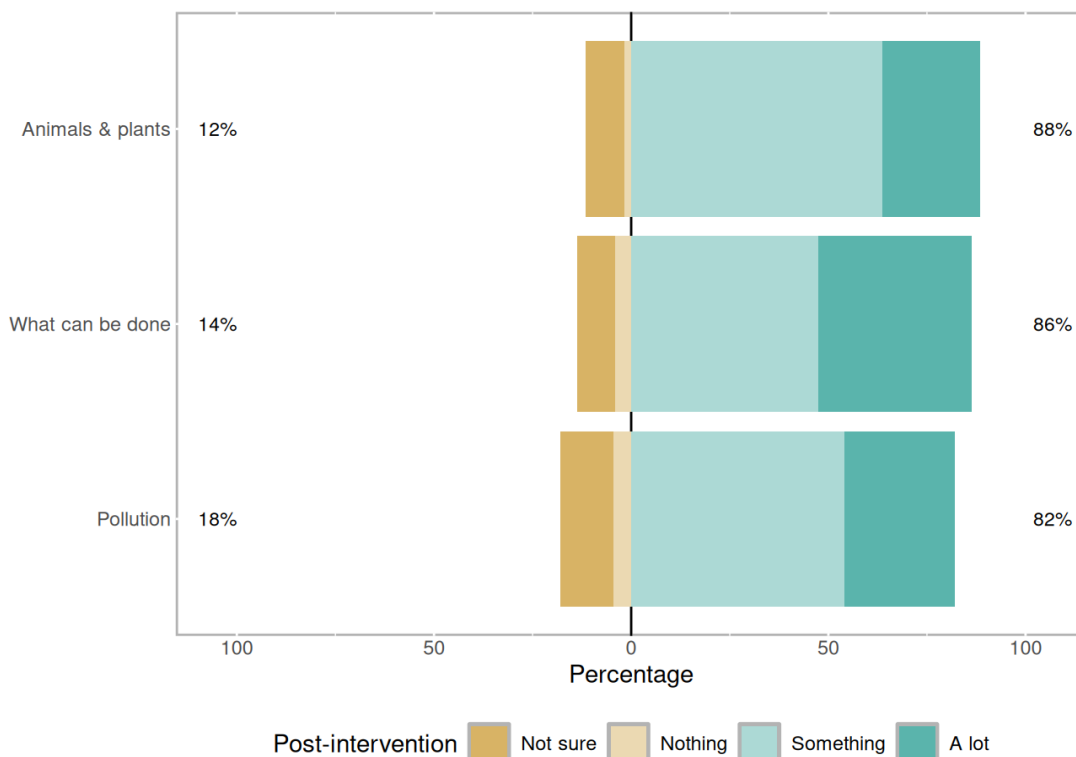


Figure 3. Awareness dimension. Post – intervention distribution among primary schools students

Table 8. The changes in awareness in primary schools

Awareness about biodiversity (How much do you know about animals and plants in the rivers, lakes, oceans, and seas: Pre- vs. Post-intervention)		
	Pre-intervention	Post-intervention
Not sure	9.8	8.9
Nothing	1.8	2.0
Something	63.8	52.9
A lot	24.6	36.2
Awareness about human impacts on the waters (How much do you know about pollution of the rivers, lakes, oceans, and seas: Pre- vs. Post-intervention).		
	Pre-intervention	Post-intervention
Not sure	13.5	11.5
Nothing	4.4	3.4
Something	54.2	42.8
A lot	27.9	42.2
Awareness about water protection (How much do you know about what can be done by people to protect rivers, lakes, oceans, and seas: Pre- vs. Post-intervention).		
	Pre-intervention	Post-intervention
Not sure	9.6	7.7
Nothing	4.0	4.8
Something	47.5	31.1
A lot	38.9	56.4

Secondary schools

The level of awareness among secondary school children is lowest in the self-reported knowledge about diversity (only 29.1% identified that they know “quite a lot”, and only 6%

think they know “a great deal”). The highest level of awareness before the intervention was of human impacts. Combined share of those saying they know “quite a lot” or “a great deal” was 59.8%.

Secondary school trends are coherent with the results from primary schools, with a consistent positive change toward higher levels of self-reported knowledge (“Quite a lot” and “A great deal”): Awareness about Biodiversity: The percentage of students feeling they know “a great deal” nearly doubled, rising from 6.0% to 11% (+5 percentage points). Those knowing “quite a lot” also grew from 29.1% to 37% (+7.9 percentage points). Awareness about human Impacts: Students reporting they know “a great deal” about human impacts increased from 14.2% to 23.1% (+8.9 percentage points). Those knowing “a little” or “nothing at all” saw a combined decrease of 9.6 percentage points. Awareness about protection: Knowledge regarding actions to protect water bodies showed strong growth in the “a great deal” category, increasing from 13.8% to 22.3% (+8.5 percentage points).

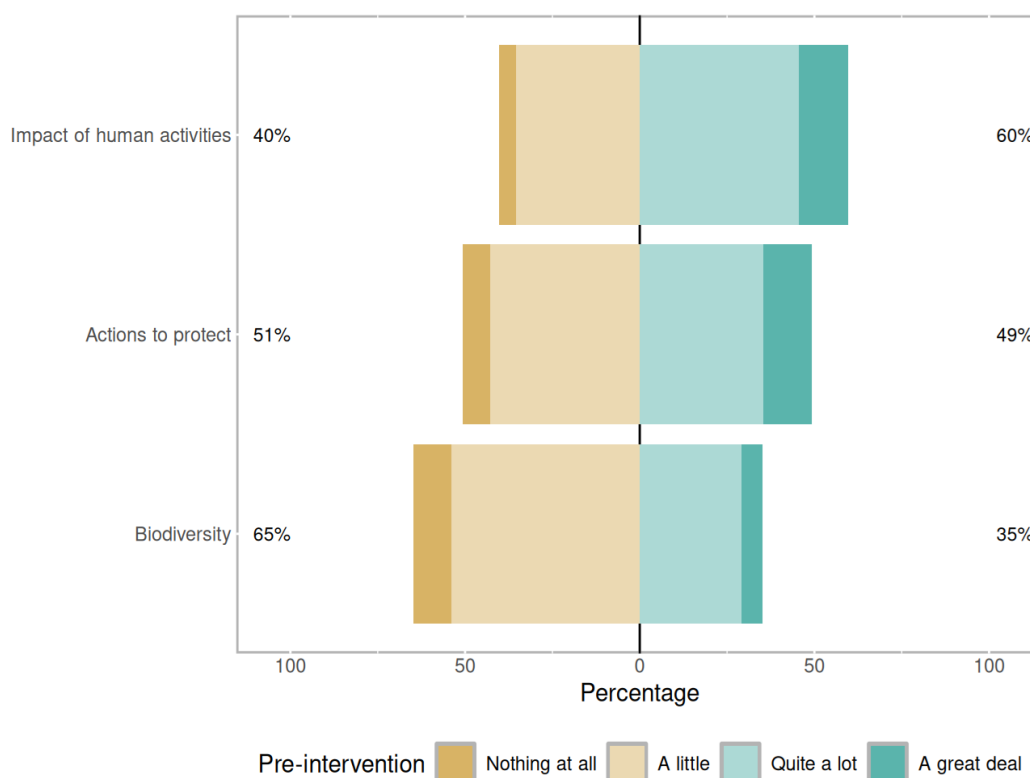


Figure 4. Awareness dimension. Pre-intervention distribution among secondary school students

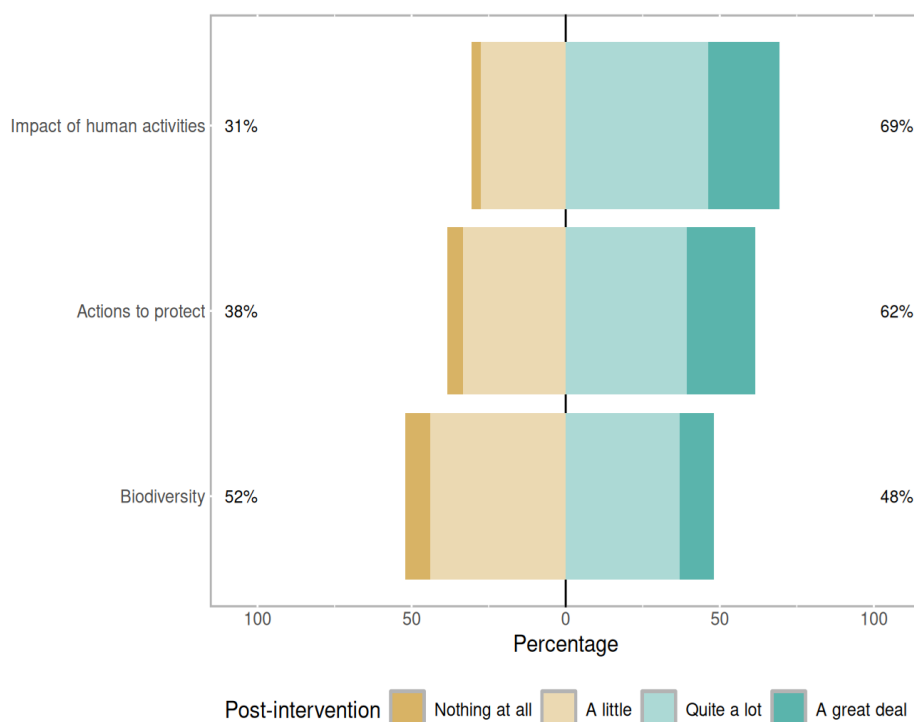


Figure 5. Awareness dimension. Post-intervention results among the students from secondary schools

Table 9. Changes in awareness in secondary schools, in %

Awareness about biodiversity: (How much you feel you know about: Biodiversity in rivers, lakes, oceans, and seas: Pre- vs. Post-intervention)		
	Pre-intervention	Post-intervention
Nothing at all	10.9	8
A little	54.0	44
Quite a lot	29.1	37
A great deal	6.0	11
Awareness about human impacts on waters: (How much you feel you know about: Impact of human activities on rivers, lakes, oceans, and seas: Pre- vs. Post-intervention)		
	Pre-intervention	Post-intervention
Nothing at all	4.8	3.0
A little	35.4	27.6
Quite a lot	45.6	46.3
A great deal	14.2	23.1
Awareness about protection: (How much you feel you know about: Actions to protect rivers, lakes, oceans, and seas Pre- vs. Post-intervention)		
	Pre-intervention	Post-intervention
Nothing at all	8.0	5.1
A little	42.8	33.4
Quite a lot	35.4	39.2
A great deal	13.8	22.3

Overall, the water awareness, or in other words, blue consciousness, had increased significantly as a result of school projects. The intervention was most effective in increasing awareness of protection measures, particularly in primary schools, where over half of respondents (56.4%) reported knowing "a lot" post-intervention, compared with 38.9% beforehand (Table 10).

Table 10: Summary of change in awareness dimension in primary and secondary schools, in %

Dimension	Primary ("A lot") Change	Secondary ("A great deal") Change
Biodiversity	+11.6	+5.0
Human Impacts	+14.3	+8.9
Protection	+17.5	+8.5

4.3.2. Attitudes

The dimension of attitudes in the measurement of water literacy focuses on the internal efficacy of children (see Table 11).

Table 11. Questions in the Attitudes dimension

Primary School	Secondary School
Thinking about rivers, lakes, oceans, and seas, we want to know what you feel you can do to help keep them clean and safe. For each statement below, choose the answer that best matches how you feel. I believe I can help keep rivers, lakes, and oceans clean by doing small things every day - ☐ Yes, I believe I can - ☐ I'm not sure if I can - ☐ No, I don't believe I can When I learn about ways to protect our water, I feel like I can make a difference - ☐ Yes, I feel like I can make a difference - ☐ Sometimes I feel like I can make a difference - ☐ No, I don't feel like I can make a difference I can tell my friends and family why it's important to save water and protect our oceans and rivers - ☐ Yes, I can tell them - ☐ Maybe, I might be able to tell them - ☐ No, I can't tell them	Considering the importance of rivers, lakes, oceans, and seas, we're curious about your thoughts on contributing to their cleanliness and safety. For the following statements, please select the option that best reflects your opinion. I feel confident in my ability to make positive choices that benefit the health of oceans, rivers, lakes, and seas - ☐ Strongly disagree - ☐ Disagree - ☐ Neither agree nor disagree - ☐ Agree - ☐ Strongly agree I believe my actions, no matter how small, can have a positive impact on protecting water environments - ☐ Strongly disagree - ☐ Disagree - ☐ Neither agree nor disagree - ☐ Agree - ☐ Strongly agree I think I can effectively communicate the importance of water conservation to others and inspire them to take action - ☐ Strongly disagree - ☐ Disagree - ☐ Neither agree nor disagree - ☐ Agree - ☐ Strongly agree

Internal efficacy in this context means believing that you can personally make a meaningful contribution to protecting the marine environment. It reflects the idea that individual actions can have a positive impact. Examples include recycling, saving water, reducing waste, or taking part in environmental activism. When children have a strong sense of internal efficacy, they are often more motivated to engage in conservation efforts because they believe their actions can make a real difference.

Primary schools

ProBleu survey results indicate that, among primary school children, the strongest support was for items reflecting a sense of empowerment and self-agency (See Figure 6 and Table 12). 76.4% pre and 76.9% post-survey respondents believe that they can help keep rivers, lakes, and oceans clean by doing small things every day (Table 13). The sense of empowerment remained unchanged after the school projects. A small change was observed in measuring confidence in the ability to communicate environmental issues (Table 14). While there was a slight shift in those who felt they could tell friends and family about saving water (increasing from 76.7% to 82.2%), the core "No" response remained virtually unchanged at 2.3% pre-intervention versus 2.4% post-intervention. Thus, the shift was from those who indicated "maybe" before the interventions. Marine attitudes in primary schools show the weakest expression on the confidence-in-making-a-difference dimension (Table 14). Only 38.9% of children in primary schools indicated "yes" to the statement that they can make a difference when they learn about ways to protect water. However, school projects had a significant impact on this aspect of self-efficacy. Students who felt they could "make a difference" rose from 38.9% to 52.6%, a significant increase of 13.7%. And those who only felt this way "sometimes" dropped from 54.2% to 41.5% (-12.7%).

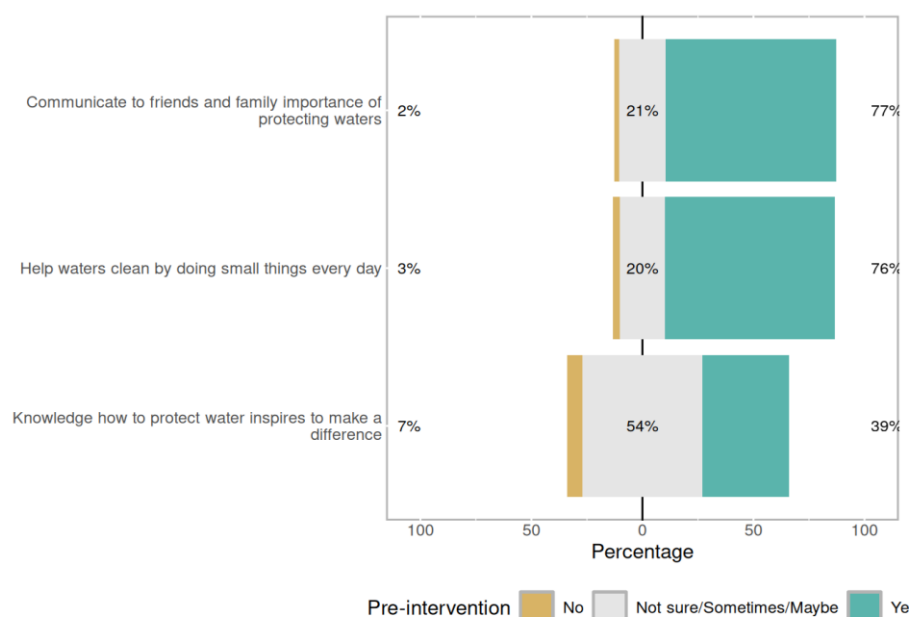


Figure 6: The level of self-efficacy in primary schools

Table 12. The sense of empowerment and self - agency in primary schools (I believe I can help keep rivers, lakes, and oceans clean by doing small things every day: Pre- vs. Post-intervention), in %

	Pre-intervention	Post-intervention
No	3.1	3.8
Not sure	20.5	19.2
Yes	76.4	76.9

Table 13. The confidence in the ability to communicate environmental issues (I can tell my friends and family why it's important to save water and protect oceans and rivers: Pre- vs. Post-intervention), in %

	Pre-intervention	Post-intervention
No	2.3	2.4
Maybe	21.0	15.4
Yes	76.7	82.2

Table 14. The confidence in making a difference in primary schools (When I learn about ways to protect our water, I feel like I can make a difference: Pre- vs. Post-intervention), in %

	Pre-intervention	Post-intervention
No	6.9	5.9
Sometimes	54.2	41.5
Yes	38.9	52.6

Secondary schools

Results from secondary schools indicate that the strongest elements of internal self-efficacy are the sense of empowerment (Table 15) and confidence in making a difference in protecting water environments (Table 16). The perceived ability to influence others through communication is weakest among the elements (Table 17). In the first two dimensions, there was no significant change after the school projects in secondary schools. Confidence in making positive choices for water health remained at the same level (71.0% in pre- and 70.7% in post-survey). Those who disagreed increased slightly from 6.7% to 9.1% (+2.4%). The belief that small actions have a positive impact saw a minor increase from 67.2% to 68.9% (+ 1.7%). Those who disagreed remained nearly the same (10.8% and 11.2%). The school's projects had a small impact on communication confidence. Students who felt they could effectively communicate the importance of conservation increased slightly from 55.9% to 60.2% (+4.3%). There was a corresponding 5.7% decrease in those who felt neutral (Neither agree nor disagree).

Table 15. The sense of empowerment and self – agency in secondary schools (I feel confident in my ability to make positive choices that benefit the health of waters: Pre- vs. Post-intervention), in %

	Pre-intervention	Post-intervention
(Strongly) disagree	6.7	9.1
Neither agree nor disagree	22.3	20.2
(Strongly) agree	71.0	70.7

Table 16. The confidence in making a difference in secondary schools (I believe my actions, no matter how small, can have a positive impact on protecting water environments: Pre- vs. Post-intervention), in %

	Pre-intervention	Post-intervention
(Strongly) disagree	10.8	11.2
Neither agree nor disagree	22.1	19.9
(Strongly) agree	67.2	68.9

Table 17. The confidence in the ability to communicate environmental issues (I think I can effectively communicate the importance of water conservation and inspire to take action: Pre- vs. Post-intervention), in %

	Pre-intervention	Post-intervention
(Strongly) disagree	10.8	12.2
Neither agree nor disagree	33.3	27.6
(Strongly) agree	55.9	60.2

The attitude dimension of blue literacy had not evidenced a significant impact of the school project. The data indicate that the intervention had a more measurable impact on primary students' sense of empowerment than on any aspect of self-efficacy. for secondary students. The 13.7% increase in primary students feeling they can "make a difference" far outpaced any positive shift in the secondary cohort, with the largest increase in communication effectiveness at only 4.3%. Both groups showed stability in their belief in personal impact with no significant changes. It can be noted that there was also no significant change in the groups that expressed negative attitudes. In both age cohorts, the "No" or "Disagree" categories remained very stable.

4.3.3. Behaviours

Questions in the dimension of behavior focus on assessing concrete behaviors, reducing water pollution, and measuring direct experiences with water (Table 18).

Table 18. Questions in the Behaviours dimension

Primary School	Secondary School
In the past week, how often do you make sure to turn off the tap tightly after using it? ☐ Almost never ☐ Sometimes ☐ Almost always 14. In the past week, how often did you turn off the water while you were brushing your teeth? ☐ Almost never ☐ Sometimes ☐ Almost always 15. In the last month, how often have you talked about oceans, seas, rivers and lakes with your friends or family? ☐ Not at all ☐ A little ☐ A lot How many times did you visit these places in the last year? 17a. Ocean ☐ Never or more ☐ Once ☐ Twice ☐ Three times 17b. River ☐ Never or more ☐ Once ☐ Twice ☐ Three times 17c. Lake ☐ Never or more ☐ Once ☐ Twice ☐ Three times	9. In the past week, how often do you make sure to turn off the faucet tightly after using it to avoid wasting water? - ☐ Never - ☐ Rarely - ☐ Sometimes - ☐ Most of the time - ☐ Always 10. In the past week, how often do you choose to take shorter showers to save water? - ☐ Never - ☐ Rarely - ☐ Sometimes - ☐ Most of the time - ☐ Always 11. In the last month, how often have you had conversations with friends or family about the ocean, seas, rivers, and lakes? - ☐ Never - ☐ Rarely - ☐ Sometimes - ☐ Most of the time - ☐ Always How many times did you visit these places in the last year?

17d.Sea ☐ Never ☐ Once ☐ Twice ☐ Three times or more 18. [IF THEY DON'T SAY NEVER TO ALL 17 a-d] Have you done any of these things when you saw trash in or near water? Choose all the actions you really did. ☐ Picked it up and threw it in the trash ☐ Told an adult about it so they could help remove it ☐ Leave it because I don't think I should touch it ☐ I haven't seen trash in or near water recently	13a. Ocean ☐ 0 times/ ☐ 1-2 times / ☐ 3-5 times/ ☐ More than 5 times 13b. River ☐ 0 times/ ☐ 1-2 times/ ☐ 3-5 times/ ☐ More than 5 times 13c. Lake ☐ 0 times/ ☐ 1-2 times/ ☐ 3-5 times/ ☐ More than 5 times 13d. Sea ☐ 0 times/ ☐ 1-2 times/ ☐ 3-5 times/ ☐ More than 5 times 14. [IF THEY DON'T SAY 0 TIMES TO 13 a-d] When you've seen trash in or near water, like a river, lake, or the ocean, which of the following have you actually done? Select all that apply. ☐ Picked it up and disposed of it properly ☐ Informed an adult so they could take care of it ☐ Didn't touch it, feeling unsure about whether I should ☐ Haven't noticed any trash in or near water lately
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Primary school students

As shown in Figure 7, primary school students report high levels of engagement in everyday water-related behaviours, with distributions strongly concentrated in the highest frequency categories. For turning off the tap tightly after use, the pre-intervention distribution is already skewed toward frequent behaviour, with 67.9% reporting “almost always”, 19.5% “sometimes”, and only a small minority in the lowest categories. A similar pattern is observed for turning off water while brushing teeth. In the pre-intervention sample, 77.7% report “almost always”, with very small shares in “almost never.”

This suggests that this behaviour is already widely adopted among primary students. In contrast, communication about water-related topics shows a more dispersed distribution. In the pre-intervention sample, 37.2% report “almost never”, 49.0% “sometimes”, and 13.7% “almost always”, indicating that regular discussion is less common. This wider spread across categories highlights greater variability in engagement.

For pro-environmental action when encountering trash near water (Figure 8), responses are also heterogeneous. In the pre-intervention sample, 55.8% report that they have picked up the trash, 23.9% told an adult, and 20.3% left it, indicating that while a majority took direct action, a sizeable minority did not.

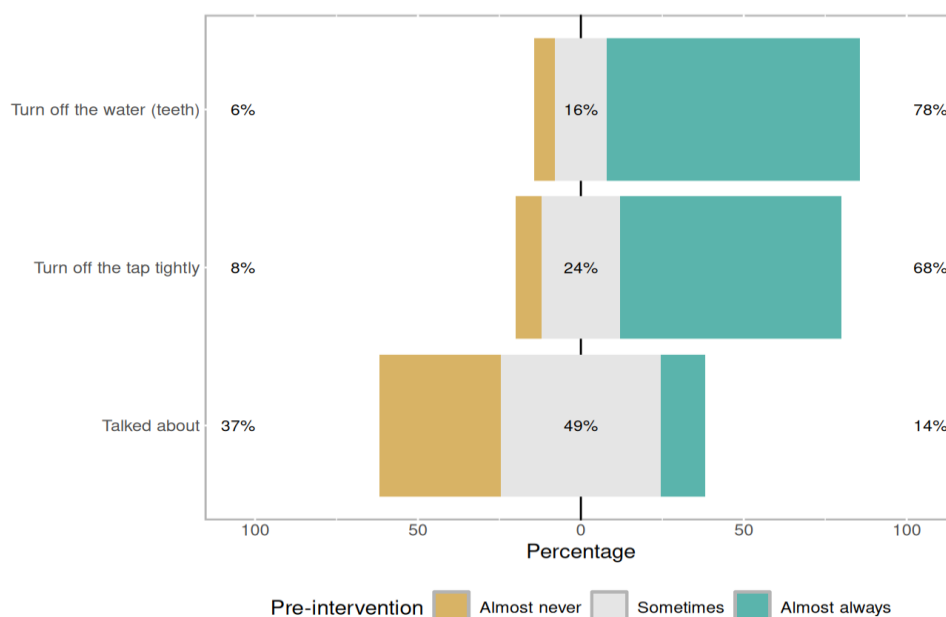


Figure 7. Pre-intervention distribution of everyday water-related behaviours among primary school students

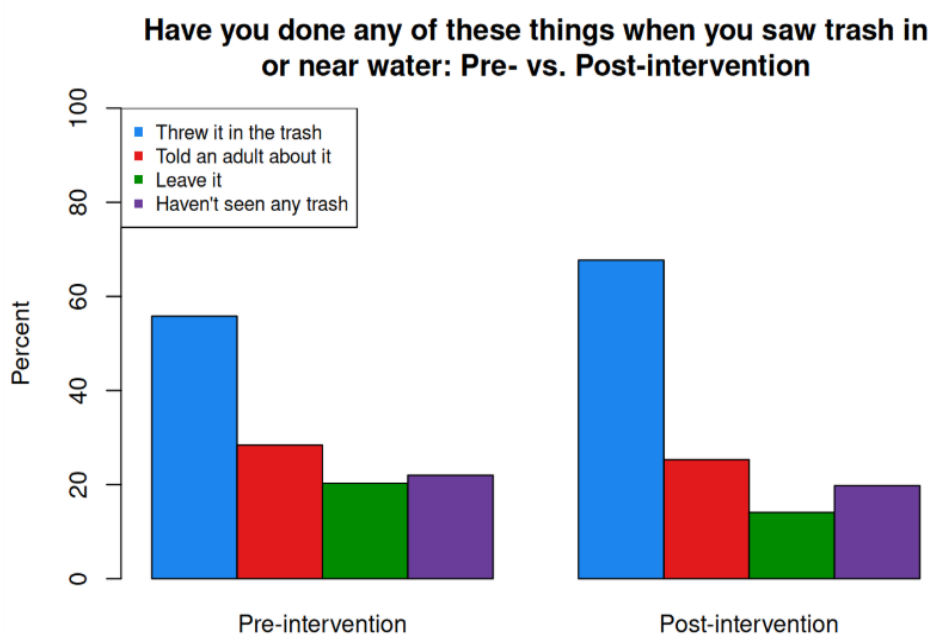


Figure 8. Pre-intervention distribution of pro-environmental action when encountering trash near water among primary school student.

Patterns for visits to water environments show substantial variation. For example, in Figure 9 (ocean visits), 42.7% report no visits in the past year, while smaller shares report one or multiple visits. In contrast, visits to lakes and rivers are more evenly distributed, with notable shares across all frequency categories, possibly reflecting differences in geographical access rather than behavioural preference.

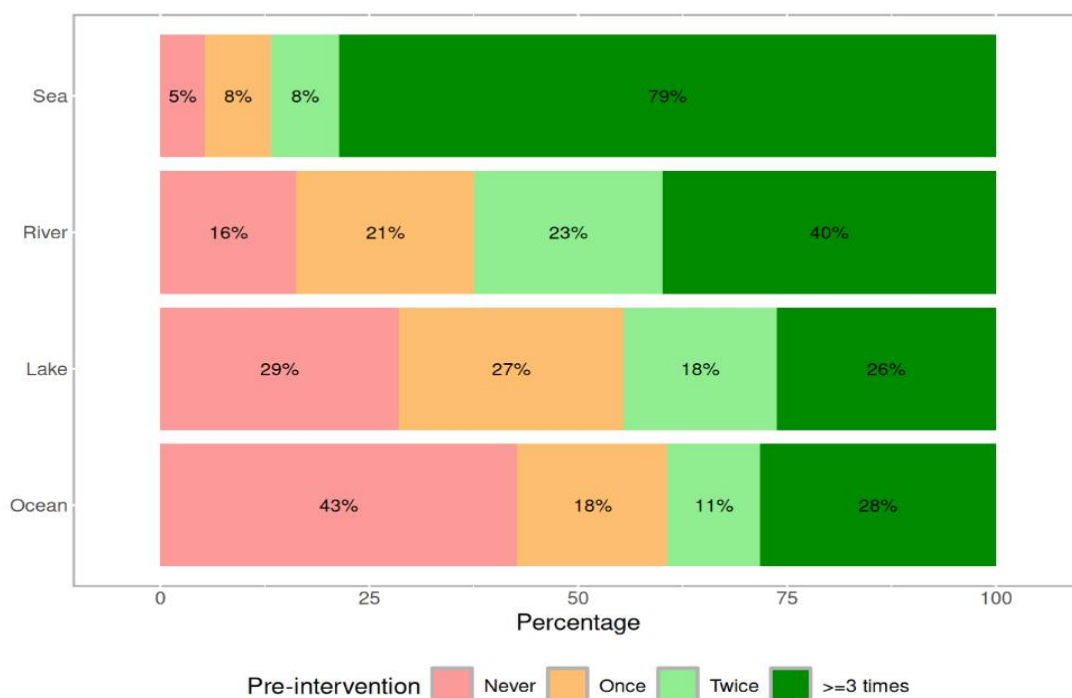


Figure 9. Pre-intervention distribution of visits to water bodies among primary school students

Comparisons between pre- and post-intervention samples indicate modest but consistent shifts, particularly in behaviours that are already relatively common. The clearest change is observed in turning off the tap tightly after use. Table 19 shows that the share reporting “almost always” increases from 67.9% to 77.1%, while “sometimes” decreases from 24.2% to 17.6%, and “almost never” declines as well. This shift reflects a consolidation of behaviour toward the highest frequency category. For turning off water while brushing teeth, changes are smaller but follow the same direction. The share reporting “almost always” increases from 77.7% to 81.0%, with slight reductions in intermediate categories, indicating incremental improvement in an already widespread habit. More pronounced changes are observed in communication behaviours. The proportion reporting “almost never” discussing water-related topics decreases from 37.2% to 28.0%, while “almost always” increases from 13.7% to 18.2%, and “sometimes” increases slightly as well. This reflects a redistribution from low to higher engagement categories.

Table 19: Pre-and post-intervention distributions of everyday water-related behaviours among primary school students, in %

<i>In the past week, how often did you make sure to turn off the tap tightly)</i>		
	Pre-intervention	Post-intervention
Almost never	8.0	5.3
Sometimes	24.2	17.6
Almost always	67.9	77.1
<i>In the past week, how often did you turn off the water while you were brushing your teeth</i>		
	Pre-intervention	Post-intervention
Almost never	6.4	4.3
Sometimes	15.9	14.7
Almost always	77.7	81.0

<i>In the last month, how often have you talked about oceans, seas, rivers and lakes with your friends or family:</i>		
	Pre-intervention	Post-intervention
Almost never	37.2	28.0
Sometimes	49.1	53.8
Almost always	13.7	18.2

For pro-environmental action (Figure 19), the share of students reporting that they would pick up trash increases from 55.8% to 67.7%, while the proportion indicating they would leave it declines from 20.3% to 14.1%. The share reporting they would tell an adult decreases slightly, suggesting a shift toward more direct action.

Results for visits to water environments (Table 20) are less consistent. For example, with regards to lakes, the share reporting no visits declines from 28.5% to 21.5%, with increases in higher-frequency categories. However, with regards to ocean visits, the proportion reporting no visits increases from 42.7% to 49.1%, while higher-frequency categories decline. Similar mixed patterns are observed for rivers and seas, indicating no clear directional change.

Table 20: Pre- and post-intervention distribution of visits to water bodies among primary school students, in %

<i>How many times did you visit in the last year: Ocean</i>		
	Pre-intervention	Post-intervention
Never	42.7	49.1
Once	18.0	15.7
Twice	11.0	9.1
>=3 times	28.2	26.1
<i>How many times did you visit in the last year: River</i>		
	Pre-intervention	Post-intervention
Never	16.3	13.7
Once	21.2	24.4
Twice	22.5	25.1
>=3 times	39.9	36.9
<i>How many times did you visit in the last year: Lake</i>		
	Pre-intervention	Post-intervention
Never	28.5	21.5
Once	26.9	29.2
Twice	18.3	21.1
>=3 times	>=3 times	>=3 times
<i>How many times did you visit in the last year: Sea</i>		
	Pre-intervention	Post-intervention
Never	5.3	7.9
Once	8.0	9.1
Twice	8.1	9.9
>=3 times	78.6	73.1

Overall, the results for primary students point to small but coherent improvements, particularly in routine water-saving behaviours, communication, and direct pro-environmental action. Changes are characterized by shifts toward higher-frequency categories rather than large redistributions. By contrast, behaviours related to visits to water environments show inconsistent patterns, reflecting factors beyond the immediate scope of the intervention.

Secondary school students

As shown in Figure 10, behavioural patterns among secondary school students are more evenly distributed across response categories, indicating greater heterogeneity than among primary students. For turning off the tap tightly after use, 48.5% report “always” in the pre-intervention sample, with substantial shares in “most of the time” and “sometimes”, suggesting less concentration at the top of the scale compared to primary students. For taking shorter showers to save water, responses are also dispersed. No single category dominates, with meaningful shares across “sometimes,” “most of the time,” and “always”, indicating variability in behaviour. In communication behaviours, 34.3% report “never” discussing water-related topics in the pre-intervention sample, while the remaining responses are distributed across increasing frequency categories. This suggests that a substantial portion of students are not regularly engaged in these discussions.

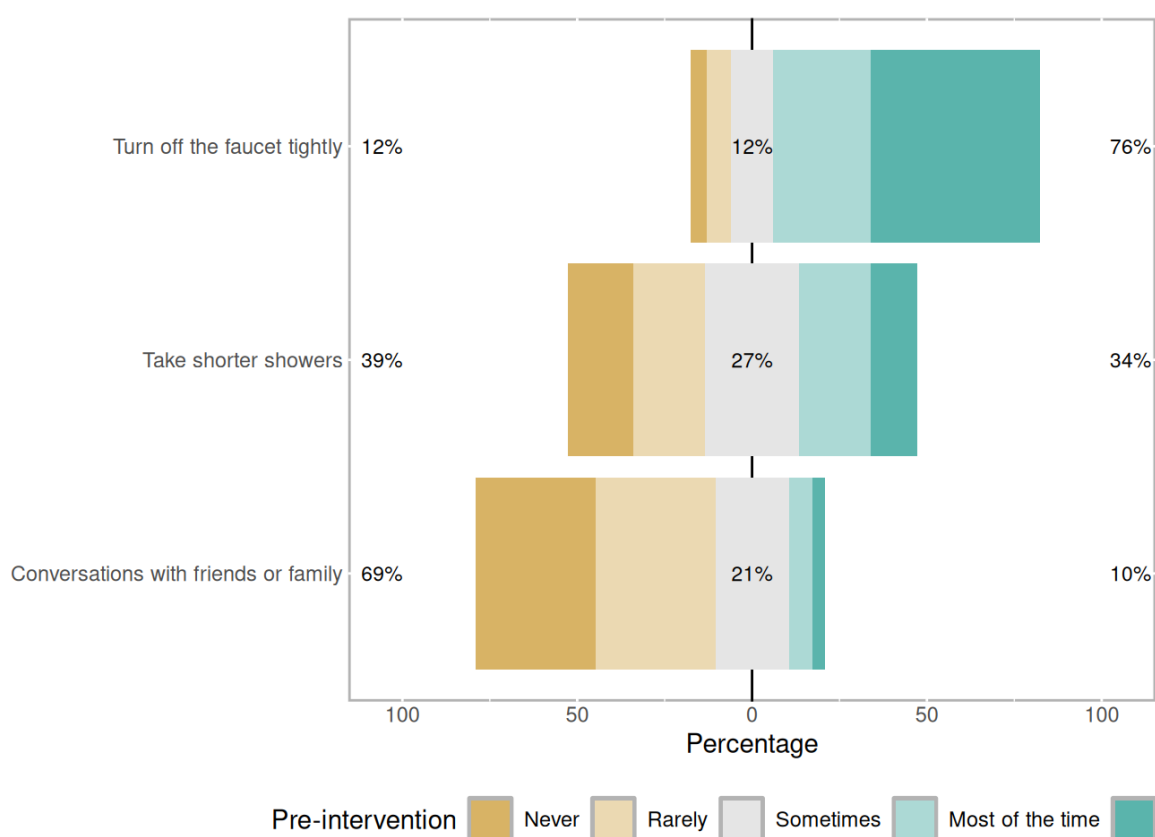


Figure 10: Pre-intervention distribution of everyday water-related behaviours among secondary school students.

Patterns for visits to water environments again show wide variation. For example, in Figure 11, for ocean visits, 48.9% of students report no ocean visits in the past year in the pre-intervention sample, making this the largest category by a wide margin. Another 24.1% report 1–2 visits, while smaller shares report 3–5 visits (9.1%) or more than 5 visits (18.0%). The pattern for river visits is somewhat different, as contact with rivers appears more frequent and more evenly distributed. In the pre-intervention sample, only 17.4% report 0 visits, while the most common category is 1–2 visits (36.3%). A further 21.8% report 3–5 visits, and 24.6% report more than 5 visits, indicating that a substantial share of students have repeated

exposure to rivers. For lake visits, in the pre-intervention sample, 24.5% report 0 visits, 36.9% report 1–2 visits, 18.2% report 3–5 visits, and 20.4% report more than 5 visits. Thus, the most common category before the intervention is 1–2 visits, but the other categories also account for substantial shares. The pattern for sea visits is the most distinctive of all four environments. Before the intervention, a majority of students—56.6%—report visiting the sea more than 5 times in the past year. Smaller shares report 0 visits (10.8%), 1–2 visits (17.5%), and 3–5 visits (15.1%).

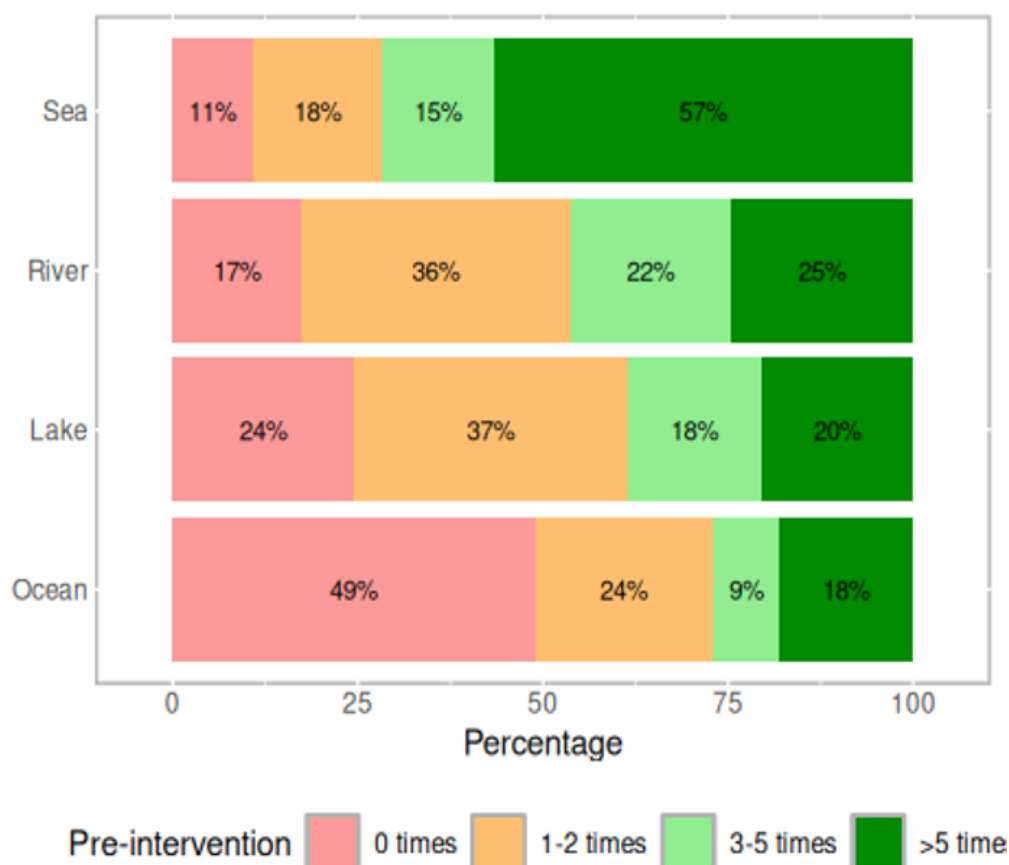


Figure 11: Pre-intervention distribution of visits to water bodies among secondary school students.

Pre-post comparisons for secondary students indicate limited changes in routine behaviours, with somewhat clearer shifts in communication. The sample consisted of $N = 766$ in the pre-survey and $N = 489$ in the post-survey. Table 21 shows, for turning off the tap tightly after use, the share reporting “always” decreases slightly from 48.5% to 46.0%, while “most of the time” increases marginally, suggesting a minor redistribution rather than a clear improvement. A similar pattern is observed for taking shorter showers in Table 21, where small increases in intermediate categories are not accompanied by substantial changes in the highest category. In contrast, communication behaviours in Table 21 show more consistent change. The proportion reporting “never” decreases from 34.3% to 28.1%, while “sometimes,” “most of the time,” and “always” all increase, indicating a shift toward more frequent engagement.

Table 21: Pre-and post-intervention distributions of everyday water-related behaviours among secondary school students, in %

<i>In the past week, how often turned off the faucet tightly after using it</i>		
	Pre-intervention	Post-intervention
Never	4.7	6.1
Rarely	6.9	7.3
Sometimes	12.2	11.4
Most of the time	27.8	29.3
Always	48.5	46.0
<i>In the past week, how often took shorter showers</i>		
	Pre-intervention	Post-intervention
Never	18.7	20.5
Rarely	20.6	18.5
Sometimes	27.0	24.1
Most of the time	20.5	22.9
Always	13.2	14.0
<i>In the last month, how often had conversations with friends or family about the ocean, seas, rivers, and lakes</i>		
	Pre-intervention	Post-intervention
Never	34.3	28.1
Rarely	34.3	31.5
Sometimes	21.0	26.4
Most of the time	6.7	8.3
Always	3.7	5.8

Results for visits to water environments are again mixed. Among the four environments, lakes show one of the clearest shifts toward more frequent visits, with movement away from the lowest and lower-middle categories and toward the highest frequency category. In Table 22, for lakes, the share reporting more than five visits increases from 20.4% to 24.9%, while no visits decline from 24.5% to 21.2%. However, for seas, the share reporting more than five visits decreases from 56.6% to 47.5%, with increases in lower-frequency categories. This indicates a redistribution away from the highest category toward the lower and middle categories. In other words, while sea visits remain common overall, they appear less concentrated at the very high end in the post-intervention sample. Additionally, patterns for oceans and rivers show only minor variation, with nearly half of students in both waves reporting no visits to the ocean at all and only small shifts across the remaining categories, and very modest shift toward somewhat more frequent river visits, although the overall distribution remains largely similar across waves.

Table 22: Pre- and post-intervention distribution of visits to water bodies among secondary school students, in %

<i>How many times did you visit in the last year: Ocean</i>		
	Pre-intervention	Post-intervention
0 times	48.9	47.8
1-2 times	24.1	23.3

3-5 times	9.1	11.4
>5 times	18.0	17.5
<i>How many times did you visit in the last year: River</i>		
	Pre-intervention	Post-intervention
0 times	17.4	15.3
1-2 times	36.3	35.7
3-5 times	21.8	23.4
>5 times	24.6	25.6
<i>How many times did you visit in the last year: Lake</i>		
	Pre-intervention	Post-intervention
0 times	24.5	21.2
1-2 times	36.9	33.8
3-5 times	18.2	20.1
>5 times	20.4	24.9
<i>How many times did you visit in the last year: Sea</i>		
	Pre-intervention	Post-intervention
0 times	10.8	13.5
1-2 times	17.5	21.9
3-5 times	15.1	17.1
>5 times	56.6	47.5

For secondary students, the results indicate modest and selective changes, with clearer improvements in communication behaviours and limited shifts in routine water-saving habits. As in the primary sample, behaviours related to visits to water environments do not show a consistent pattern and are likely influenced by contextual factors.

Across both age groups, the Behaviour dimension shows modest but generally positive developments, particularly in communication about water-related topics and, among primary students, in direct pro-environmental actions. Changes in routine behaviours are smaller and primarily reflect incremental shifts within already established patterns, while indicators related to visits to water environments remain mixed and less clearly attributable to the intervention.

4.3.4. Emotional connection

Questions in the dimension of emotional connection focus on assessing concrete behaviors, reducing water pollution, and measuring direct experiences with water (Table 23).

Table 23. Questions in the Emotional connection dimension

Primary School	Secondary School
When you think about oceans, rivers, lakes, or seas, how much do you feel each of the following? [RANDOMIZE ITEMS] Inspired, feeling sparkly ☐ Not at All ☐ A Little ☐ A lot Excited, feeling happy ☐ Not at All ☐ A Little ☐ A lot Enthusiastic, feeling ready	When you think about oceans, rivers, lakes, or seas, how much do you feel each of the following? [RANDOMIZE ITEMS] Inspired, feeling sparkly ☐ Not at all ☐ A little ☐ Moderately ☐ Quite a bit ☐ Extremely Excited, feeling happy ☐ Not at all ☐ A little ☐ Moderately

☐ Not at All ☐ A Little ☐ A lot	☐ Quite a bit ☐ Extremely
Afraid, feeling scared	Enthusiastic, feeling ready
☐ Not at All ☐ A Little ☐ A lot	☐ Not at all ☐ A little ☐ Moderately
Upset, feeling sad	☐ Quite a bit ☐ Extremely
☐ Not at All ☐ A Little ☐ A lot	Afraid, feeling scared
Nervous, feeling worried	☐ Not at all ☐ A little ☐ Moderately
☐ Not at All ☐ A Little ☐ A lot	☐ Quite a bit ☐ Extremely
Feelings are powerful! 🧡 Now that we know how the ocean makes you feel, let's see what actions you take. What do you do to help our oceans and water?	Upset, feeling sad
	☐ Not at all ☐ A little ☐ Moderately
	☐ Quite a bit ☐ Extremely
	Nervous, feeling worried
	☐ Not at all ☐ A little ☐ Moderately
	☐ Quite a bit ☐ Extremely

Primary school students

Figure 12 shows that primary school students report predominantly positive emotional responses, with clear concentration in higher-intensity categories for several items. The distribution of students “feeling excited” is strongly skewed toward the upper end of the scale: around 45–50% of students report feeling “a lot” or “quite a lot”, while lower categories (“a little” or “not at all”) account for a much smaller share. A similar pattern is observed for “feeling inspired”, although with slightly more dispersion, with a noticeable share (around 20–25%) selecting “somewhat”, indicating moderate emotional engagement. For “feeling enthusiastic”, the distribution is more spread out: while higher categories remain prominent, lower-intensity responses and “I don’t know” together represent a sizeable minority (roughly 25–30%), suggesting that this emotion is less consistently experienced across students. In contrast, negative emotions are concentrated in the lowest categories. For example, over 60% of students report feeling “not at all” afraid or nervous, with only a small minority selecting “quite a lot” or “a lot.” This indicates that negative effect toward water environments is relatively limited. Overall, the figures indicate a profile characterized by strong positive emotions, limited negative emotions, and some variation in intensity across items.

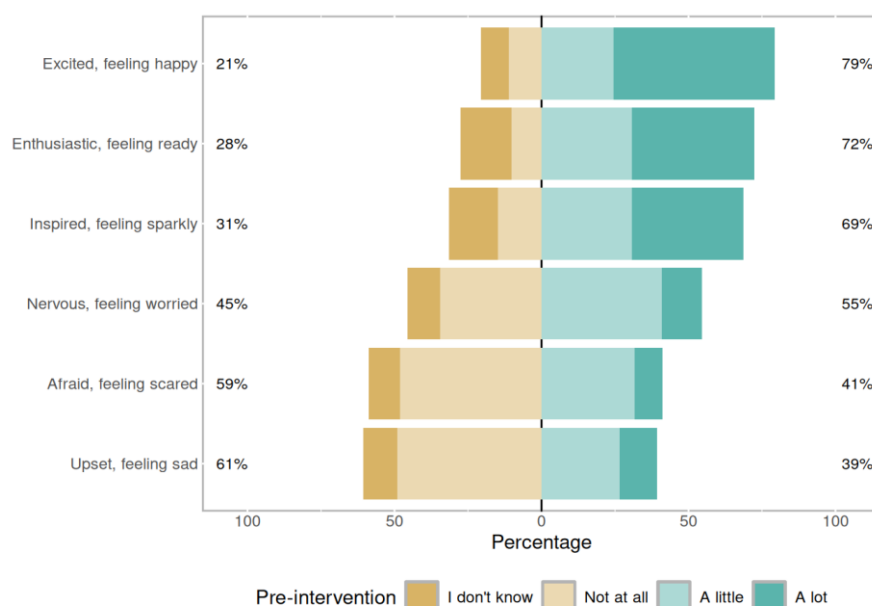


Figure 12. Pre-intervention distribution of emotions associated with water bodies among primary school students

Pre-post comparisons in Table 24 show small but consistent shifts toward stronger and more clearly defined emotional responses. The share of students reporting feeling excited “a lot” increases (e.g., from approximately 22% to around 28%), while “a little” decreases, indicating a shift toward higher emotional intensity. Similarly, there is a modest increase in the share of students feeling inspired “quite a lot” and “a lot” combined, accompanied by a reduction in mid-scale responses (“somewhat”). Additionally, a particularly clear pattern emerges in Table 24: the share of “I don’t know” responses declines (e.g., from roughly 12% to around 7–8%), while “quite a lot” increases, suggesting that students move from uncertainty toward more defined emotional positions. For negative emotions, changes are smaller but directionally consistent. The share of students reporting “not at all” increases slightly (e.g., from about 58% to 63%), while higher categories decline marginally. This indicates a small reduction in negative affect. Overall, the figures point to incremental strengthening of positive emotions and a reduction in uncertainty, rather than large shifts across categories.

Table 24. Pre- and post-intervention distribution of emotions associated with water bodies among primary school students, in %

<i>How much do you feel: Inspired, feeling sparkly</i>		
	Pre-intervention	Post-intervention
I don't know	16.5	14.7
Not at all	14.9	17.0
A little	30.7	30.1
A lot	37.9	38.2
<i>How much do you feel: Excited, feeling happy</i>		
	Pre-intervention	Post-intervention
I don't know	9.6	9.0
Not at all	11.1	10.4
A little	24.4	19.0
A lot	54.9	61.6
<i>How much do you feel: Enthusiastic, feeling ready</i>		
	Pre-intervention	Post-intervention
I don't know	17.4	12.1
Not at all	10.2	12.1
A little	30.7	27.8
A lot	41.6	48.1
<i>How much do you feel: Afraid, feeling scared</i>		
	Pre-intervention	Post-intervention
I don't know	10.6	8.6
Not at all	48.2	53.0
A little	31.8	29.2
A lot	9.4	9.2
<i>How much do you feel: Upset, feeling sad</i>		
	Pre-intervention	Post-intervention
I don't know	11.8	8.2
Not at all	49.0	55.6
A little	26.5	25.6

A lot	12.8	10.6
<i>How much do you feel: Nervous, feeling worried</i>		
	Pre-intervention	Post-intervention
I don't know	11.0	6.3
Not at all	34.5	44.2
A little	40.8	36.0
A lot	13.7	13.5

Taken together, data suggest that the intervention is associated with stronger and more clearly articulated positive emotional responses, alongside slightly reduced negative emotions. The most consistent pattern is not large redistribution, but rather movement from mid- and low-intensity categories toward higher-intensity responses, as well as a decline in “I don’t know” answers.

Secondary school students

Figure 13 shows a more even distribution of emotional responses among secondary school students, with less concentration in extreme categories. Students feeling excited are spread across categories: approximately 30–35% report “quite a lot” or “a lot”, while a similar share falls into “somewhat”, and a non-negligible proportion remains in “a little”. This contrasts with the stronger concentration observed among primary students. A similar pattern is observed for those feeling inspired by water bodies, where mid-scale responses dominate, indicating moderate emotional engagement rather than strong affect.

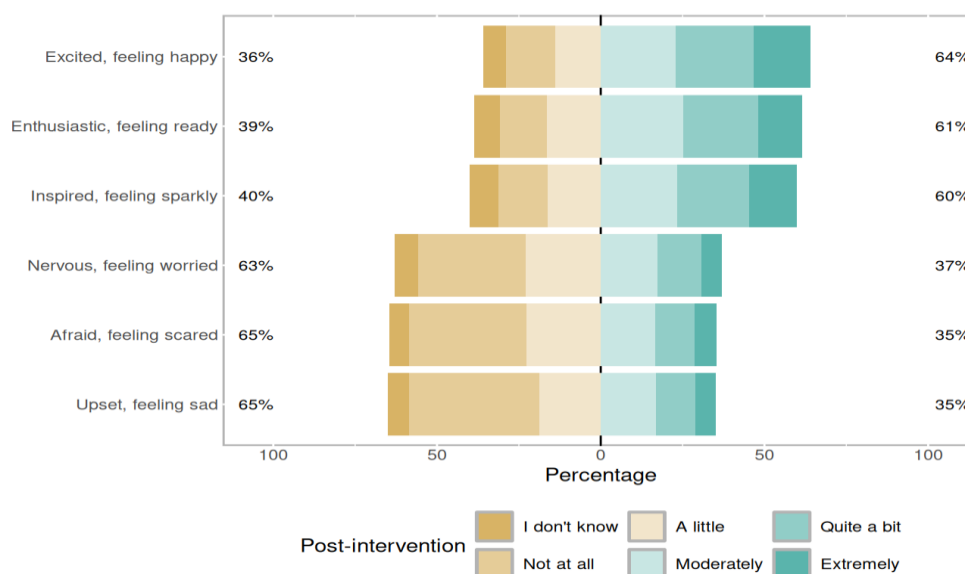


Figure 13. Post-intervention distribution of emotions associated with water bodies among secondary school students

For negative emotions, the majority of students report “not at all” or “a little” (around 65–70%), but there is slightly more dispersion than in the primary sample, with a larger share in “somewhat”, suggesting a broader range of emotional responses. Levels of uncertainty are generally lower than in primary students as “I don’t know” responses are below 10%, indicating that most students provide substantive answers. Overall, the figures show a profile

characterized by moderate and heterogeneous emotional engagement, with less clustering at the top of the scale.

Pre-post comparisons in Table 25 reveal modest shifts, primarily within adjacent categories rather than large redistributions. The share of students reporting feeling excited “quite a lot” increases slightly (e.g., from around 18% to 22%), while “somewhat” decreases, suggesting a small upward shift in intensity. However, the “a lot” category remains relatively stable, indicating limited movement at the top end. For feeling inspired, a similar pattern is observed: small increases in higher categories are offset by decreases in mid-scale responses, with overall changes remaining modest. There is a slight increase in the share of students reporting “not at all” feeling negative emotions (e.g., from ~52% to ~56%), accompanied by small declines in higher categories. This indicates a minor reduction in negative effect, although the magnitude of change is limited. Changes in uncertainty are minimal, with “I don’t know” responses remaining low and relatively stable across waves. Overall, the figures suggest broad but shallow changes, with no single indicator showing a strong shift.

Table 25. Pre- and post-intervention distribution of emotions associated with water bodies among primary school students, in %

<i>How much do you feel: Inspired, feeling sparkly</i>		
	Pre-intervention	Post-intervention
I don't know	8.9	6.9
Not at all	15.0	13.7
A little	16.2	15.8
Moderately	23.3	23.5
Quite a bit	22.1	20.1
Extremely	14.5	20.0
<i>How much do you feel: Excited, feeling happy</i>		
	Pre-intervention	Post-intervention
I don't know	7.0	4.7
Not at all	15.1	12.6
A little	13.8	14.3
Moderately	22.9	22.7
Quite a bit	23.8	24.9
Extremely	17.4	20.9
<i>How much do you feel: Enthusiastic, feeling ready</i>		
	Pre-intervention	Post-intervention
I don't know	7.8	6.6
Not at all	14.3	12.5
A little	16.5	16.4
Moderately	25.2	24.3
Quite a bit	22.9	21.6
Extremely	13.4	18.6
<i>How much do you feel: Afraid, feeling scared</i>		
	Pre-intervention	Post-intervention
I don't know	6.0	4.2

Not at all	35.8	37.0
A little	22.7	21.4
Moderately	16.6	16.1
Quite a bit	12.1	12.5
Extremely	6.8	8.8
<i>How much do you feel: Upset, feeling sad</i>		
	Pre-intervention	Post-intervention
I don't know	6.5	4.3
Not at all	39.8	38.1
A little	18.7	19.3
Moderately	16.9	17.4
Quite a bit	12.0	11.7
Extremely	6.1	9.0
<i>How much do you feel: Nervous, feeling worried</i>		
	Pre-intervention	Post-intervention
I don't know	7.3	4.8
Not at all	32.8	32.6
A little	22.9	20.1
Moderately	17.4	18.5
Quite a bit	13.3	13.6
Extremely	6.3	10.4

In sum, Table 25 indicate that, for secondary students, the intervention is associated with small increases in positive emotional intensity and slight reductions in negative affect, but changes remain limited and diffuse. Compared to primary students, shifts are less pronounced and more evenly distributed across categories, reflecting a more stable baseline.

Across both groups, the Emotional Connection dimension shows consistent directional changes in the figures, characterized by increases in higher-intensity positive emotions (e.g., “quite a lot,” “a lot”), declines in mid- or low-intensity categories, and reductions in uncertainty (“I don’t know”), particularly among primary students. At the same time, the magnitude of change remains modest, with most shifts occurring between adjacent categories rather than across the full scale. The figures therefore support an interpretation of incremental strengthening and clarification of emotional engagement, rather than substantial transformation.

4.3.5. Communication

In the dimension of communication in Probleu questionnaire (Table 26), the main question focuses on the sources from where schoolchildren gained information about oceans, seas, rivers, lakes, and their inhabitants. The question is the same for both samples, with only slight differences in the answer categories to better suit the different age groups.

Table 26. Questions in Communication dimension

Primary School	Secondary School
In the last month , where did you learn about the ocean, seas, rivers, and lakes and its animals and	In the last month , from which of the following sources have you gained information about

plants? Pick all the places you've really learned from. [Randomize response categories] ☐ Watching TV shows or documentaries ☐ Reading books or magazines ☐ Exploring websites or online videos ☐ Checking out posts and videos on social media ☐ In school, from my teachers or school projects ☐ Talking with my family or friends ☐ Other: _____ (please specify) Thinking about oceans, seas, rivers, and lakes, how interested are you to learn more about them? - ☐ Really interested - ☐ A little interested - ☐ Not much interested [If "Really interested!" or "A little interested" to Q28] How would you like to explore and find out more? Pick up to three ways that sound like the most fun to you! [Randomize response categories] - ☐ In our school classes with our teachers - ☐ Visiting a university or a laboratory where scientists study water - ☐ Learning from cool posts and videos about water on social media - ☐ By looking through magazines with cool pictures - ☐ Reading big books with lots of pictures - ☐ Watching exciting documentaries on TV - ☐ Playing games on the computer - ☐ Going to science museums or special water exhibitions - ☐ Playing board games that teach me about water - ☐ Going on real adventures to places like the ocean or a river - ☐ Working on a project with kids from other classes or schools, or even people from your town - ☐ Something else (What is it?): _____	oceans, seas, rivers, lakes, and their inhabitants? Select all the sources you've actually learned from. - ☐ Watching TV shows or documentaries - ☐ Reading books or magazines - ☐ Browsing websites or watching online videos - ☐ Scrolling through posts and videos on social media - ☐ At school, through lessons or projects assigned by teachers - ☐ In conversations with family or friends - ☐ Other (please specify): _____ How interested are you to learn more about oceans, seas, rivers, and lakes? ☐ Not at all/ ☐ A little / ☐ Moderately/ ☐ Quite a bit/ ☐ Extremely [If "A little", "Moderately", "Quite a bit", "Extremely" in Q28] What are the coolest ways you'd like to discover more about water bodies? Choose up to three options that sound most exciting to you! [Randomize response categories] ☐ Through classes at school with our teachers ☐ By visiting universities or labs where scientists dive deep into water studies ☐ Checking out awesome water-related posts and videos on social media ☐ Flipping through magazines filled with amazing water photos ☐ Diving into big, picture rich books about water ☐ Watching thrilling documentaries on TV ☐ Getting into computer games focused on water themes ☐ Exploring science museums or water-themed exhibitions ☐ Playing board games that flow with water facts ☐ Embarking on real-life water adventures to the ocean, rivers, or lakes ☐ Collaborating on projects with peers from other classes, schools, or community members ☐ Other (please specify): _____
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The intervention appears to have strengthened the role of formal education as a primary source of information (See Tables 27 and 28).

Primary Schools students

There was a significant increase in students learning from school teachers or projects, rising from 68.7% to 78.2% (a change of +9.5%). The interest in digital sources as a source of information has also increased, with "websites or online videos" increasing as a source from 19.1% to 29.3% (+10.2%), and social media rising from 23.6% to 30.3% (+6.7%). On the other hand, traditional sources, such as the use of books or magazines, declined from 34.3% to 28.1% (-6.2%).

Table 27. Preferred sources of information about waters in primary schools pre- vs. post-intervention, in %

Learned about the ocean, seas, rivers, and lakes from: Pre- vs. Post-intervention		
	Pre-intervention	Post-intervention
TV	46.6	45.9
Books or magazines	34.3	28.1
Websites or online videos	19.1	29.3
Social media	23.6	30.3
School teachers or projects	68.7	78.2
Family or friends	34.0	30.7
Other	14.3	11.3

Secondary Schools students

Similar to primary schools, school lessons or projects were supported more after ProBleu school projects, moving from 58.7% to 66.9% (+8.2%). Unlike primary school students, secondary school students reported a decrease in the use of social media for this information, dropping from 51.7% to 42.9% (-8.8%). There was also a decrease in TV usage from 41.7% to 35.6% (-6.1%).

Table 28. Preferred sources of information about waters in secondary schools pre- vs. post-intervention, in %

Got information about the ocean, seas, rivers, and lakes from: Pre- vs. Post-intervention		
	Pre-intervention	Post-intervention
TV	41.7	35.6
Books or magazines	13.5	15.5
Websites or online videos	31.2	34.7
Social media	51.7	42.9
School lessons or projects	58.7	66.9
Family or friends	19.0	19.8

Preferences for how students want to learn also shifted, generally favoring classroom engagement and collaborative work (See Tables 29 and 30).

Primary School Preferences

The desire to learn "in school with teachers" saw a sharp increase from 21.2% to 30.7% (+9.5%). Working on projects with others also became more popular, rising from 8.6% to 12.9% (+4.3%). While "going on real adventures outside" remained the most popular preference overall, there was no significant change after the school project. Interest in visiting museums or exhibitions fell from 27.8% to 22.4% (-5.4%).

Table 29. Preferred ways to find out more about oceans, seas, rivers, and lakes: Pre- vs. Post-intervention in primary schools, in %

	Pre-intervention	Post-intervention
In school with teachers	21.2	30.7
Visiting university or laboratory	18.3	19.6
Learning from social media	12.8	12.7
From magazines	7.4	8.3
From books with pictures	17.4	14.1

Watching documentaries on TV	24.7	25.3
Playing computer games	21.3	22.0
Visiting museums or exhibitions	27.8	22.4
Playing board games	21.1	20.4
Going on real adventures outside	42.0	41.2
Working on a project with others	8.6	12.9
Other	4.7	5.7

Secondary School Preferences

Learning "in school with teachers" increased from 16.7% to 20.8% (+4.1%), and working on projects with others rose from 13.9% to 16.9% (+3.0%). Similar to primary students, their preference for outdoor adventures remained high but decreased from 38.5% to 34.9% (-3.6%)

Table 30. Preferred ways to discover more about oceans, seas, rivers, and lakes: Pre- vs. Post-intervention in secondary schools, in %

	Pre-intervention	Post-intervention
In school with teachers	16.7	20.8
Visiting university or laboratory	23.1	22.8
Learning from social media	20.4	18.2
From magazines	5.5	6.5
From books with pictures	7.2	7.6
Watching documentaries on TV	23.3	20.5
Playing computer games	19.1	18.7
Visiting museums or exhibitions	26.4	27.1
Playing board games	15.5	16.4
Going on real adventures outside	38.5	34.9
Working on projects with others	13.9	16.9
Other	2.1	3.8

In general, both age groups are really interested in learning more about waters (See Tables 31 and 32). General interest in water-related topics remained largely stable across both groups despite the school projects.

Primary Schools:

The percentage of students who are "really interested" in learning more stayed nearly identical, moving from 61.6% to 61.4% (-0.2%).

Secondary Schools:

Interest levels showed very little fluctuation. Those who were "extremely" interested moved from 16.0% to 16.2% (+0.2%), while those "quite a bit" interested went from 30.3% to 30.1% (-0.2%)

Table 31. How interested to learn more about oceans, seas, rivers, and lakes: Pre- vs. Post-intervention in primary schools, in %

	Pre-intervention	Post-intervention
Not much interested	6.6	8.0
A little interested	31.8	30.6
Really interested	61.6	61.4

Table 32. How interested to learn more about oceans, seas, rivers, and lakes: Pre- vs. Post-intervention in secondary schools, in %

	Pre-intervention	Post-intervention
Not at all	6.2	7.7
A little	18.7	19.0
Moderately	28.8	27.1
Quite a bit	30.3	30.1
Extremely	16.0	16.2

Table 33 presents a comparison of changes in information sources used by respondents at the primary and secondary school levels, highlighting how preferences have evolved following the implementation of project activities.

The results show that school lessons and projects experienced a substantial increase in both groups, with a +9.5% change among primary school students and +8.2% among secondary school students, indicating a strengthened role of formal education as a key source of information about oceans and waters. Similarly, websites and online videos demonstrate the largest increase among primary school students (+10.2%) and a moderate increase among secondary school students (+3.5%), reflecting the growing importance of digital resources, particularly for younger learners. In the case of social media, a positive change is observed among primary school students (+6.7%), whereas a notable decrease is recorded among secondary school students (-8.8%), suggesting differing patterns of engagement with social media across age groups. Traditional information sources show mixed trends. Books or magazines decrease among primary school students (-6.2%) but increase slightly among secondary school students (+2.0%), indicating a potential shift in how these resources are valued across age groups. Television declines in both groups, with a marginal decrease in primary schools (-0.7%) and a more pronounced decline in secondary schools (-6.1%), pointing to its reduced relevance as an information source. Family or friends show a decrease among primary school students (-3.3%) and a slight increase among secondary school students (+0.8%), suggesting that informal information channels remain relatively stable but less prominent overall.

Table 33. Comparison of Changes in Information Sources, in %

Information Source	Primary school: Change	Secondary school: Change
School Lessons/Projects	+9.5	+8.2
Websites / Online Videos	+10.2	+3.5
Social Media	+6.7	-8.8
Books or Magazines	-6.2	+2.0
TV	-0.7	-6.1
Family or Friends	-3.3	+0.8

Table 34 presents a comparison of changes in preferred learning methods among respondents at the primary and secondary school levels, highlighting how learning preferences have evolved following the implementation of project activities. The results indicate that learning in school with teachers shows the most significant positive change in both groups, with an increase of +9.5% among primary school students and +4.1% among secondary school students, underlining the strengthened role of formal, teacher-led education. Similarly, projects with others demonstrate positive changes in both groups (+4.3% in primary and +3.0% in secondary

schools), suggesting increased appreciation for collaborative and participatory learning approaches. In contrast, museums or exhibitions show a decrease among primary school students (-5.4%) but a slight increase among secondary school students (+0.7%), indicating differing engagement with experiential learning environments across age groups. Real adventures outside decline in both groups (-0.8% in primary and -3.6% in secondary schools), suggesting a reduced preference for outdoor experiential learning within the observed period. Digital and media-based learning methods show mixed or declining trends. Social media slightly decreases in both groups (-0.1% in primary and -2.2% in secondary schools), while TV documentaries show a marginal increase among primary school students (+0.6%) but a decrease among secondary school students (-2.8%). Books with pictures decline among primary school students (-3.3%) but show a small increase among secondary school students (+0.4%). Magazines display a modest increase in both groups (+0.9% in primary and +1.0% in secondary schools), indicating a relatively stable but minor role as a preferred learning method.

Table 34: Comparison of Changes in Preferred Learning Methods, in %

Preferred Method	Primary School: Change	Secondary School: Change
In School with Teachers	+9.5	+4.1
Projects with Others	+4.3	+3.0
Museums or Exhibitions	-5.4	+0.7
Real Adventures Outside	-0.8	-3.6
Social Media	-0.1	-2.2
Books with Pictures	-3.3	+0.4
TV Documentaries	+0.6	-2.8
Magazines	+0.9	+1.0

4.3.6. Open Schooling

In the dimension of open schooling in Probleu questionnaire (Table 35), the main question focused on schoolchildren's ways of learning beyond the classroom.

Table 35. Questions in Open schooling dimension

Primary School	Secondary School
Children learn about oceans, seas, rivers, and lakes in many fun ways, not just in the classrooms! Can you remember all the cool activities you did to learn more about water <u>in the ongoing school year</u>? Tick all the boxes for the things you did! [Randomize response categories] - ☐ A special lesson taught by scientists or other exciting guests - ☐ A trip to a museum or an exhibition about water - ☐ A visit to a company or a group that helps protect water - ☐ A fun day out at a university or a laboratory where scientists study water - ☐ Working on a project with kids from other classes or schools, or even people from your town - ☐ Classroom assignments where you read extra books, searched the internet, or watched movies about water	Beyond the classroom, there are loads of exciting ways to learn about oceans, seas, rivers, and lakes. Think back over this school year and mark all the activities you've participated in to learn more about water. Select all that apply. [Randomize response categories] - ☐ Participated in a special lesson given by scientists or guest speakers about water - ☐ Visited a museum or an exhibition focused on water and aquatic life - ☐ Went to a company or organization dedicated to water conservation - ☐ Explored a university or lab where scientists do research on water - ☐ Collaborated on a project with peers from other classes, schools, or community members - ☐ Completed classroom assignments that involved researching water through books, the internet, or documentaries

- [] Homework where you explored more about water through books, the internet, or movies	- [] Did homework that encouraged further exploration about water via reading, online research, or watching films
- [] Something else (What was it?): _____	- [] Other (Please describe): _____

Primary Schools:

The results show a substantial increase in participation in several interactive and externally supported learning activities following the intervention (see Table 36 and Figure 14). Notably, the share of students reporting lessons delivered by scientists or guest speakers more than doubled, rising from 14.8% pre-intervention to 34.3% post-intervention. Similarly, visits to companies or organisations increased significantly from 19.3% to 36.6%, and visits to universities or laboratories rose from 12.1% to 21.0%, indicating enhanced exposure to real-world and professional environments.

Collaborative and activity-based learning also shows strong growth. The proportion of students who reported working on projects with others increased from 28.4% to 44.0%, while classroom assignments rose from 38.8% to 47.3%, and homework-related activities increased from 33.6% to 38.2%. These findings suggest a broader engagement in structured and participatory learning experiences. In contrast, visits to museums or exhibitions decreased slightly from 31.9% to 27.1%, indicating a relative decline in this type of activity. The share of students selecting “none of the above” decreased from 12.0% to 6.7%, suggesting that a greater proportion of students engaged in at least one type of activity after the intervention. Additionally, responses under “other” dropped from 15.4% to 0.0%, which may indicate improved alignment of listed activities with students’ experiences.

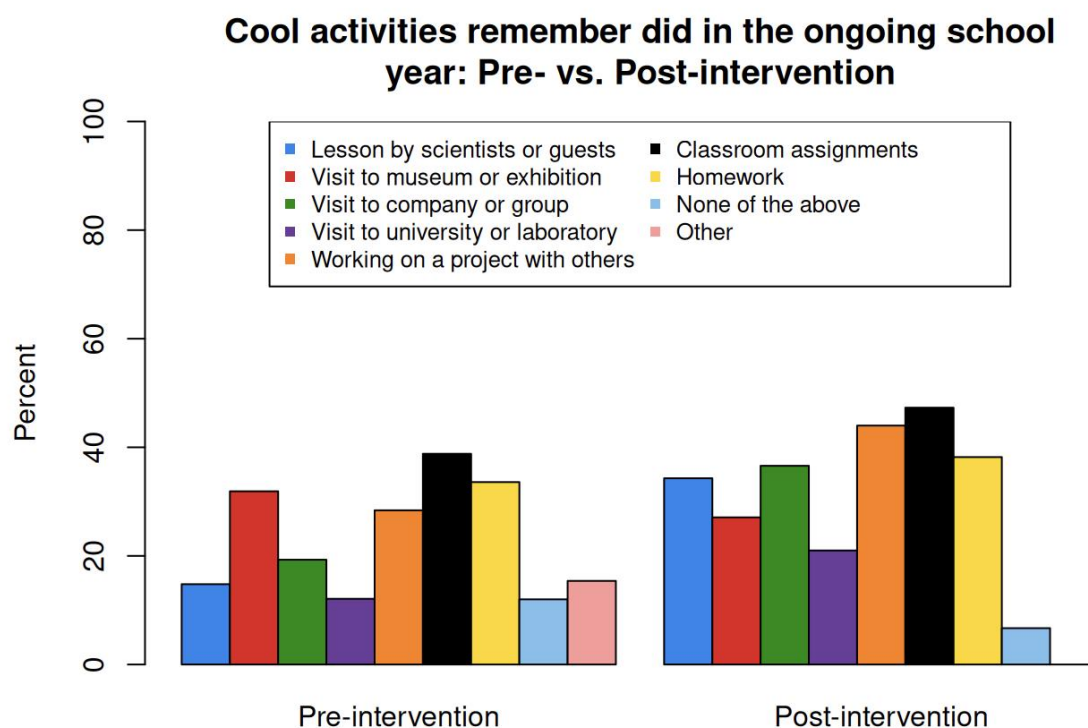


Figure 14. Pre- and post- intervention distribution of open schooling practices among primary school students.

Table 36: Beyond the classroom activities children remember that they did in the ongoing school year: Primary school, Pre- vs. Post-intervention, in %

	Pre-intervention	Post-intervention
Lesson by scientists or guests	14.8	34.3
Visit to museum or exhibition	31.9	27.1
Visit to company or group	19.3	36.6
Visit to university or laboratory	12.1	21.0
Working on a project with others	28.4	44.0
Classroom assignments	38.8	47.3
Homework	33.6	38.2
None of the above	12.0	6.7
Other	15.4	0.0

Secondary Schools:

The results indicate an overall increase in engagement with externally supported and experiential learning activities following the intervention (see Table 37 and Figure 15). The proportion of students reporting lessons delivered by scientists or guest speakers increased from 5.3% pre-intervention to 13.7% post-intervention, while visits to universities or laboratories more than doubled, rising from 3.9% to 9.3%. Similarly, visits to companies or organisations showed a moderate increase from 8.7% to 11.6%, reflecting enhanced exposure to real-world contexts. Participation in collaborative learning also improved, with working on projects with others increasing from 12.2% to 17.7%, suggesting a growing emphasis on participatory and group-based activities.

In contrast, some activities show a decline. Visits to museums or exhibitions decreased notably from 22.0% to 12.2%, indicating reduced engagement with this type of learning experience. Similarly, classroom assignments and homework-related activities show slight decreases, from 15.7% to 14.1% and 10.4% to 9.9%, respectively. The proportion of students selecting “none of the above” decreased from 9.6% to 4.6%, suggesting that more students participated in at least one activity following the intervention. Additionally, responses under “other” declined from 12.2% to 6.8%, which may reflect a better alignment of listed activities with students’ actual experiences.

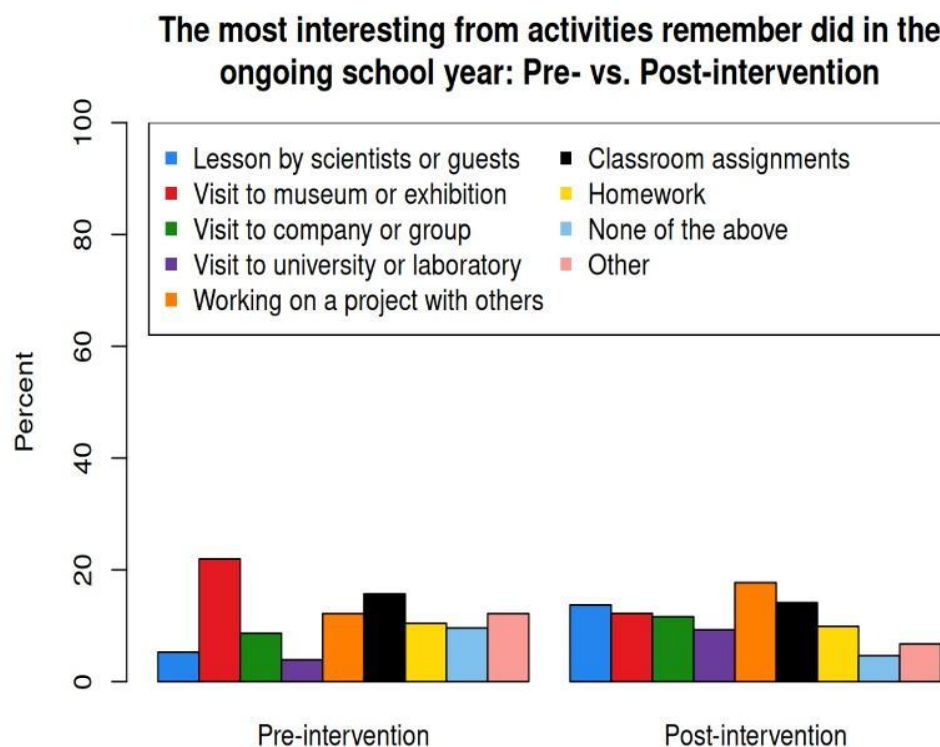


Figure 15. Pre- and post- intervention distribution of open schooling practices among secondary school students

Table 37: Beyond the classroom activities children remember that they did in the ongoing school year: Secondary school, Pre- vs. Post-intervention, in %

	Pre-intervention	Post-intervention
Lesson by scientists or guests	5.3	13.7
Visit to museum or exhibition	22.0	12.2
Visit to company or group	8.7	11.6
Visit to university or laboratory	3.9	9.3
Working on a project with others	12.2	17.7
Classroom assignments	15.7	14.1
Homework	10.4	9.9
None of the above	9.6	4.6
Other	12.2	6.8

4.4. Measurement evaluation of the questionnaires after the pre-post application

This section evaluates the performance of the ProBleu questionnaires for primary and secondary school students as measurement instruments for monitoring ocean and water literacy in school-based interventions. The purpose is not only to assess whether students differed between the pre- and post-intervention measurements, but also to examine whether the questionnaires themselves appear to function adequately as tools for capturing meaningful variation and change across the main dimensions of ocean and water literacy. This evaluative perspective is fully consistent with D5.1, which defined the student surveys as instruments to measure multiple dimensions of ocean and water literacy and explicitly planned the identification of intervention effects at both the item and scale level.

The ProBleu student surveys were designed around a clear conceptual framework. D5.1 states that the student questionnaires focus on the same dimensions, however, they were deliberately adapted to the developmental and cognitive capabilities of younger and older students, and that they were kept short in order to maintain attention and data quality. For that reason, this section treats the primary and secondary questionnaires as conceptually parallel but not metrically identical instruments. Accordingly, the measurement evaluation focuses on whether each questionnaire performs adequately within its own target population rather than assuming strict comparability across age groups.

A first strength of the questionnaires is their strong content alignment with the conceptual framework established in D5.1. The student instruments cover the core dimensions that ProBleu identified as most appropriate for short-term educational interventions among children and adolescents. D5.1 also noted that these are the dimensions most directly connected to the learning outcomes the project hopes to influence, while dimensions such as activism, trust, and transparency were excluded because they were less suitable for younger respondents and for brief school-based interventions. In this sense, the questionnaires display good face validity and content validity: the item content corresponds closely to the domains the project set out to monitor, and the age-adapted wording is coherent with the survey design principles reviewed in D5.1.

At the same time, content coverage alone is not sufficient. A useful monitoring instrument must also show adequate empirical performance. With the results the team has processed so far, the most feasible form of measurement evaluation is an assessment of item difficulty, distributional balance, responsiveness to intervention, and the extent to which different dimensions appear more or less suitable for repeated measurement. This assessment should be interpreted as a measurement evaluation based on observed item behaviour rather than as a complete psychometric validation.

4.4.1 Knowledge

The knowledge items show an uneven but substantively informative pattern, and this is one of the clearest areas in which the questionnaires can be evaluated as measurement tools. In the questionnaire for primary students, all three knowledge items move in the expected direction from pre- to post-intervention, but they differ substantially in baseline difficulty and in their capacity to detect change. The item “Where is most of the water on Earth?” already shows a relatively high rate of correct responses at pre-intervention, rising from 85.2% to 91.3%, with a small-to-moderate effect size. By contrast, “What is the largest animal ever to live on Earth?” rises from 74.4% to 88.1%, and “What is the largest ocean in the world?” rises from 56.6% to 77.0%, the latter showing the strongest change among the primary knowledge items.

From a measurement perspective, this is a desirable pattern because it suggests that the knowledge battery for primary students contains items with different baseline difficulty levels. The easiest item still leaves some room for improvement, but the strongest-performing item for monitoring change appears to be the “largest ocean” question, precisely because it avoids an excessive ceiling at baseline and captures substantial post-intervention movement. In other words, the knowledge battery for primary students appears capable of discriminating both between lower and higher prior knowledge and between pre- and post-intervention.

The knowledge battery for secondary students performs less evenly. One item, “Where is most of the water on Earth?”, starts at 87.0% correct pre-intervention and remains essentially unchanged at 86.7% post-intervention, with a null effect size. This suggests that the item is too easy for this age group and suffers from a ceiling effect that greatly limits its usefulness for evaluating intervention impact in secondary schools. The other two secondary knowledge items perform better. “How much of Earth’s living space is found in the ocean?” improves from 31.2% to 38.0%, and “How is climate change impacting the Arctic?” improves from 47.7% to 52.8%, but in both cases the magnitude of change is modest.

Taken together, the evidence suggests that the knowledge dimension functions reasonably well in primary schools but more unevenly in secondary schools. The main measurement implication is that future versions for secondary students would benefit from replacing or revising items that are too easy, especially those with very high baseline correctness and no measurable post-intervention movement. A monitoring instrument needs items with enough difficulty to allow change to be observed. On this criterion, the secondary “water on Earth” item appears weak.

4.4.2. Awareness

Among all dimensions, awareness appears to be one of the strongest for monitoring purposes. In the questionnaire for primary students, all three awareness items show clear shifts from lower to higher self-assessed knowledge categories. For example, the share reporting “a lot” of knowledge increases from 24.6% to 36.2% for biodiversity, from 27.9% to 42.2% for pollution, and from 38.9% to 56.4% for actions to protect rivers, lakes, oceans, and seas. These changes are accompanied by small-to-moderate effect sizes, with the strongest movement in the item related to protective actions.

The same general pattern appears in the questionnaire for secondary students. The proportion selecting the highest knowledge category increases from 6.0% to 11.0% for biodiversity, from 14.2% to 23.1% for the impact of human activities, and from 13.8% to 22.3% for actions to protect water environments. This consistency across age groups is important because it suggests that the awareness items are both developmentally appropriate and substantively sensitive to the type of learning processes that ProBleu interventions are designed to stimulate.

This dimension therefore seems especially valuable as a core monitoring component. Conceptually, it is well aligned with D5.1, which emphasized not only awareness of environmental problems but also awareness of solutions and possible protective actions. Empirically, it is also one of the few dimensions that shows coherent and repeated movement across all items in both age groups. That combination of conceptual clarity and empirical responsiveness makes awareness one of the best-performing parts of the instrument.

4.4.3. Attitudes and internal efficacy

The attitude dimension, operationalized mainly as internal efficacy, performs more modestly. D5.1 explicitly framed these items as measures of students’ perceived ability to contribute to environmental protection and communicate its importance to others. In the questionnaire for primary students, the efficacy scale shows a statistically significant but small shift between pre-

and post-intervention, with Cohen's d of 0.16. In the secondary questionnaire, the change is close to zero, with a non-significant difference and Cohen's d of only 0.03.

This does not necessarily mean that the items are poorly written or conceptually inappropriate. Rather, it suggests that efficacy may be a dimension that is harder to move through relatively short-term educational interventions, especially among adolescents. It is also possible that baseline attitudes in secondary students are already fairly stable, leaving less room for measurable change over the intervention period. From a measurement standpoint, however, the implication is clear: this scale appears less sensitive than awareness and some knowledge items. It may still be worth retaining because of its theoretical relevance, but expectations about its responsiveness should be modest, and future work might consider whether more behaviourally anchored attitude items could improve sensitivity.

4.4.4. Behaviour

The behaviour dimension presents a mixed pattern and should be interpreted carefully. Some items, especially those referring to concrete, everyday actions, show desirable movement. In primary schools, the proportion reporting they "almost always" turn off the tap tightly rises from 67.9% to 77.1%, and the proportion who report picking up trash when they see it rises from 55.8% to 67.7%, while the proportion saying they leave it decreases from 20.3% to 14.1%. In secondary schools, some changes are smaller, but discussions with friends or family about oceans, seas, rivers, and lakes become more frequent, and proper disposal of trash also increases somewhat.

At the same time, other behaviour items are less clearly tied to the intervention. This is especially true for the retrospective "visits in the last year" items. D5.1 itself noted that behavior questions for younger respondents should ideally be rooted in the here-and-now and that retrospective measures should use clear reference periods because recall is more demanding. The problem here is not only memory burden but also construct validity. Visiting an ocean, river, lake, or sea in the last year depends heavily on geography, family routines, transport opportunities, and seasonality. Those items may therefore capture exposure or access as much as behavioural change attributable to the school project. They are still useful descriptively, but they are weaker indicators of intervention impact than the shorter-term, action-oriented items.

Accordingly, the behaviour battery appears to combine at least two distinct types of measures: direct pro-environmental behaviour and contextual experience or access. For future refinement, these should ideally be separated analytically and perhaps conceptually. The former is better suited to impact monitoring, while the latter is better treated as a contextual or profiling variable.

4.4.5. Emotional connection

The emotional connection items appear to be among the least responsive dimensions, though they remain conceptually important. In primary schools, positive emotions such as excitement and enthusiasm increase modestly, but the effect sizes are generally small. For example, the proportion reporting "a lot" of excitement rises from 54.9% to 61.6%, and "a lot" of enthusiasm

risers from 41.6% to 48.1%, while several other items show little movement. In general, the battery does not show the same coherent post-intervention shift observed for awareness.

This pattern suggests that emotional connection may be more difficult to alter over short educational periods, or that the battery mixes positive and negative emotions that do not necessarily respond symmetrically to intervention. D5.1 justified the inclusion of this dimension on the grounds that emotional responses are important for longer-term behaviour change. That rationale remains persuasive, but from a measurement standpoint the current battery appears less sensitive than the awareness or knowledge components. A shorter set of positive emotional indicators or a clearer distinction between affective activation and emotional concern might improve measurement efficiency in future rounds.

4.4.6. Communication and open schooling

Communication and open schooling items are valuable, but they should be interpreted somewhat differently from the core literacy outcomes. D5.1 explicitly included these dimensions because they are central to the ProBleu educational model and because they capture how students learn, discuss, and experience water-related issues beyond conventional classroom instruction. Empirically, these items are very useful for describing project implementation and for identifying which learning experiences students encountered or valued. For example, the open schooling items in primary schools show marked shifts in reported participation in guest lessons, visits, collaborative projects, and classroom assignments.

However, these items are not pure literacy indicators in the same sense as knowledge, awareness, or efficacy. Many of them function more as exposure, implementation, or preference measures. This does not reduce their value, but it does mean they should not be interpreted in exactly the same way as the core outcomes. In measurement terms, they are closer to explanatory or contextual variables than to direct indicators of ocean and water literacy gains.

4.4.7. Overall assessment

Overall, the questionnaires appear to function reasonably well as monitoring tools, but their performance is uneven across dimensions. The strongest evidence of good measurement performance comes from the awareness items and several of the knowledge items for primary students. These indicators show sufficient baseline variation, avoid severe floor or ceiling effects, and display clear post-intervention movement. Some behaviour items also perform well, especially those anchored in concrete and recent actions. By contrast, selected knowledge items for secondary students, the efficacy scale in secondary schools, and parts of the emotional connection battery appear less sensitive to short-term change.

The main implication is not that the weaker dimensions should be removed, but that the instrument would benefit from targeted refinement. In particular, future revisions should consider replacing very easy knowledge items for secondary students, distinguishing more clearly between behavioural outcomes and contextual experience, and revisiting the attitude

and emotional batteries to determine whether alternative formulations could better capture intervention-sensitive change.

In sum, the current evidence suggests that the ProBleu student questionnaires are promising and substantively well-grounded instruments for monitoring ocean and water literacy. Their greatest strength lies in their close alignment with the project's conceptual framework and in the strong performance of the awareness dimension. Their main limitation is that responsiveness is not uniform across all dimensions and age groups. As a result, the instruments are already useful for evaluation purposes, but they should be understood as evolving tools that would benefit from continued refinement on the basis of the empirical patterns observed here.

4.5. Limitations

While the analytical approach adopted in this report allows for a timely and coherent assessment of patterns in ocean and water literacy across participating schools, several limitations should be acknowledged when interpreting the results.

First, the analysis is based on repeated cross-sectional data rather than longitudinal data at the individual level. The surveys administered before and after the intervention do not track the same students over time, and no individual-level linkage between waves is available. As a result, the observed differences between pre-intervention and post-intervention responses cannot be interpreted as within-student change. Instead, they reflect differences between two independent samples of respondents drawn from the same set of participating schools. This distinction is important, as changes in outcomes may be influenced not only by the intervention but also by differences in the composition of respondents across waves.

Second, although the analytical sample is restricted to schools that participated in both waves, the number of respondents per school varies considerably, and in some cases is relatively small. This implies that individual schools may be represented by only a limited number of observations in one or both waves. Consequently, the analyses are conducted at the pooled respondent level rather than at the school level, which limits the ability to assess variation in outcomes across schools or to derive robust school-level estimates of change. It also means that schools with larger numbers of respondents may implicitly have greater influence on the overall results.

Third, the analytical strategy does not explicitly control for potential differences in response patterns across countries, schools, or survey implementations. The data were collected across a diverse set of contexts, using multiple language versions of the questionnaire and with varying levels of implementation fidelity. These sources of heterogeneity may contribute to differences in observed outcomes that are not directly attributable to the intervention itself. While the inclusion of a broad range of schools enhances the ecological validity of the findings, it also introduces additional complexity in interpretation.

Fourth, although all schools with data in both waves are included, some countries contribute relatively small numbers of observations. As a result, country-level comparisons should be interpreted with caution, particularly where sample sizes are limited. The analyses presented

in this report focus primarily on aggregate patterns across the full sample, rather than on detailed country-specific estimates.

Fifth, the current analytical approach focuses on item-level and aggregated descriptive comparisons between pre- and post-intervention samples. While this provides a useful overview of potential changes across key dimensions of ocean and water literacy, it does not involve more advanced modelling strategies (e.g., multilevel or causal inference models) that could account for clustering within schools or adjust for compositional differences across waves. Such approaches may be considered in future analyses.

Finally, the analytical choices made in this report are influenced by practical considerations related to the timing of the deliverable and the structure of the available data. In particular, the decision to use a consistent analytical sample across descriptives and pre-post comparisons, and to rely on pooled respondent-level analyses, reflects a balance between methodological rigor, clarity of presentation, and feasibility within the project timeline.

Taken together, these limitations suggest that the findings presented in this report should be interpreted as indicative of patterns and potential shifts in ocean and water literacy, rather than as definitive evidence of causal impact. Nevertheless, the analyses provide a valuable and systematic overview of the data collected through the ProBleu initiative and establish a foundation for more refined analyses in future research outputs.

5. Qualitative findings: teachers and administration interviews

This section provides an overview of results from online interviews with school administration representatives and teachers. The interviews were only completed by schools that implemented the ProBleu funded school projects on ocean and water literacy.

5.1. School project implementation and open schooling dynamics

ProBleu-funded school projects on ocean and water literacy were implemented over varying timeframes, depending on the choices and organisational capacities of the schools.

School project duration, as reported by school administration representatives during the interviews, was concentrated toward the longer end of the scale. The most common duration was 12 months (31.58%, n=12). A further 15.79% of projects lasted 11 months (n=6), while 13.16% lasted 10 months (n=5) and another 13.16% lasted 7 months (n=5). Projects lasting 9 to 12 months accounted for 68.42% of all responses (n=26), whereas very short durations were rare. Overall, the pattern suggests that ProBleu implementation was usually aligned with an extended school-year cycle rather than with short, stand-alone activities. This matters for interpretation of later findings, because longer delivery periods are more conducive to curriculum integration, repeated student exposure, and sustained school-level engagement.

The schools in the sample (school administration representatives) were already relatively engaged in environmental activities. The largest group, 42.11% (n=16), reported that their school is very actively involved in multiple ocean and water literacy or related environmental initiatives in addition to ProBleu. Another 31.58% (n=12) said their school is occasionally involved in similar projects. At the same time, 26.32% (n=10) indicated that the ProBleu-funded project is the only such initiative their school has implemented so far.

To better understand the institutional context of the funded projects, respondents were invited to describe **how engaged their schools are in ocean and water literacy projects and other environmental initiatives**. The schools in the sample were already relatively engaged in environmental activity. The largest group, 42.11% (n=16), reported that their school is very actively involved in multiple ocean and water literacy or related environmental initiatives in addition to ProBleu. Another 31.58% (n=12) said their school is occasionally involved in similar projects. At the same time, 26.32% (n=10) indicated that the ProBleu-funded project is the only such initiative their school has implemented so far.

This distribution shows that ProBleu reached two somewhat different profiles of schools: institutions with an already established environmental portfolio, and schools for which ProBleu represented a more entry-level experience. This is a useful signal that the ProBleu scheme appears capable of both deepening existing practice and widening participation among less experienced schools.

To complement the structured survey items, school administration representatives and teachers were invited to briefly list **the main activities carried out during the school project** in order to capture the practical content of the interventions implemented with students.

The open-ended descriptions of project activities by representatives of school administration reveal a clear pattern of experiential, multi-format learning, with most schools combining field-based investigation, scientific observation or testing, and communication or creative dissemination activities. The open-ended responses provided by teachers confirm this overall pattern and add further detail on how these activities were implemented in practice, highlighting the central role of hands-on, student-centred learning in the funded projects. A large share of school administrations representatives refers to field trips, sampling, water quality testing, biodiversity observation, microplastic analysis, coastal or river monitoring, and clean-up actions, indicating that the projects were strongly practice-oriented and often linked environmental literacy to direct observation of local ecosystems. Teachers' accounts reinforce this finding by showing that these activities often included visits to laboratories, environmental centres, museums, treatment plants, wetlands, rivers, lakes, and coastal sites, as well as practical tasks such as data collection, water testing, species observation, and environmental monitoring.

Another recurring pattern is the integration of awareness-raising and multiplier activities, such as posters, campaigns, exhibitions, films, blogs, infographics, public lectures, teacher training, and peer-to-peer sessions for other students, suggesting that many schools sought not only to educate participating learners but also to extend project benefits to the wider school and community. The teachers' responses also point to a particularly strong emphasis on creative and communication-oriented work, including digital content creation, murals, brochures, children's books, presentations, competitions, exhibitions, and student-led awareness activities, which complemented the more research-oriented elements of the projects.

A third notable theme is cross-sector collaboration, as many responses mention partnerships with universities, laboratories, NGOs, aquariums, treatment plants, museums, research institutes, and partner schools, which appears to have strengthened both the scientific credibility and the practical relevance of the activities. Several responses also show an interdisciplinary approach, combining science with art, drama, robotics, digital tools, gamification, or citizen science. This interdisciplinary character is especially visible in the teacher interviews, where project activities are described as bringing together science, technology, arts, literacy, sports, foreign languages, and digital tools such as AI, virtual reality, social media, and online dissemination platforms.

Overall, the interview material suggests that the funded projects were not limited to isolated classroom lessons, but frequently developed into broader learning processes that connected investigation, behaviour change, public engagement, and tangible outputs such as educational materials, manuals, exhibitions, and student-led campaigns.

Teachers were additionally asked if all the activities went smoothly. When **commenting on the organization of activities**, teachers were predominantly very positive, often describing the process as "well-organized", "smooth", "flawless", "perfect", or "excellent". Many responses suggest that activities were implemented successfully and according to plan, with several

teachers noting that “everything went well” or that execution was “smooth, no problem”. At the same time, a smaller number of comments indicate that organization could also be time-consuming, demanding, or stressful, especially when activities had to be integrated into the school schedule, coordinated with external partners, or adapted to weather and logistical constraints.

When **commenting on the motivation of the students**, teachers were overwhelmingly positive, most often describing motivation as “high”, “very high”, “great”, or “exceptional”. Many responses suggest that students were especially engaged by the hands-on, outdoor, and practice-based nature of the activities, with teachers noting that they were “eager to participate”, “highly engaged and enthusiastic”, and particularly motivated during fieldwork, creative tasks, and activities outside the classroom.

School administration representatives were also asked to indicate **how many school staff members were involved in the projects**, using only general role descriptions, in order to provide an overview of the human resources mobilised for project implementation. The school administration sample results (32 schools that participated in the interview) show that in those schools, 47 members of school administration and 392 teachers and no less than 67 external partners have been involved in the ProBleu funded school projects on ocean and water literacy.

Teachers’ comments indicate that administrative support was generally strong and dependable throughout project implementation. It was frequently described as “very good”, “excellent”, “outstanding”, or “efficient”, with many responses highlighting the role of school leadership in providing permissions, coordination, communication, and logistical assistance. Only a few comments suggested minor limitations or scope for improvement, so overall the responses point to consistently supportive administrative backing.

Respondents were further invited to briefly identify **the external partners involved in the school projects** in order to capture the extent and variety of collaboration beyond the school itself. The responses indicate that ProBleu-funded school projects were typically embedded in broad partnership networks extending beyond the school itself, with particularly frequent involvement of families, researchers, public authorities, NGOs, universities, museums, environmental organisations, and local community actors. The most consistently mentioned partner group was families or parents, suggesting that many projects sought to connect student learning with the home environment and the wider community. Another prominent pattern is the strong presence of research and science-related partners, including universities, research institutes, museums, science centres, and subject experts, which points to the importance of scientific input and external expertise in the implementation of ocean and water literacy activities. Public authorities and municipalities also appeared regularly in the responses, indicating that local government structures often played a supportive or facilitating role, whether through institutional backing, access to services, or collaboration in educational and environmental initiatives. In addition, many schools reported cooperation with non-governmental and environmental organisations, as well as cultural, artistic, and sports organisations, showing that the projects often adopted a multidisciplinary and community-oriented approach rather than a narrowly classroom-based model. Although the level of detail in the answers varied considerably, the overall picture is one of open schooling in practice,

where schools frequently mobilised a diverse set of external actors to enrich learning activities, strengthen local relevance, and expand the reach of project outcomes.

When **commenting on the involvement of partners**, teachers were again predominantly very positive, often describing cooperation as “very good”, “excellent”, “productive”, or “seamless”. Many responses emphasised that partners provided valuable expertise, resources, and strong support, helping to enrich activities and extend learning beyond the school. A few teachers mentioned scheduling difficulties or uneven engagement from some partners, but overall the comments suggest that partner involvement was generally active, supportive, and beneficial for project implementation.

Respondents were also asked whether they **cooperated with other schools** during school project implementation and, if so, to indicate which schools were involved, with particular attention to links with schools that are members of, or applicants to, the Network of European Blue Schools (NEBS). The responses suggest a mixed but generally positive picture of inter-school cooperation. A substantial share of schools reported no cooperation with other schools (n=8), indicating that many ProBleu-funded projects were implemented primarily within a single school setting. At the same time, a considerable number of respondents (n=21) described collaboration with nearby schools, schools within the same municipality or region, Erasmus+ and eTwinning partners, and, in some cases, schools in other countries, showing that project activities were not confined to isolated institutional contexts. Several responses also point to connections with Network of European Blue Schools (NEBS) members or applicants, although these links appear uneven rather than systematic across the sample. In some cases, cooperation involved clearly identified NEBS schools, exchanges of ideas and materials, joint seminars or events, and even support for other schools preparing ProBleu applications. In other cases, collaboration was more informal, for example through shared online groups, dissemination of project outputs, or participation in common local events.

Students from all the participating schools did have to participate in pre- and -post project surveys, administered by the teachers. The teachers' sample were then asked during the interviews to indicate, **whether students needed support when completing the surveys** administered before and after the project activities. The responses suggest that students were generally able to complete the pre- and post-project surveys with a relatively high degree of independence, although support was still needed in a substantial share of cases. A slight majority of teachers reported that most students completed the surveys independently (51.8%, n=29). At the same time, 30.4% (n=17) indicated that some students needed support, and 12.5% (n=7) reported that most students needed support. Only a small share of respondents were not sure or did not remember (n=3).

The most common issue concerned understanding the wording of some questions, especially among younger students or those with more limited language skills. Teachers frequently referred to the need to explain words, clarify meanings, or support translation, and some noted that students found certain questions ambiguous or answer options too long or too similar. A second challenge was student uncertainty and lack of confidence, as some pupils were concerned about giving the “correct” answer or being evaluated negatively rather than responding freely. In a smaller number of cases, teachers also mentioned practical and technical barriers, such as limited access to computers or internet, difficulties completing the survey in

class, or issues related to timing and concentration. At the same time, many responses stressed that the questionnaires were generally manageable, often describing them as easy or age-appropriate.

Overall, the teachers' answers indicate that while the survey process was manageable for many students, support remained important for a notable proportion of participants, likely reflecting differences in age, reading ability, language skills, or familiarity with survey-based tasks.

5.2. Perceived learning outcomes and broader impacts

School administration representatives were asked to identify, in their own assessment, the **most important results of the school project**, in order to capture which outcomes they considered most significant in terms of student learning, school development, and wider community impact.

The school administration representatives' responses suggest that the *most important school project results were perceived primarily at the level of student learning, awareness, and engagement, with many respondents emphasising stronger ocean and water literacy, more responsible environmental attitudes, and the development of practical skills through hands-on activities*. A particularly frequent theme is the growth of environmental awareness and sense of responsibility. Several respondents stressed that students came to see water as "a precious resource", developed "a lasting sense of environmental responsibility", and increased their understanding of the need to reduce pollution, especially plastic and microplastic contamination. Closely related to this is a second recurring theme: the value of experiential and research-based learning. Many answers refer to students carrying out measurements, collecting empirical data, participating in fieldwork, or working in "a real experimental environment", which appears to have strengthened both motivation and scientific thinking. In several cases, respondents highlighted that students "performed measurements they had never done before", that "hands-on experience" helped "take learning beyond the classroom walls", and that project activities enabled pupils to connect abstract environmental issues with real-world observation and practice.

Another important pattern concerns *the development of broader competences and educational outputs*. Respondents often referred not only to knowledge gains, but also to teamwork, communication, peer learning, and the creation of longer-term resources such as manuals, lesson plans, protocols, online materials, or data tables. In this sense, some projects appear to have produced results that extend beyond the immediate cohort of participating students. For example, one respondent noted that "the equipment and protocols (as well as the results) are available online", while another emphasised "lesson plans with a manual for teachers" as one of the most significant results.

A further theme is *institutional and community-level impact*: some schools reported outreach within the wider educational community, strengthened collaboration with local organisations, or progress towards embedding ocean and water literacy more firmly in school practice, for instance through "the successful consolidation of ocean-themed activities into a more unified curriculum".

Teachers were also asked about most important results of the projects. Many comments emphasised that *students moved beyond theory into meaningful action and developed a stronger sense of responsibility, curiosity, and connection with nature*. As respondents put it, the project led to “a significant increase in students’ water literacy”, “a shift in thinking: as an individual, I can do something to preserve ecosystems”, and “students learned how to use microscopes, analyse water samples, and independently work with testing devices”. Others stressed “rising environmental awareness among students”, “students’ engagement with the theme of ocean literacy”, and “the feeling that students can and are able to do more”. Several teachers also underlined lasting and visible outputs, such as “the school’s greenhouse that will be used by students in the future”, “a manual for teachers”, or a “functioning network able to grow”, suggesting that the most important results were seen not only in immediate learning gains, but also in longer-term educational and institutional effects.

School administration representatives and teachers were asked to assess **whether, in their opinion, the project had increased the level of ocean and water literacy in the wider school community**. Perceived impact of the school projects on ocean and water literacy in the school communities was exceptionally strong. Two thirds of school administration representatives (66.7%, n=22) and 75.5% (n=37) of teachers stated that the project increased literacy 'significantly', and a further 30.3% (n=10) of school administration representatives and 20.4% (n=10) of teachers said it did so 'to a great extent'. Only one school selected 'to some extent', while no school administration representatives chose neutral or negative options, and no teachers selected “not important”. Taken together, 96.97% of school administration representatives and 95.9% of teachers placed the effect in the top two positive categories. Within the limits of self-reported evidence, this indicates a very consistent perception that ProBleu school projects generated meaningful educational value for the school community.

Teachers’ assessments were uniformly positive regarding **the school project’s contribution to students’ ocean and water literacy**. A clear majority of those who answered (N=50 and 12 skipped) stated that the project had increased literacy significantly (70%, n=35), while a further 26% (n=13) believed it had done so to a great extent. Only two teachers selected “yes, to some extent”, and no respondents chose neutral or negative options. Overall, this distribution indicates *a very strong perception among teachers that the ProBleu-funded activities had a substantial positive effect on the ocean and water literacy of students involved in the projects, whether directly or indirectly*.

Teachers were also asked **which learning outcomes related to ocean and water literacy, in their opinion, had been supported through the project activities**.

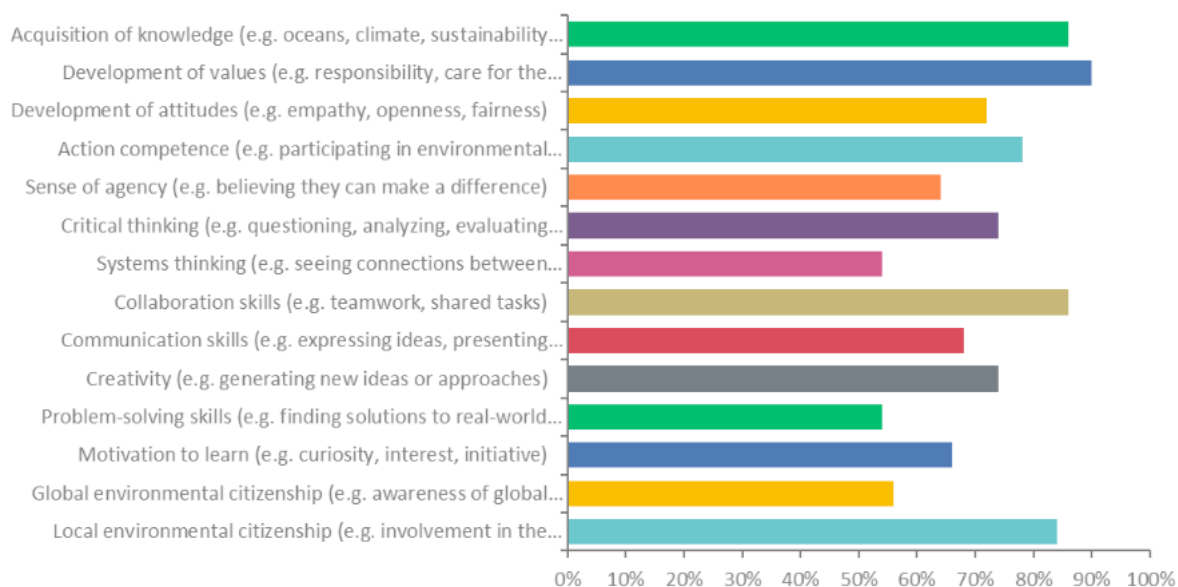


Figure 16. Which learning outcomes related to ocean and water literacy were supported through the project activities (school teachers, N=50 full answers)

Teachers' responses suggest that the supported learning outcomes extended well beyond knowledge acquisition alone and were especially strong in the domains of values, collaboration, and local environmental engagement. The most frequently selected outcome was the development of values such as responsibility and care for the environment (90%, n=45), followed closely by acquisition of knowledge (86%, n=43) and collaboration skills (86%, n=43). A similarly high share of teachers also identified local environmental citizenship as an important outcome (84%, n=42), indicating that the projects were perceived as particularly effective in linking ocean and water literacy to concrete participation in the school and community context. Other highly rated outcomes included action competence (78%, n=39), critical thinking (74%, n=37), creativity (74%, n=37), and the development of attitudes such as empathy and openness (72%, n=36). By contrast, more abstract or broader-level outcomes were selected somewhat less often, although still by a substantial share of teachers. These included communication skills (68%, n=34), motivation to learn (66%, n=33), sense of agency (64%, n=32), global environmental citizenship (56%, n=28), as well as systems thinking and problem-solving skills (both 54%, n=27).

Overall, the pattern suggests that teachers perceived ProBleu-funded activities as especially successful in fostering environmentally grounded values, teamwork, participation, and locally relevant citizenship, while also supporting a broad range of cognitive, social, and action-oriented competences. This distribution reinforces the view that the projects functioned not only as vehicles for teaching environmental content, but also as broader educational interventions contributing to students' personal, social, and civic development.

In addition, teachers were asked to assess **the importance of different types of learning experiences and project components** in developing students' ocean and water literacy (see Figure 17).

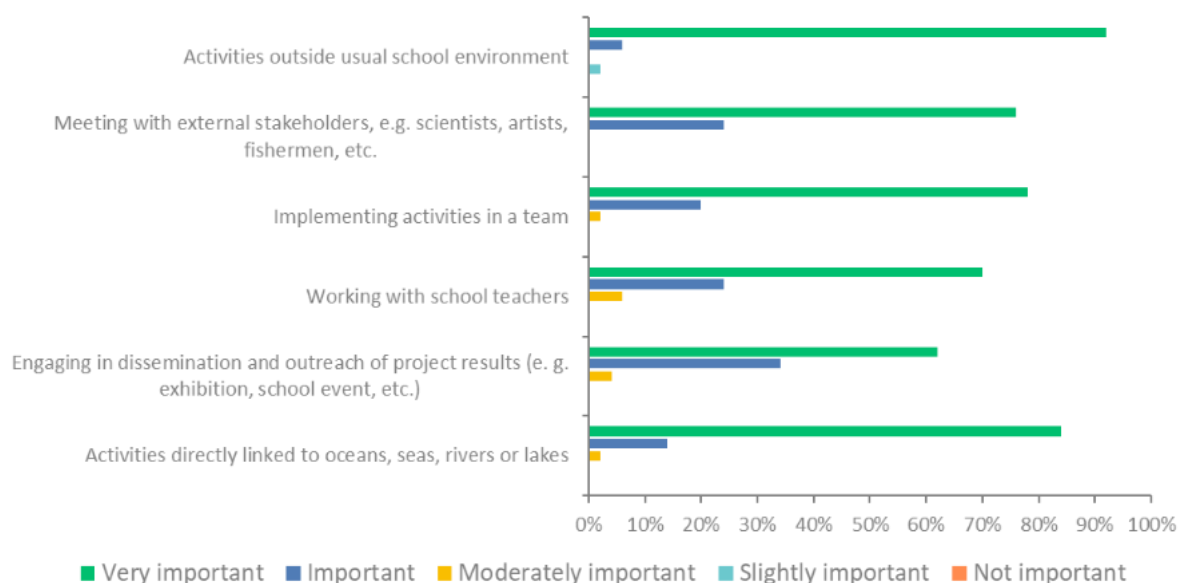


Figure 17. Importance of different types of learning experiences and project components in developing students' ocean and water literacy (school teachers, N=50 of full answers)

Teachers' assessments indicate that all listed elements were considered important in developing students' ocean and water literacy, but some were valued especially highly. The *strongest emphasis was placed on activities outside the usual school environment*, which 92% (n=46) rated as very important. This was followed by activities directly linked to oceans, seas, rivers or lakes, rated as very important by 84% (n=42). Implementing activities in a team was also assessed very positively, with 78% (n=39) selecting very important, while meeting with external stakeholders such as scientists, artists, or fishermen was seen as highly relevant as well (76%, n=38 very important). Overall, the pattern suggests that teachers regarded direct contact with real environments, concrete water-related contexts, teamwork, and external engagement as the most important drivers of students' ocean and water literacy.

Responses to the open-ended question in teachers interviews further suggest that the most impactful aspect of the project for students was, above all, *direct, hands-on engagement with real environmental issues*. Many teachers emphasised the value of fieldwork, visits, experiments, sampling, and practical tasks that allowed students to move beyond abstract learning and connect theory with lived experience. Several comments explicitly referred to learning "beyond the classroom", "direct involvement in hands-on activities", or "real-world settings" as the key element that made the project meaningful. Another recurring theme was the growth of environmental awareness and emotional connection to nature, with teachers highlighting students' stronger understanding of ocean and water issues, "love for nature", and recognition that "we have only one planet". In some cases, particularly memorable moments included specific visits or outputs, such as the "visit to the turtle rehabilitation centre", the greenhouse, the final exhibition, or the creation of a children's book. Overall, the comments indicate that *the strongest impact came from combining practical action, emotional engagement, and visible*

student contribution, helping students feel that their learning mattered and that they could act as responsible environmental actors.

An important aspect of the ProBleu funded school projects was open schooling. Teachers' comments suggest that the **open schooling methods used in the projects** were assessed very positively and, in most cases, seen as clearly effective. A recurring theme, once again, is that these methods helped to move learning beyond the classroom by connecting students with real environments, local communities, external experts, and practical problems. Many responses explicitly state that the methods "worked very well", were "highly successful", or even "worked perfectly". Another notable pattern is that teachers often linked open schooling to higher student motivation, stronger engagement, better understanding, and more meaningful learning, especially when students could apply knowledge in real-life contexts. At the same time, a small number of comments noted practical constraints, such as the difficulty of integrating all activities into the formal school schedule. Overall, the responses indicate that *open schooling was widely regarded not as a peripheral add-on, but as a central and successful pedagogical feature of the ProBleu-funded school projects.*

School administration representatives were also asked **whether the activities, materials, and other practices developed through the project were likely to remain integrated into the school's curriculum or wider activities**, in order to assess the perceived sustainability and longer-term institutional embedding of the intervention. Responses point to strong prospects for continuity. Most schools (69.70%, n=23) reported that the activities or materials are already integrated and will continue to be used regularly. Another 24.24% (n=8) said they plan to integrate them in the near future.

Teachers were also asked whether they intended to take up and integrate some aspects of the project into their usual school activities or curricula. The responses indicate a very strong intention to sustain the project's educational legacy. Two thirds of teachers reported that they had already started integrating project aspects into their usual school activities or curricula (66%, n=33), while a further 24% (n=12) planned to do so in the near future. The remaining 10% (n=5) were still considering it, and no respondent selected a negative option. Overall, this suggests *broad teacher commitment to embedding ProBleu-related practices in longer-term teaching.*

These results suggest that the project outputs were usually not treated as temporary add-ons. Instead, they were more often absorbed into ongoing teaching or school activity. This is one of the strongest indicators that ProBleu may have left a legacy beyond the funded implementation period.

Respondents were further asked whether they **had made the project results available to the ProBleu consortium and to other schools**. The pattern is broadly positive and shows use of several channels. The most frequently selected option was making results freely accessible online (48.48%, n=16). This was followed by sharing results directly with others, for example by email or during events (42.42%, n=14), and making them available in an open and editable format (39.39%, n=13). A smaller group of schools (18.18%, n=6) had not yet shared results but planned to do so.

The overall picture is that openness and transferability were common features of school project delivery, although a minority of schools may still need support to move from intention to actual public sharing.

Respondents were further invited to briefly indicate any future actions planned to promote the project results and encourage their further use by others. The responses suggest that most schools planned to continue dissemination and follow-up activities after the formal end of the project, most commonly through school websites and social media, exhibitions, presentations, meetings, workshops, and community events. A recurring pattern is the *intention to embed project results into future teaching and school activities*, while some schools also planned broader outreach through publications, cooperation with other schools, local stakeholders, or public events.

School administration representatives were also asked **whether students with fewer opportunities had been directly or indirectly involved in the school project**, in order to assess the inclusiveness of the intervention and the extent to which participation reached groups who may face social, economic, geographical, or other barriers (see Figure 18).

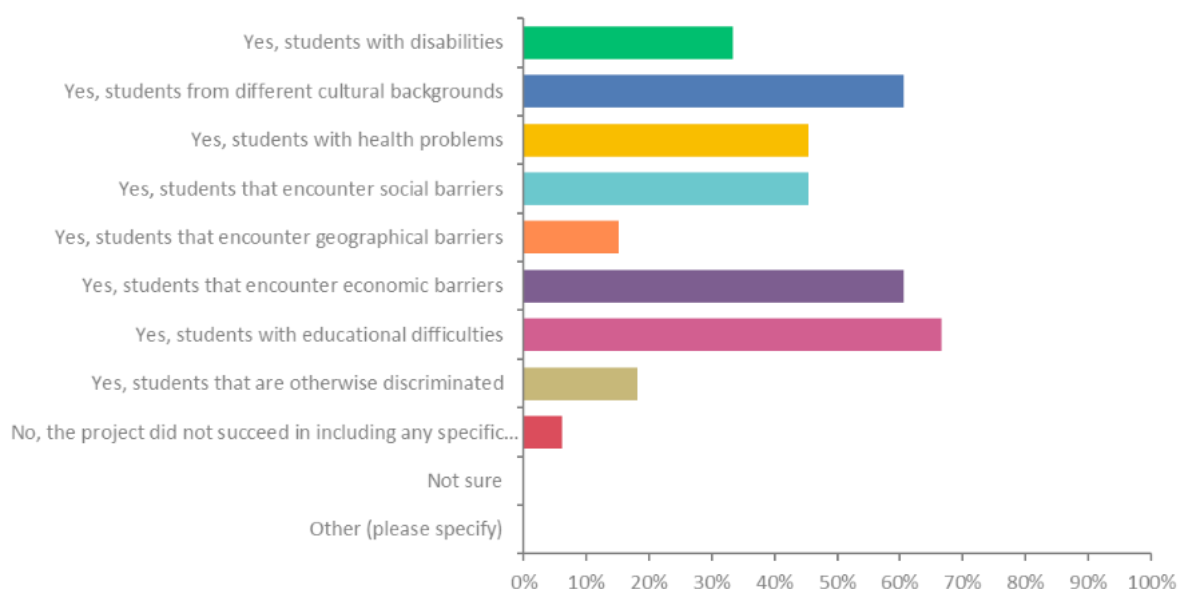


Figure 18. Students with fewer opportunities directly or indirectly involved in the school projects (school administration representatives, N=32)

The results indicate a *broad and multidimensional inclusion profile*. The most frequently mentioned group was students with educational difficulties (66.67%, n=22). This was followed by students from different cultural backgrounds (60.61%, n=20) and students encountering economic barriers (60.61%, n=20). Students with health problems and students encountering social barriers were each selected by 45.45% of respondents (n=15), while 33.33% (n=11) reported involvement of students with disabilities. Lower but still notable shares referred to students otherwise discriminated against (18.18%, n=6) and students encountering geographical barriers (15.15%, n=5). Only 6.06% of respondents (n=2) said the project did not succeed in including any specific student groups.

A notable feature of this question is the breadth of overlap. The total number of selections was 116 across 33 respondents, equivalent to roughly 3.5 selected categories per school that answered the question. This suggests that inclusion was often not limited to one target group, but rather reflected layered vulnerabilities within school communities.

In their additional comments, teachers highlighted that project funding helped remove economic barriers, for example by covering transport, materials, food, or accommodation, so that participation was “not conditioned by the financial capabilities of the families” and “all the students could participate because of the funds.” Several teachers also stressed the inclusion of students from low-income families, migrant backgrounds, rural areas, and those with special educational needs, while noting that some challenges remained, such as transport for students with disabilities.

Respondents were further asked whether any measures had been implemented during the project to reduce the carbon footprint or combat pollution, in order to capture the extent to which environmental sustainability was reflected not only in project themes, but also in project practice (see Figure 19).

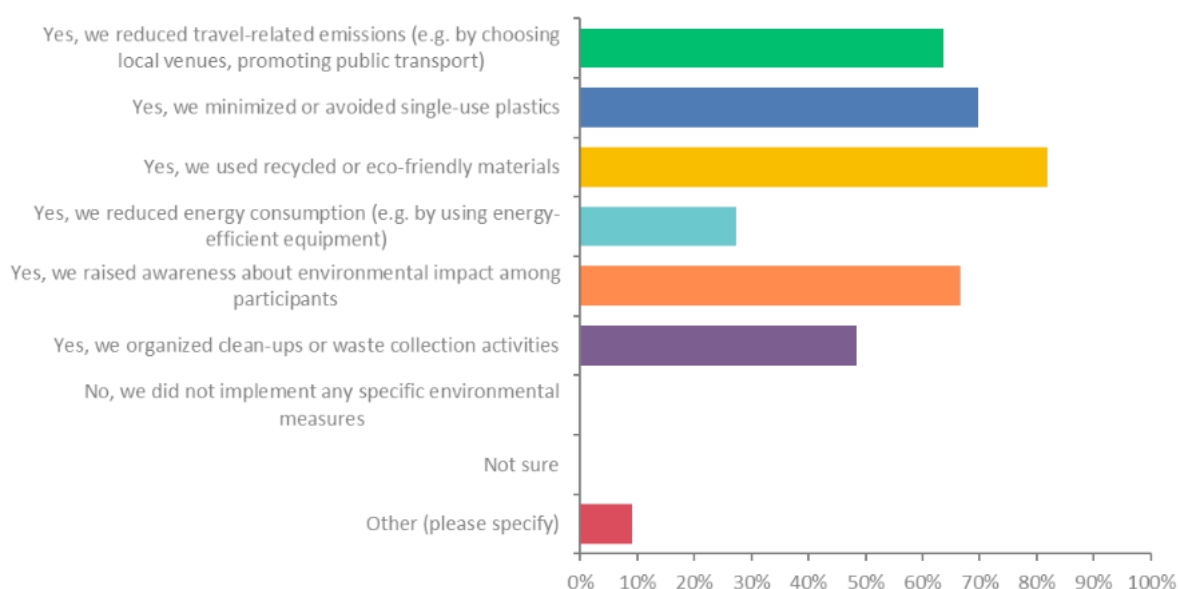


Figure 19. Measures schools took to reduce the carbon footprint or combat pollution during the project activities (school administration representatives, N=32)

Environmental implementation measures were very widespread. The most common action was using recycled or eco-friendly materials, selected by 81.82% of respondents (n=27). This was followed by minimizing or avoiding single-use plastics (69.70%, n=23), raising awareness about environmental impact among participants (66.67%, n=22), and reducing travel-related emissions, for example by choosing local venues or promoting public transport (63.64%, n=21). Nearly half of the schools also organized clean-ups or waste collection activities (48.48%, n=16). The least frequent of the listed measures was reducing energy consumption (27.27%, n=9). No schools reported that they had implemented no environmental measures.

The distribution suggests that schools most often relied on measures that were practical, visible, and directly manageable within project activities. Material choices, plastic reduction,

travel-related decisions, and awareness-raising are actions that schools can implement without large infrastructural changes. By contrast, energy reduction often depends more heavily on building systems, equipment, or institutional control, which may help explain its lower prevalence.

This question also shows strong bundling of actions. There were 121 selections across 33 respondents, or approximately 3.7 measures per responding school. That means the typical project did not adopt just one environmentally responsible practice, but several in parallel. This is important because it indicates that ProBleu projects were not only teaching about environmental issues; they were also, in many cases, attempting to align project delivery itself with environmental values. This creates a stronger coherence between message and practice, and could be further reinforced through light-touch guidance on high-impact operational measures.

In addition, teachers frequently referred to *practical sustainability measures implemented during the projects*, often highlighting concrete actions such as “proper waste separation”, “recycling”, “cleaned the areas around the water bodies”, and “collected litter” during field activities. Many comments stressed efforts to reduce plastic use through “reusable metal water bottles”, “sustainable packing and bottles”, “we didn't use single use plastic materials”, or the reuse of waste in creative outputs such as art works and exhibitions. Another recurring theme was more sustainable mobility, with teachers noting that they “used public transport instead”, travelled “on foot or by bicycle”, or planned visits according to “proximity criteria” in order to reduce emissions. Several responses also framed these actions as part of a broader educational purpose, emphasising not only reduced environmental impact, but also the development of more responsible student habits and awareness.

School administration representatives and teachers were asked to assess their **overall level of satisfaction with the ProBleu-funded project** implemented in their school. Overall satisfaction in both samples was uniformly positive. A large majority of respondents, 84.85% (n=28) of school administration representatives and 95.9% (n=47) of teachers, said they were very satisfied, while the remaining 15.2% (n=5) of school administration representatives and 4% (n=2) of teachers said they were satisfied. No respondents selected neutral or dissatisfied categories. While self-assessment data should always be interpreted with some caution, the absence of neutral or negative responses indicates very high satisfaction with the funded projects among participating schools.

In addition, teachers' general feedback included a lot of overwhelmingly positive comments, with many describing the project as “a resounding success”, “highly successful”, “very positive”, “wonderful”, or even “one of the best projects implemented”. The comments suggest that teachers valued the project not only for its educational outcomes, but also for the engaging experience it created for students, schools, and in some cases the wider community. Several responses highlighted that the activities were “very valuable for the school community”, offered “enriching and diverse learning experiences”, and left “a real impact both educationally and environmentally”. A recurring theme was also the wish to continue building on the results, with some teachers noting that the project created lasting resources and opened opportunities for future initiatives.

School administration representatives were then invited to briefly comment on the main **benefits of implementing the school project**, in order to complement the satisfaction ratings with a more substantive account of the value and advantages they associated with the intervention. Most frequently, schools highlighted *increased environmental awareness and stronger ocean and water literacy among students*, often linked to more responsible attitudes and behaviours. Respondents repeatedly referred to *greater understanding* of marine protection, water conservation, plastic reduction, and sustainability, with some noting that the project helped create a “water-saving culture” in the school and encouraged students to become “active environmental stewards” or “active water guardians”. A second major theme concerns *the benefits of hands-on, experiential learning*, as many schools stressed that the projects successfully connected theory with practice. Respondents emphasised that students learned through field visits, experiments, citizen science, and practical conservation activities, helping to “take learning beyond the classroom” and making environmental issues more concrete and meaningful. Another recurrent pattern is the *development of skills, motivation, and collaboration*. Many responses mention gains in practical and scientific competences, including research, analysis, water testing, teamwork, communication, and even entrepreneurial spirit. Several schools also underlined the value of interdisciplinary learning, for example by describing the activities as “a scientific but also art project”. Overall, the school administration representatives’ responses suggest that the perceived benefits were not limited to student knowledge gains alone, but extended to school culture, teaching practices, partnerships, and the long-term capacity of schools to address ocean and water literacy in a more structured and impactful way.

Where there are benefits, there also are the challenges. The responses suggest that the **main challenges of school projects’ implementation** were practical and organisational rather than conceptual. The most frequently mentioned difficulty was *time*, including limited time for planning, fitting activities into the school schedule, and balancing project work with the regular curriculum. Several respondents referred very briefly to “time” or “time constraints”, while others explained that the intensive nature of the project “required significant time for planning and execution” and often conflicted with existing school obligations. A second recurring challenge concerned coordination and logistics, especially when activities involved fieldwork, excursions, several teachers, or external partners. Respondents noted difficulties in “organizing all the activities with external partners”, “organizing the trip, and the project in the regular school organisation”, and managing “logistics and mobility”. In some cases, implementation across multiple schools and partners added further complexity, especially in maintaining consistent participation and communication.

Another prominent theme was the influence of *weather and field conditions* on outdoor activities. Several schools reported delays or complications due to rain, wind, heat, difficult terrain, or transport-related barriers. For example, respondents mentioned “weather-related delays affecting our outdoor schedule”, “often rainy weather, difficult terrain”, and difficulties linked to “the transport to the Drava river”. Some schools also pointed to the challenge of sustaining engagement over time, particularly in longer projects, including “maintaining students’ interest in a project that extended over two academic years” and reaching the broader school and local community with messages about water protection and plastic reduction. At the same time, it is important to note that some respondents reported few or no

major difficulties, stating that “no significant challenges were encountered” or simply “we had no challenges”.

School administration representatives and teachers were also asked how they perceive the **importance of the Network of European Blue Schools (NEBS)**, in order to capture how this network is valued as a framework for cooperation, exchange of experience, and the further development of ocean and water literacy in schools. Perceptions of NEBS were strongly positive. Most respondents (60.6%, n=20 of school administration representatives and 73.5%, n=36 of teachers) described the network as very valuable, and another 30.3% (n=10) of school administration representatives and 26.5% (n=13) of teachers considered it valuable. Several school administration representatives expressed a neutral position, while no respondents considered the network to be of little value or not valuable at all.

In total, majority of schools attached positive value to the NEBS network. This suggests that schools see added benefit not only in project funding itself, but also in the wider community, recognition, and exchange opportunities associated with a European-level network.

At the end of the questionnaire, respondents were invited to add any further comments they considered relevant before submitting their responses. The **final comments from both school administration representatives and teachers were overwhelmingly positive, appreciative, and forward-looking**. Many respondents expressed gratitude for the opportunity to participate in ProBleu and emphasised that the projects had meaningful educational and institutional value for their schools. Teachers in particular often highlighted the importance of the funding and support received, describing participation as “a very enriching experience”, “an amazing experience and opportunity”, or even “among the most rewarding and meaningful moments of my 30-year teaching career”, while also noting that the programme enabled learning experiences that would otherwise have been difficult to realise, especially in smaller or resource-constrained schools. A **particularly notable theme across both respondent groups was the wish for continuation**: many expressed hope for further support, future funding opportunities, and the possibility to participate again in related initiatives. Teachers frequently referred to plans to continue activities beyond the funded period, for example by restarting activities in the next school year, extending project work without immediate funding, or preparing new applications. Overall, these closing remarks suggest that ProBleu-funded projects were widely perceived as worthwhile and impactful, and that many schools saw them not as isolated interventions, but as a foundation for longer-term engagement with ocean and water literacy.

5.3. Cross-cutting interview findings

The school administration and teachers’ interview results point to a consistently positive overall assessment of the ProBleu-funded projects and, in particular, to a strong perceived impact on student learning outcomes. Across the responses, schools most often described the projects as educationally meaningful, well aligned with their teaching aims, and capable of generating lasting effects beyond the immediate implementation period. The projects were typically implemented over a substantial period of time, often close to a full school year, which likely supported deeper engagement and allowed learning processes to develop through repeated activities, reflection, and practice rather than through one-off interventions.

A central cross-cutting finding is the strong perceived contribution of the projects to ocean and water literacy. School representatives consistently linked the projects with gains in knowledge, awareness, values, motivation, and action-oriented competences. Learning outcomes were not described narrowly in terms of factual understanding alone, but rather as a broader combination of environmental awareness, stronger responsibility towards nature, practical and collaborative skills, and a greater readiness to engage with real-world issues. In this sense, the projects appear to have supported both cognitive and affective dimensions of learning, while also encouraging participation, initiative, and connections between school learning and everyday environmental practice.

The results also suggest that ProBleu often worked in synergy with schools' existing environmental engagement, while at the same time opening this field for schools with less prior experience. Most schools reported that they were already active in environmental or related initiatives, but around one quarter seem to have entered this space more directly through ProBleu. This indicates that the programme functioned both as a reinforcement mechanism for already engaged schools and as an entry point for schools beginning to build ocean and water literacy into their educational practice.

Another important cross-cutting finding concerns continuity and sustainability. Respondents frequently indicated that activities, materials, and practices developed through the projects were likely to remain integrated into school life. This suggests that the projects were not widely perceived as isolated or temporary interventions, but rather as initiatives with potential for longer-term curricular and institutional embedding. The strong intention to continue using project outputs further reinforces the view that the projects generated durable educational value.

At the same time, the findings show that project implementation was often linked with broader educational principles, especially inclusion and environmental responsibility. Schools commonly reported the involvement of students with fewer opportunities and described efforts to ensure accessibility and equal participation. Likewise, many respondents referred to practical measures taken to reduce carbon footprint, limit pollution, or promote more sustainable behaviour during project implementation. These patterns suggest that schools did not treat inclusion and sustainability as separate add-ons but rather integrated them into the pedagogical logic of the projects themselves.

Finally, the broader ecosystem surrounding the funded projects also appears to have mattered. The Network of European Blue Schools (NEBS) was assessed positively by almost all schools, indicating that schools valued not only the direct support received through project funding, but also the opportunities for recognition, networking, exchange, and belonging to a wider educational community focused on ocean and water literacy. Taken together, these cross-cutting findings suggest that ProBleu-funded projects were perceived as contributing not only to immediate learning outcomes, but also to longer-term educational development, institutional learning, and the strengthening of a wider culture of environmental engagement.

6. Conclusions and recommendations

The implementation of school interventions has led to a significant increase in blue consciousness across both age groups, with the most pronounced improvements occurring in the dimensions of knowledge and awareness. The highest impact of the projects was documented in primary schools, particularly regarding knowledge of the largest ocean, which saw a 20.4 percentage point gain, and awareness of water protection measures, which increased by 17.5 percentage points. While secondary school students initially possessed a higher knowledge in shared questions, they achieved more modest improvements. A visual summary comparing primary and secondary school outcomes across key dimensions, including knowledge, awareness, self-efficacy, and information sources, is presented in Annex 7.

A comparison of the two groups reveals that the intervention was more effective for younger students, who not only outperformed secondary students on shared knowledge post-intervention but also experienced a more substantial increase in self-efficacy. Specifically, primary students showed a 13.7-percentage-point increase in feeling they could "make a difference," whereas secondary students' attitudes regarding their personal impact remained largely stable. However, the confidence in communicating environmental issues has increased slightly in secondary schools as a result of school projects.

The Probleu projects also had an impact on environmental behaviors. The positive change was larger in the primary schools, compared to secondary school students, especially in water saving actions, such as turning off the tap tightly (+9.2 percentage points) and turning off water while brushing teeth. There was also a significant change in the waste disposal behaviours, again, larger in primary schools. Primary students "throwing trash in the trash" rose by 11.9 percentage points, while secondary students "disposing of it properly" increased by 5.4 percentage points.

Probleu projects had a positive impact on emotional connection to waters. Following the interventions, primary students reported a rise in positive emotions and a decline in negative ones. Feeling "excited/happy" in the "a lot" category increased by 6.7 percentage points, while those feeling "not at all" nervous or worried increased by 9.7 percentage points. Unlike the primary group, secondary students also saw a slight increase in extreme negative emotions. The percentage of secondary students feeling "extremely" nervous or worried rose by 4.1 percentage points. Despite this rise in worry for older students, the overall trend for both groups indicates a higher level of readiness to act.

In the communication dimension, there was a divergent trend in digital communication: children in primary schools showed a significant increase in using websites and social media for information, while secondary students experienced a decline in social media as an informational source, however it still remains as an important information source. Despite these differences, both age groups showed a strengthened reliance on formal school lessons and projects as primary sources of information following the intervention.

The summary of the change reflection is presented in Table 38.

Table 38. Significance of the changes

Dimension	Indicator	School Level	Pre (%)	Post (%)	Change (pp)	Effect size (Cohen's h) and χ^2 test st. significance
Knowledge	Location of most water	Primary	85.2	91.3	+6.1	0.19**
	Location of most water	Secondary	87.0	86.7	-0.3	-0.01**
	Largest animal ever	Primary	74.4	88.1	+13.7	0.36***
	Living space in the ocean	Secondary	31.2	38.0	+6.8	0.14***
	Largest ocean in the world	Primary	56.6	77.0	+20.4	0.44***
	Arctic climate impacts	Secondary	47.7	52.8	+5.1	0.10**
Behaviours	Trash disposal: Threw it in the trash	Primary	55.8	67.7	+11.9	0.24***
	Trash disposal: Disposed of it properly	Secondary	50.4	55.8	+5.4	0.11**
Communication: Sources	Websites or online videos	Primary	19.1	29.3	+10.2	0.24***
		Secondary	31.2	34.7	+3.5	0.07*
	Social media	Primary	23.6	30.3	+6.7	0.15**
		Secondary	51.7	42.9	-8.8	-0.18***
	School teachers or projects	Primary	68.7	78.2	+9.5	0.22***
		Secondary	58.7	66.9	+8.2	0.17***
Communication: Preferred ways of receiving information	In school with teachers	Primary	21.2	30.7	+9.5	0.22***
		Secondary	16.7	20.8	+4.1	0.11**
	Visiting university or laboratory	Primary	18.3	19.6	+1.3	0.03
		Secondary	23.1	22.8	-0.3	-0.01
	Visiting museums or exhibitions	Primary	27.8	22.4	-5.4	-0.12**
		Secondary	26.4	27.1	0.7	0.02
	Going on real adventures outside	Primary	42.0	41.2	-0.8	-0.02
		Secondary	38.5	34.9	-3.6	-0.08*
	Working on a project with others	Primary	8.6	12.9	+4.3	0.14**
		Secondary	13.9	16.9	+3.0	0.08**
Open Schooling	Lesson by scientists or guests	Primary	14.8	34.3	+19.5	0.46***
		Secondary	16.9	23.7	+6.8	0.17**
	Visit to museum or exhibition	Primary	31.9	27.1	-4.8	-0.11*
		Secondary	26.6	27.7	+1.1	0.03
	Visit to company or group/organization	Primary	19.3	36.6	+17.3	0.39***
		Secondary	12.4	15.6	+3.2	0.09**
	Visit to university or laboratory	Primary	12.1	21.0	+8.9	0.24***
		Secondary	11.9	13.6	+1.7	0.05
	Working on a project with others	Primary	28.4	44.0	+15.6	0.33***
		Secondary	28.4	37.8	+9.4	0.20***
	Classroom assignments	Primary	38.8	47.3	+8.5	0.17**
		Secondary	36.0	43.4	+7.4	0.15***
	Homework	Primary	33.6	38.2	+4.6	0.10
		Secondary	27.0	29.3	+2.3	0.05

Note: Significance levels: *** $p < 0.001$, ** $p < 0.05$, * $p < 0.1$.

When investigating associations between variables, effect size measures are used in conjunction with hypothesis testing. First, statistical significance of the association is evaluated. A "statistically significant" relationship means that, given the data, it is likely that there is an association in the population, too. However, this association might be very small – the statistically significant result does not provide information about the size of the association. In many cases, "statistically significant" effects may be established, when sample sizes are large, even though the "substantive effects" are small. Effect size measures quantify the size of the association, allowing to compare different associations.

Coefficients of Cohen's h and Cohen's w are effect size measures for proportions and categorical data. The first is used for determining the strength of association between two dichotomous variables, and the second is a generalized version for categorical variables with more than two categories. Raw differences in proportions (like 0.10 vs 0.20) may not be equally meaningful across different scales of variables. Cohen's h uses an arcsine transformation to makes differences in proportions more comparable, especially near 0 or 1. Usually, Cohen's h 0.2 is considered as a small effect, 0.5 – medium, and 0.8 – large effect. Similarly, Cohen's w enables comparisons of associations between categorical variables that have more than two categories. Importantly, it evaluates how the joint distribution of categories of two variables deviates from expectation – not just one pair of proportions. Usually, Cohen's w 0.1 is considered as a small effect, 0.3 – medium, and 0.5 – large effect.

Survey results show that Open schooling practices are used in both primary and secondary schools. The findings from primary schools show a clear increase in engagement with diverse and interactive learning activities beyond the traditional classroom setting, reflecting the positive impact of project interventions on enriching students' learning experiences. Results from secondary schools also suggest a positive shift towards more diverse and externally oriented learning activities, particularly those involving interaction with experts and real-world environments, although some traditional and cultural activities appear to have decreased in frequency. A comparison of primary and secondary school results reveals both common trends and notable differences in engagement with learning activities beyond the classroom. In both groups, there is a clear increase in participation in externally oriented and interactive activities, particularly lessons delivered by scientists or guest speakers, visits to universities or laboratories, and collaborative project work. These increases are generally more pronounced among primary school students, who show stronger growth across most activity types, including visits to companies or organisations and classroom-based assignments. In contrast, secondary school students demonstrate more moderate increases and, in some cases, slight declines in traditional learning activities such as classroom assignments and homework. A notable difference is observed in visits to museums or exhibitions, which decline in both groups but more sharply among secondary school students.

The qualitative evidence from interviews with school administration representatives and teachers shows that the ProBleu-funded projects were perceived as highly valuable educational interventions, with strong relevance for ocean and water literacy development in schools. Across both respondent groups, the overall assessment was consistently positive, and the projects were widely described as meaningful, well aligned with school-level educational aims, and capable of producing effects that extended beyond the funded implementation period.

A central conclusion is that the projects were perceived (by school administration and teachers) as making a substantial contribution to students' ocean and water literacy. Respondents did not describe the main effects only in terms of factual knowledge acquisition, but rather in terms of a combination of knowledge, awareness, values, motivation, practical competences, teamwork, responsibility, and readiness to engage with environmental issues in everyday life. Teachers' responses in particular indicate that the strongest perceived learning outcomes were linked to the development of environmental values, collaboration, local environmental citizenship, action competence, critical thinking, and creativity. This suggests that ProBleu-funded activities functioned not only as vehicles for transmitting environmental content, but also as broader educational interventions contributing to students' personal, social, and civic development.

The interview findings also indicate that the perceived educational impact was closely tied to the pedagogical form of the projects. Both school administration representatives and teachers repeatedly highlighted the importance of hands-on, experiential, and field-based learning. Activities outside the usual school environment, tasks directly linked to rivers, lakes, seas, or oceans, teamwork, and interaction with external stakeholders were all regarded as especially important for literacy development. Open schooling methods were evaluated very positively and were widely seen as successful in making learning more meaningful, motivating, and connected to real-world problems. The interviews therefore suggest that the impact of ProBleu was associated not only with what was taught, but also with how it was taught: through practical engagement, contact with local environments, collaboration, and the involvement of external actors.

The interview results also point to strong prospects for continuity and institutional embedding. A substantial majority of both school administration representatives and teachers indicated that activities, materials, or practices developed through the projects had already been integrated, or were likely to be integrated, into regular school activities and curricula. This is one of the strongest indicators in the qualitative material that the projects were not generally treated as temporary add-ons. Instead, they were often perceived as generating durable educational value and leaving behind methods, resources, routines, and outputs that could continue to shape teaching and learning. Respondents' forward-looking final comments, including explicit wishes to continue, expand, or build on project work, reinforce this conclusion.

Finally, the interview evidence highlights the importance of the wider ProBleu ecosystem, including the Network of European Blue Schools. The NEBS network was valued positively by the overwhelming majority of interview participants, indicating that schools appreciated not only the direct support provided through project funding, but also the opportunities for recognition, exchange, networking, and belonging to a wider European community of practice.

Taken together, the qualitative findings suggest that ProBleu-funded projects were perceived as contributing not only to immediate student learning outcomes, but also to longer-term pedagogical innovation, school development, institutional learning, and the strengthening of a wider culture of environmental engagement.

These conclusions inspired some **RECOMMENDATIONS** for the strengthening water literacy through strategy design and implementation and methodology and toolkit to monitor water and ocean literacy:

- To further strengthen water literacy, educational programs should **prioritize teacher-led classroom engagement and collaborative projects**, as both age groups showed a growing preference for learning in school settings and working with peers. Because "real adventures outside" remain the most preferred learning method for both primary and secondary students, these experiential activities should be maintained as an important part of the curriculum. For younger learners, there is a clear opportunity to expand high-quality digital learning resources, given the notable increase in their use of websites and online videos to discover information about water environments.
- **Strategies for both primary and secondary schools should be specifically designed to target and strengthen internal self-efficacy**, as the current intervention did not significantly influence their belief that personal actions can positively impact the environment. Educational content for older students should shift away from social media-heavy delivery, considering their declining interest in it as a learning tool, and instead focus on complex, collaborative problem-solving that aligns with their existing interests. Finally, efforts should be made to reverse the decline in interest toward museums and exhibitions among primary students by making these visits more interactive and integrated with their preferred peer-based project work.
- The survey results show that **activities such as lessons delivered by scientists, visits to universities, and project-based collaboration have a positive impact on engagement and learning outcomes**, especially among primary school students. To enhance the impact of these learning/teaching methods, it is recommended to further integrate these experiential and real-world learning opportunities into school programmes. This could include increased collaboration with external experts, more structured partnerships with research institutions and organisations, and the design of age-appropriate project-based activities that better align with the interests and learning preferences of older students.
- While school-based and collaborative learning methods have increased, the decline in activities such as museum visits, outdoor learning, and certain informal learning channels suggests a need for a more balanced approach. It is recommended to **diversify learning methods by combining formal instruction with interactive, cultural, and outdoor experiences**. This could help sustain engagement, particularly among secondary school students, and support different learning styles. Ensuring a varied mix of learning formats may also strengthen long-term interest and deeper understanding of ocean and water-related topics.
- The interview findings suggest that future development of ProBleu and similar initiatives should continue to **prioritise project formats that allow sufficient implementation time**. Since many of the strongest perceived outcomes were associated with repeated practice, curricular connection, and sustained student engagement, it would be advisable to maintain support for projects that can run across a substantial part of the school year. This appears particularly important for educational interventions that seek not only to inform, but also to shape values, habits, and action-oriented competences.

- The findings also support continued emphasis on experiential and open schooling pedagogies. **Future calls, guidance documents, and support materials should continue to encourage schools to design projects that move learning beyond the classroom and connect students with real environments and external actors.** Particular value seems to lie in field-based learning, practical investigation, teamwork, and contact with scientists, public authorities, community organisations, and other stakeholders. Where possible, programme guidance could make these features more explicit as desirable design principles, given how strongly they were associated with motivation and perceived learning impact.
- A further recommendation is to **strengthen support for the long-term embedding of project results.** Since both school administration representatives and teachers frequently reported that project materials, methods, and activities had already been integrated or were likely to be integrated into regular school practice, future programme design could more explicitly support continuation planning. This might include light-touch guidance on curriculum integration, re-use of outputs, internal teacher dissemination, and post-project sustainability planning. Such measures could help ensure that the educational legacy of funded projects is retained and scaled within schools after the end of the funding period.
- Any future ProBleu school projects funding programme could also continue to **treat inclusion as a central implementation principle.** The interviews suggest that ProBleu-funded projects were often able to involve students with fewer opportunities and that funding frequently helped reduce participation barriers. This is an important strength that should be preserved.
- Similarly, any future ProBleu school projects funding programme could continue to **encourage coherence between environmental content and environmental practice.** Many schools already implemented practical measures to reduce pollution, avoid waste, and lower the environmental footprint of project activities. This alignment is educationally important, as it reinforces the credibility of the intervention and models sustainability in action. Future guidance could therefore encourage schools to reflect systematically on environmentally responsible implementation choices, including materials, transport, event organisation, and reuse of outputs, without creating excessive reporting burden.
- Another recommendation concerns differentiated support for schools with different levels of prior experience. Since ProBleu appears to have supported both already highly engaged schools and those entering ocean and water literacy work for the first time, future programming may benefit from recognising this diversity more explicitly. Schools with strong prior experience may be well placed for more ambitious innovation, peer mentoring, or scaling activities, whereas less experienced schools may benefit from clearer templates, examples, and implementation guidance.
- Finally, the results suggest that monitoring and evaluation should continue to combine quantitative and qualitative approaches. Some of the most important effects identified in the interviews concern values, responsibility, citizenship, motivation, pedagogical innovation, and institutional continuity. These dimensions are central to the educational value of the projects but are not always fully captured through quantitative indicators alone. Future evaluation work should therefore continue to **include space for narrative**

reflection from teachers and school leaders, especially on mechanisms of change, school-level uptake, and the longer-term continuation of school project effects.

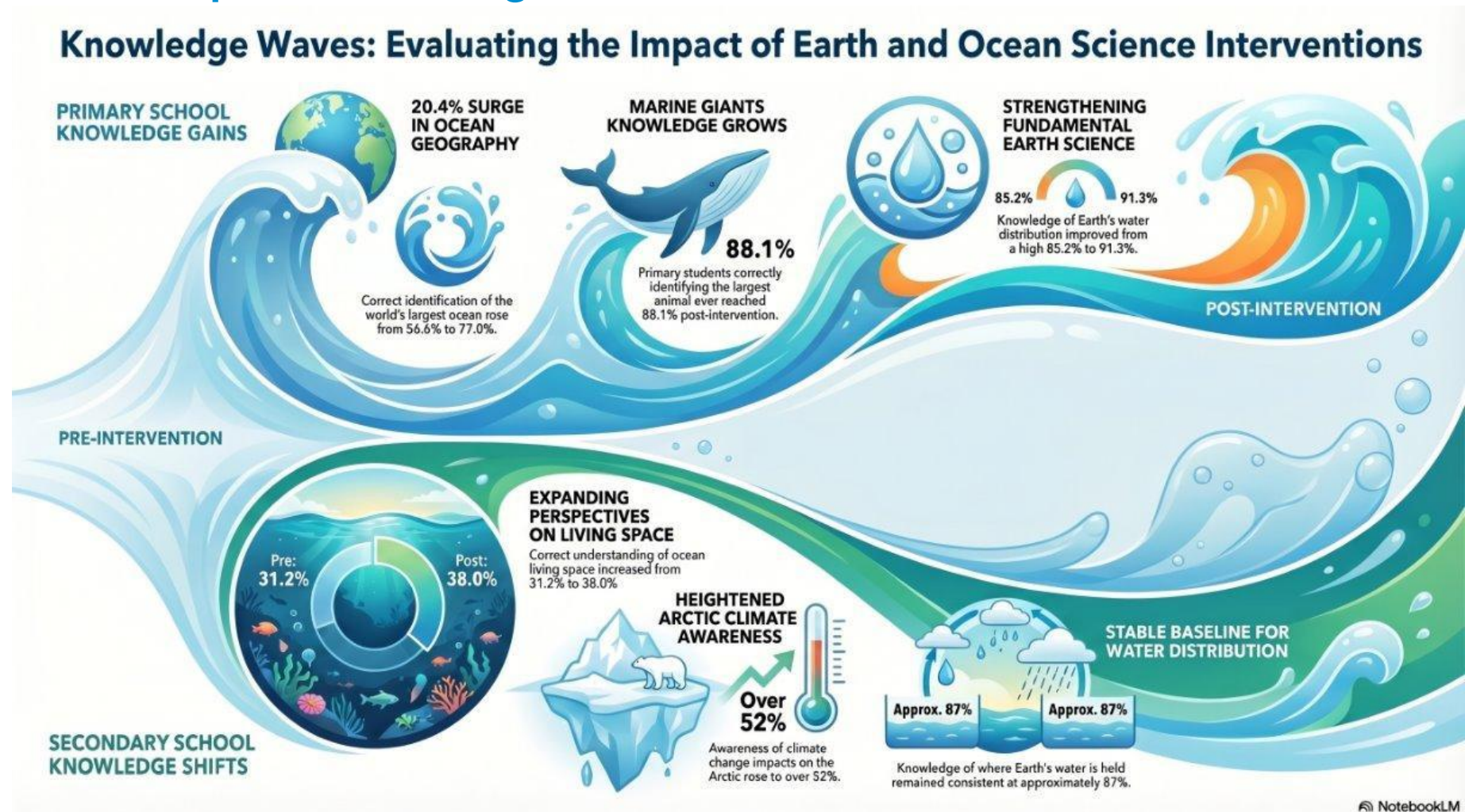
Acknowledgements

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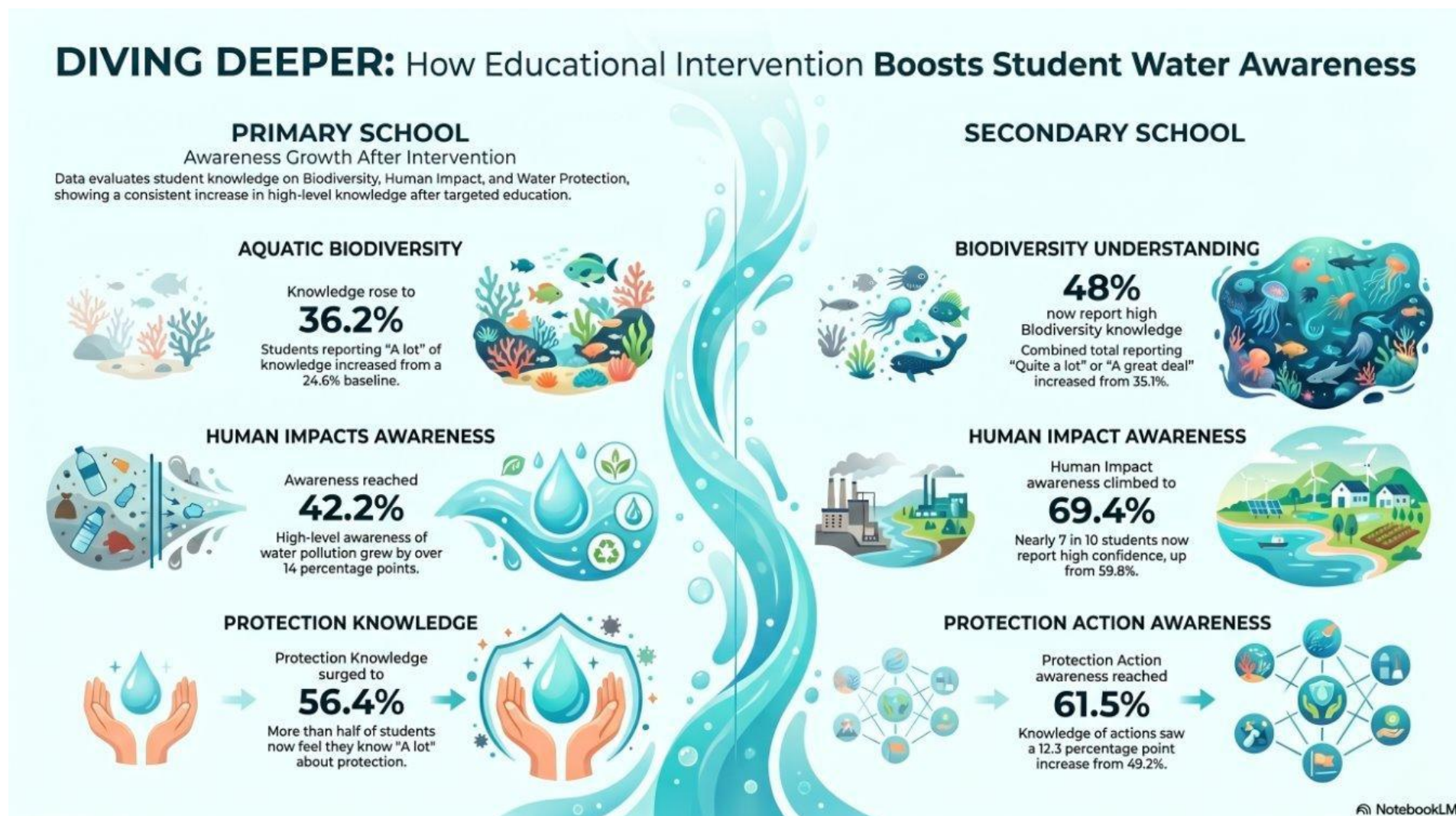
Declaration of Generative AI and AI-Assisted Technologies in the Writing Process

During the preparation of this report, Google NotebookLM was used to create Infographics and to summarize the materials. Open AI ChatGTP was used for grammar and phrasing refinement. The content was reviewed and edited by authors as needed, and full responsibility for the content of the report is taken. During the preparation of the questionnaire translations into multiple languages, Microsoft Excel, Microsoft Word, and ChatGPT were used for translation purposes, including the use of built-in translation functions and AI-assisted language support. The translated materials were reviewed and edited by the project participants as needed, and full responsibility for the final content is taken.

Annex 1. Impact: Knowledge Dimension



Annex 2. Impact: Awareness Dimension



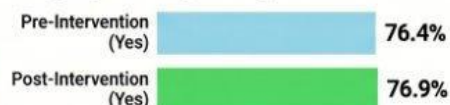
Annex 3. Impact: Attitudes Dimension

From Awareness to Action: Shifting Student Attitudes on Water Protection

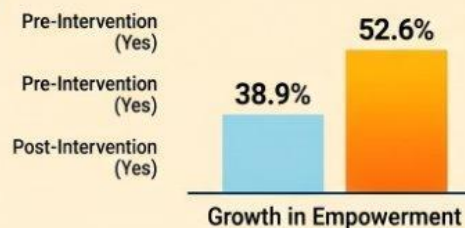
PRIMARY SCHOOL: BUILDING FOUNDATIONS



Helping Through Daily Actions



Significant Jump in Feeling Empowered



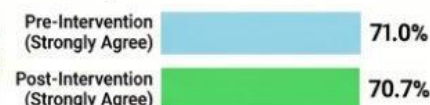
Confidence in Communicating Importance



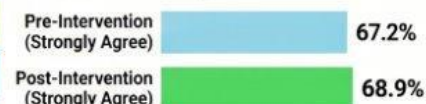
SECONDARY SCHOOL: EXPANDING INFLUENCE



Stability in Choice Confidence



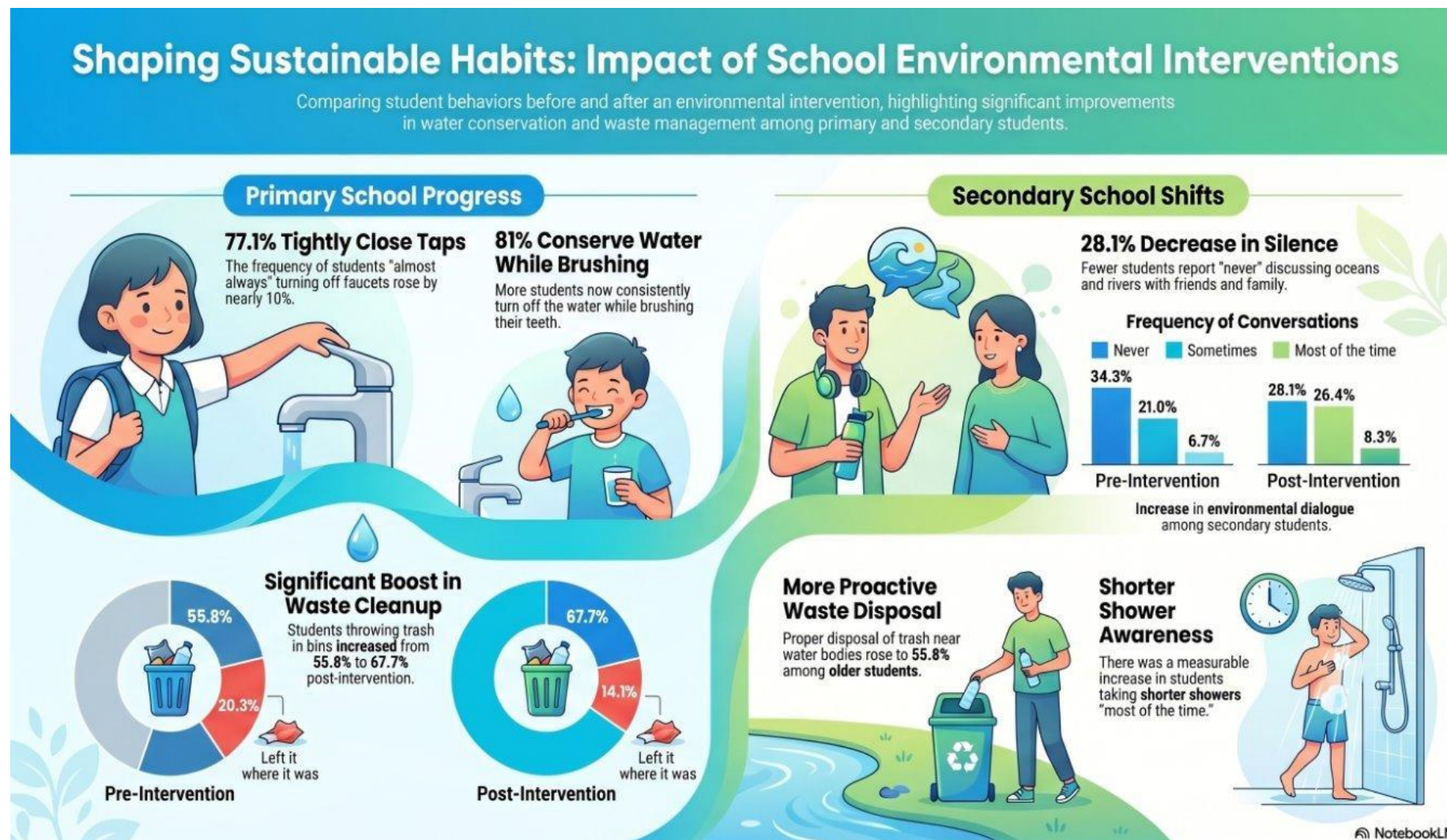
Belief in the Impact of Small Actions



Growth in Effective Communication and Inspiration



Annex 4. Impact: Behaviour Dimension



Annex 5. Impact: Emotional Connection

Boosting Emotional Wellbeing: Impact of School Interventions

Primary School: Growing Happiness & Confidence



Reduction of Negative Emotions (Intensity: Not at all)

	Pre-Intervention	Post-Intervention
 Nervous / Worried	34.5%	44.2%
 Upset / Sad	49.0%	55.6%
 Afraid / Scared	48.2%	53.0%

Secondary School: Reaching Peak Inspiration



Surge in High-Intensity Inspiration
The number of students feeling "extremely" inspired rose from 14.5% to 20.0%



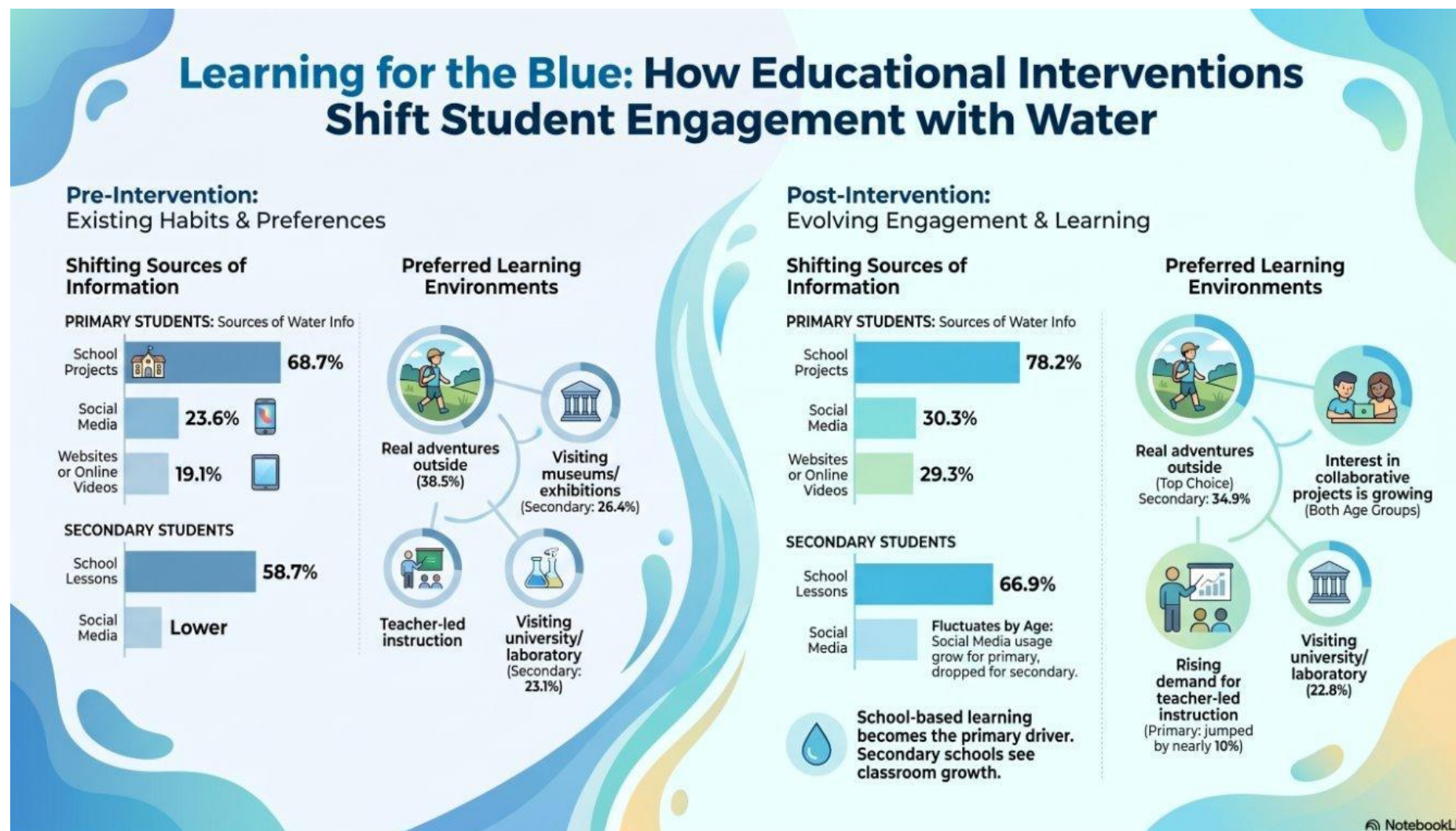
38% Increase in "Extremely" Ready Students
Extreme enthusiasm for being "ready" climbed from 13.4% to 18.6% post-intervention



More Students Identify Their Feelings

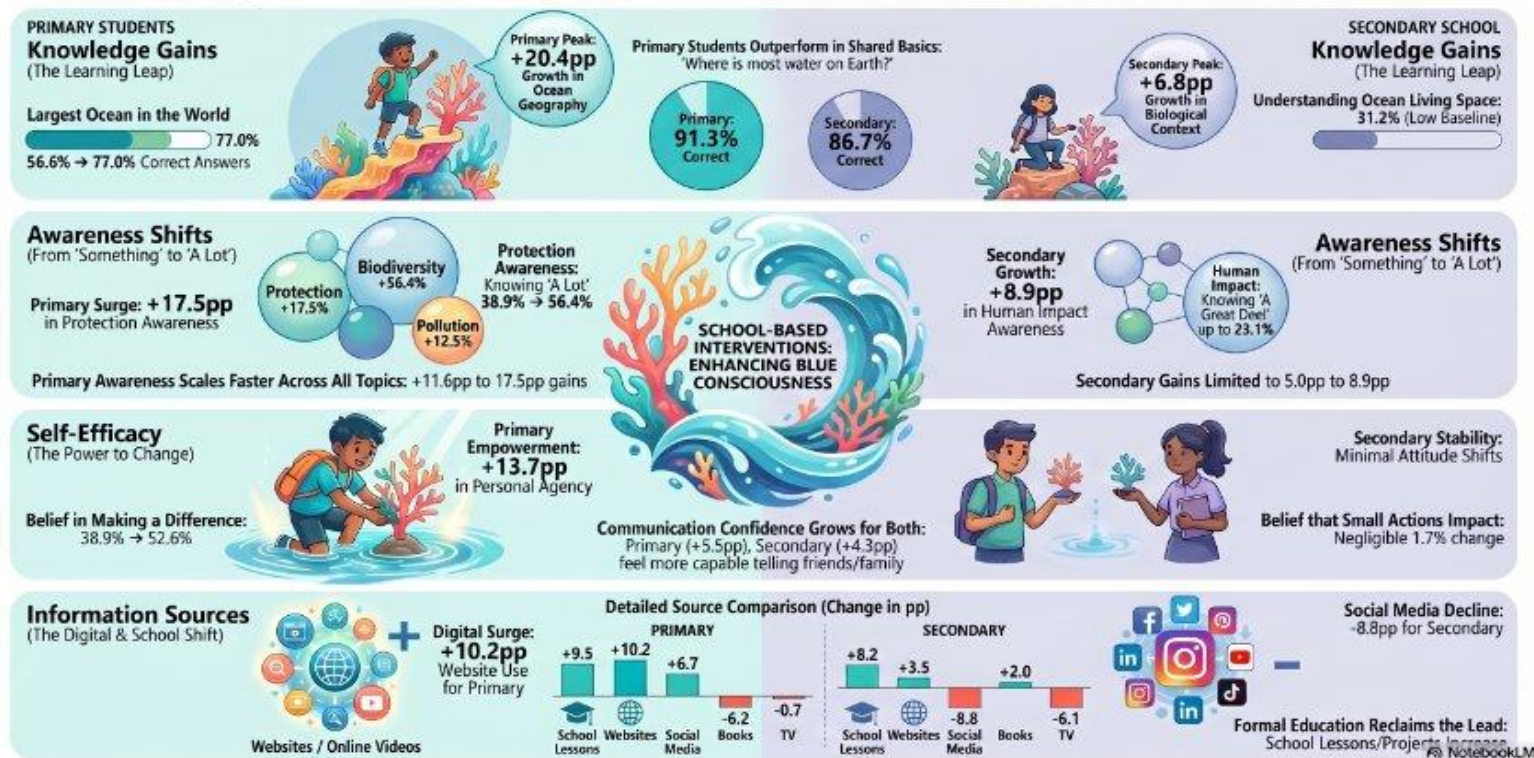
Across all positive categories, "I don't know" responses decreased, suggesting higher emotional literacy

Annex 6. Impact: Communication Dimension



Annex 7. Summary

Impact of School Interventions on Blue Consciousness



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