



ProBleu

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

Call HORIZON-MISS-2022-OCEAN-01

Deliverable D5.3 The impacts of ProBleu

Lead Beneficiary: Earthwatch

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List of Abbreviations

DMP - Data Management Plan

CSIC - Spanish National Research Council (Consejo Superior de Investigaciones Científicas)

IPA – Interested parties and actors

KTU - Kaunas University of Technology

MICS - Measuring the Impact of Citizen Science (European project)

NEBS - Network of European Blue Schools

OCT - Ocean Conservation Trust

PML - Plymouth Marine Laboratory

SDG – UN Sustainable Development Goal

Summary

ProBleu is a Coordination and Support Action supporting school communities across the EU and associated countries in undertaking ocean and freshwater literacy projects, often through citizen science. Operating within the framework of the EU Mission “Restore our Ocean and Waters by 2030”, the project has supported 111 school projects through pedagogical resources, accreditation pathways via the *Network of European Blue Schools* (NEBS), and small-grant funding.

This deliverable, D5.3, reports on the impact assessment activities carried out under Task 5.4 of *Work Package 5* (WP5). Impact assessment was based on the MICS methodology. Seven school projects, from Malta, Belgium, Cyprus, Slovakia, and Slovenia, completed the MICS assessment across the five MICS domains: Society, Science and Technology, Environment, Economy, and Governance. To expand on this manual assessment, an AI-assisted analysis was also conducted across all 111 ProBleu-funded projects using project proposals and, where available, final reports as the evidence base. Together, these analyses provide both detailed project-level insight and a broader comparative view of impact patterns across all ProBleu-funded projects.

The findings show a highly consistent impact profile across ProBleu projects. Environment is the strongest domain, with environmental awareness and environmental footprint scores substantially above the MICS platform averages. Society is similarly strong, particularly participant activeness, reflecting the effectiveness of ProBleu’s hands-on, open-schooling citizen science model in generating active learner engagement. Science is also consistently strong across projects.

In contrast, Governance is the weakest domain, particularly the Policy indicator, where most projects show little connection to formal policy processes or governance structures. Scientific productivity is also comparatively weak: although projects generate substantial educational, observational, and environmental data, this is rarely translated into formal scientific outputs such as open repositories or publications. The AI-assisted analysis confirms that these patterns are characteristic across the wider group of ProBleu-funded projects and are not limited to the manually assessed cohort.

Three principal recommendations emerge from the analysis. First, future projects should strengthen policy engagement by supporting schools to communicate findings to local and regional authorities. Second, schools should receive greater support in converting project data into formats suitable for scientific reuse and contribution to wider monitoring initiatives. Third, impact assessment should be more systematically integrated into future programmes to strengthen the evidence base for evaluating educational and societal impact.

Overall, the evidence assembled in this deliverable demonstrates that ProBleu’s school-based citizen-science model is highly effective at generating environmental engagement, participatory learning, and interdisciplinary educational impact, while also highlighting

important areas for future development in governance engagement and the formalisation of scientific data.

1. Introduction

1.1 Background

The degradation of marine and freshwater ecosystems represents one of the defining environmental challenges of the twenty-first century. Addressing it requires not only technological and governance responses, but a fundamental shift in public awareness, values, and behaviour, a transformation that needs to be rooted in education. Citizen science has been identified as a key mechanism for fostering such societal transformations by actively involving the public in knowledge production and environmental stewardship (Haklay, 2013). It is within this context that the European Commission launched the Mission "Restore our Ocean and Waters by 2030", one of five EU Horizon Europe Missions designed to address major societal challenges through ambitious, measurable targets. The Mission sets out to protect and restore marine and freshwater ecosystems, prevent and eliminate pollution, and enable the transition to a sustainable blue economy, with explicit recognition that citizen engagement and ocean and water literacy are preconditions for success. This aligns with internationally recognised ocean literacy frameworks, which emphasise understanding the reciprocal relationship between humans and the ocean as a prerequisite for behavioural change (UNESCO Intergovernmental Oceanographic Commission, 2017).

ProBleu is a Coordination and Support Action specifically designed to advance this agenda within formal education. Together, ProBleu partners contribute complementary expertise spanning marine science, pedagogy, citizen-science methodology, institutional coordination, and educational technology.

ProBleu's operational model is structured around six *work packages* (WPs). WP4 manages the delivery of small-grant funding to schools, which are supported in designing and implementing citizen-science projects investigating ocean or freshwater issues. Over the course of the project, four funding calls were launched, resulting in 111 school projects being awarded and carried out. These projects span a broad geographic and thematic range, from coastal communities monitoring seagrass to inland schools analysing nutrient loads in rivers.

WP5 focuses on assessing learning outcomes and impacts and is led by KTU. It encompasses a range of evaluation activities designed to assess not only individual school learning but the broader societal, environmental, economic, scientific, and governance impacts of the projects funded under ProBleu. Task 5.4, led by Earthwatch, focuses on conducting systematic impact assessments of funded school projects using the MICS framework [mics.tools]. This deliverable, D5.3, presents the results of those assessments.

1.2 Purpose and scope

Deliverable 5.3 serves as the primary evidence-based record of the societal, environmental, economic, scientific, and governance impacts generated by ProBleu-funded school projects, as assessed through the MICS tool [mics.tools].

Of the 111 projects funded across four calls, eight school projects completed MICS impact assessments following a dedicated training session that 11 school representatives attended. One of these eight assessments (reBLUE 4.0, Cyprus) was only 27% complete at the time of analysis and is excluded from this manual assessment, though it is referenced in methodological discussion. The primary cohort for the manual assessment, therefore, comprises 7 school projects from 5 countries. To expand on this, an AI-assisted analysis was conducted across all 111 ProBleu-funded projects using project documentation as the evidence base. This expanded analysis is used to identify patterns across all projects and to contextualise the findings from the manually completed MICS assessments.

In addition to individual project assessments, a full MICS assessment was also conducted for the ProBleu project as a whole, providing a project-level perspective against which individual school project scores can be contextualised. The deliverable covers all five MICS domains (Society, Science and Technology, Environment, Economy, and Governance) and all MICS indicators. It presents cross-project comparisons based on the manually completed MICS assessments, AI-assisted analysis across all ProBleu-funded projects, qualitative analysis of MICS-generated recommendations, and a synthesis of lessons learned and actionable recommendations for schools, for ProBleu, and for future funded initiatives of a similar character.

The MICS tool was originally developed under the H2020 MICS project and has been adopted by ProBleu as part of WP5's evaluation toolkit. While it was designed for citizen science broadly, its comprehensive multi-domain framework makes it applicable to school-based citizen science projects, though with certain limitations discussed in Section 2.6.

1.3 Link to EU Mission Ocean

The *EU Mission "Restore our Ocean and Waters by 2030"* (Mission Ocean) defines three interlinked objectives:

- protecting and restoring marine and freshwater ecosystems and biodiversity;
- preventing and eliminating pollution; and
- making the sustainable blue economy a reality.

Critically, the Mission's implementation roadmap identifies ocean literacy, defined as an understanding of the ocean's influence on human life and of human influence on the ocean, as an enabling condition for achieving all three objectives. Citizens who understand and value aquatic ecosystems are more likely to adopt sustainable practices, support protective policies, and contribute to scientific monitoring efforts.

ProBleu's school-based approach is directly aligned with this rationale. By engaging students and teachers in authentic citizen-science investigations of local marine and freshwater

environments, the project cultivates first-hand environmental awareness, scientific skills, and pro-environmental attitudes among a generation that will carry these values into adulthood. The impact data presented in this deliverable provide empirical evidence for the effectiveness of this approach, particularly in the domains of environmental awareness and participant activeness.

Beyond the classroom, ProBleu projects demonstrate connections to several specific Mission Ocean ambitions: the data collected by schools on water quality, macroinvertebrates, turtle sightings, and plastic pollution contributes, however modestly, to the monitoring infrastructure that underpins evidence-based ecosystem management; the storytelling and communication activities of some projects (notably ECSTAO, Cyprus) seek to translate scientific findings into public narratives that can influence attitudes and, ultimately, policy; and the integration of sustainability practices into school operations, such as reducing plastic use and managing waste, addresses pollution prevention at an institutional level. The governance and policy impact findings discussed in Section 4.5, while currently the weakest dimension of ProBleu's impact profile, point towards an important frontier for development: equipping schools not merely to observe and understand their local water environments, but to act upon and communicate findings within civic and political arenas.

2. Methodology

2.1 The MICS impact assessment framework

The MICS tool is an AI-based digital assessment platform originally developed as part of the H2020 MICS project. It is designed to provide citizen-science projects with a standardised, evidence-informed framework for evaluating their impacts across multiple dimensions of social benefit. Similar structured approaches have been developed to evaluate learning and engagement outcomes in citizen science, particularly in educational contexts (Phillips et al., 2018). Unlike tools that rely on narrative accounts, MICS generates quantified indicator scores by applying AI (Ceccaroni et al., 2026) and predefined rules to structured questionnaire responses. The result is a composite score for each of 10 indicators, each scored on a scale of 0 to 42, distributed across five thematic domains:

- **Society:** Activeness; Involvement
- **Science and Technology:** Scientific productivity; Interdisciplinary science
- **Environment:** Environmental awareness; Environmental footprint
- **Economy:** Economic productivity; Financial sustainability
- **Governance:** Policy; SDGs alignment

Each indicator-score reflects the aggregated responses to a set of structured questions addressing the activities, outputs, and practices of the project being assessed. The scoring algorithm assigns weights and combines responses according to established rules, yielding

indicator scores that can be compared both internally (across indicators and domains within a project) and externally (against the MICS platform's aggregated database of citizen science projects, referred to in this report as the "platform average"). The platform average represents the mean score of all projects that have used the MICS tool globally, across all types of citizen science initiatives, and therefore provides a reference point that, while not specific to school-based or water-focused projects, enables meaningful benchmarking. In the EU, the growing emphasis on structured impact assessment reflects increasing policy interest in demonstrating the societal and environmental value of citizen science for decision-making (European Commission, 2020).

In addition to indicator scores, the MICS platform generates a set of tailored recommendations for each project. These recommendations align with citizen-science best practices and provide practical guidance to strengthen impact in areas where performance is below optimal. Both the quantitative scores and the qualitative recommendations are used in the analysis presented in this deliverable.

The total questionnaire administered through the MICS platform comprises 222 questions distributed across five thematic domains and a General category, as follows: Society (67 questions), Governance (43 questions), Science and Technology (39 questions), Economy (31 questions), Environment (30 questions), and General (13 questions). Not all questions apply to every project type; the system filters out inapplicable questions based on earlier responses, so the effective number of questions for any given project may be lower than the domain totals suggest. This also explains the variation in completion rates across projects, as some questions may not have been reached due to branching logic.

2.2 Data sources

The analysis presented in this deliverable draws on the following data sources:

1. **MICS answers dataset**, comprising 1,054 individual answer records submitted by the eight school projects, used to examine response patterns at the question level, where relevant to the analysis.
2. **Eight individual MICS impact reports** generated by the MICS platform for each of the eight school projects that had manually completed or partially completed assessments. These reports include indicator scores, domain scores, and text-based recommendations.
3. **One full ProBleu-project MICS assessment**, completed at the project level with a 94% completion rate, providing a programme-wide reference point.
4. **MICS questions dataset**, comprising the full set of 222 questions across all domains, used to contextualise scores and understand the scope of each indicator.
5. **Project documentation** used for the AI-assisted analysis, comprising project proposals and, where available, final reports for all 111 ProBleu-funded projects. These documents served as the evidentiary basis for the structured, AI-assisted application of the MICS questionnaire.

2.3 Assessment process

The MICS manual impact assessment process within ProBleu was structured as follows. All school contacts from the four calls were invited to attend a dedicated online MICS training session, which 11 school representatives attended. The training covered the purpose and structure of the MICS assessment, the process for registering a project on the MICS platform, and guidance on completing the questionnaire to accurately reflect their project's activities and outputs.

Following the training, school representatives were supported to complete their assessments independently on the MICS platform. Of the 11 who attended training, three did not proceed to complete an assessment: two registered on the platform but did not create a project entry, and one registered a user account but added no project content. The remaining eight school projects proceeded to submit assessments.

Assessment completion rates varied across the eight projects. Six projects achieved completion rates of between 90% and 100%, indicating that virtually all applicable questions were answered. One project, FEKRUNA (Malta), achieved an 89% completion rate, while another, reBLUE 4.0 (Cyprus), achieved only 27%, yielding scores that reflect incomplete data rather than genuine project performance. Specifically, reBLUE 4.0 scored zero on eight of the ten indicators as a direct consequence of unanswered questions, with non-zero scores recorded only for *Scientific productivity* and *Interdisciplinary science*, where responses were captured. This project was therefore excluded from the manual cross-project analyses, though it is included in the project overview table and referenced in the discussion of assessment process limitations.

The seven projects included in the primary analytical cohort are drawn from five countries: Malta (two projects: A.W.A.R.E.N.E.S.S. and FEKRUNA), Belgium (two projects: NEMU and Guardians of the Streams), Cyprus (one project: ECSTAO), Slovakia (one project: SLW – Looking for Living Water), and Slovenia (one project: LoveWater).

2.4 Analytical approach

The analysis follows four principal methods.

First, **quantitative benchmarking** compares each project's indicator scores against the MICS platform average, identifying where ProBleu school projects collectively exceed, meet, or fall below the average for citizen science projects globally. Domain-level aggregates (mean scores across the two indicators within each domain) are calculated for the cohort of seven projects and compared with the corresponding platform averages.

Second, **cross-project synthesis** examines patterns of variation across the seven projects, identifying shared strengths, common weaknesses, and notable outliers. This approach enables conclusions to be drawn about the ProBleu's school-based citizen-science model as a whole.

Third, **qualitative analysis of MICS recommendations** identifies recurring themes in the platform-generated guidance, which are used to triangulate the quantitative findings and ground the recommendations presented in Section 9.

Fourth, an **AI-assisted analysis** across all 111 funded projects was undertaken using project documentation as the evidence base for structured MICS question interpretation. This enabled broader pattern identification and triangulation of the findings emerging from the manually assessed cohort. Where individual project scores are cited, the project name or identifier is provided alongside the score to enable traceability. All scores are presented on the 0–42 scale used by the MICS platform, and domain means are calculated as the arithmetic mean of the two constituent indicator scores.

2.5 AI-assisted analysis approach

In addition to the manually completed MICS assessments undertaken by school representatives, an AI-assisted analysis was conducted across all 111 ProBleu-funded projects. This analysis used project proposals and, where available, final reports as the evidentiary basis for answering the MICS questionnaire using the predefined response categories. Responses were supported by explicit evidence tracing to statements in the project documentation.

The purpose of this analysis was to extend the comparative evidence base across all ProBleu-funded projects and identify patterns that could not be observed from the seven-project manual cohort alone. Because the AI-assisted assessments are inference-based and dependent on documented evidence, they are interpreted separately from the manually completed MICS scores.

2.6 Limitations

Several limitations should be kept in mind when interpreting the findings of this analysis:

Sample size. Only 8 of the 111 ProBleu-funded school projects completed the manual MICS assessment, representing 7% of all ProBleu-funded projects. While the assessment process was open to all projects and actively promoted through training, participation was voluntary, and the projects that engaged with the tool may not be representative of the full range of projects funded. Projects with more active and engaged school contacts, or those with more confident reporting practices, may be over-represented. The small sample size is likely due to time constraints, as answering the questions required by MICS is time-consuming and takes approximately three hours.

Self-reported data

This limitation is widely acknowledged in citizen science evaluation, where reliance on self-reported data may introduce bias despite structured assessment frameworks (Bonney et al., 2016). MICS assessments are completed by the project teams themselves, and scores therefore depend on self-reported accounts of project activities. Although the structured, rules-based scoring algorithm limits the scope for subjective inflation compared with purely narrative evaluation approaches, the quality of responses is still dependent on respondents' understanding of the questions and their accuracy in recording project activities.

Incomplete assessment

The exclusion of reBLUE 4.0 from manual analysis reduces the effective cohort to seven projects and removes (from the manual assessment) the only project that may have represented a particular type of activity (a toy-lending and reuse programme focused on reducing plastic consumption) that is methodologically distinct from the other, more science-intensive projects.

Platform benchmark context

The MICS platform average is drawn from a diverse global database of citizen science projects, spanning professional research programmes, community monitoring initiatives, and school-based activities. It is not specific to school-based, education-focused, or ocean/water-themed projects. Comparisons against this benchmark should therefore be interpreted with caution: where ProBleu projects score above the platform average, this may reflect genuine impact strength, but it may also reflect a different mix of project types in the benchmark population.

MICS tool design

The MICS framework was designed for citizen science broadly and has not been specifically adapted for school-based projects. Some indicators, particularly *Scientific productivity* and *Policy influence*, implicitly assume conditions (such as publication infrastructure or policy access) that are structurally difficult for schools to fulfil. Scores on these indicators may therefore understate genuine impact or reflect structural constraints rather than lack of effort or ambition.

Stage of implementation

Projects were assessed at varying points in their lifecycle, and some projects were at earlier stages of implementation than others at the time of assessment. This introduces additional variance into the scores.

AI-assisted inference limitations

The AI-assisted analysis was completed to address the small sample size associated with the manual MICS assessment, but it brings its own set of limitations. The AI-assisted analysis relies entirely on the information made visible within project proposals and final reports. Any activities that were undertaken but not documented cannot be captured by the analysis. Consequently, some areas, particularly relating to governance procedures, ethics, data management, and behavioural outcomes, may reflect documentation gaps rather than a genuine absence of activity. The AI-assisted findings should therefore be interpreted as evidence of documented practice rather than exhaustive accounts of project implementation.

3. Overview of participating projects

The eight school projects that engaged with the MICS assessment represent a small but geographically and thematically diverse subset of ProBleu's funded projects (see Table 1). They span five European countries, Malta, Belgium, Cyprus, Slovakia, and Slovenia, and address a wide range of aquatic and marine topics. Their budgets range from €2,500 to €10,000 in ProBleu funding. All were implemented within formal school settings and designed around citizen-science principles of student-led investigation, data collection, and community engagement.

Thematically, the projects encompass: marine plastic pollution and the transition to renewable energy and biological alternatives (A.W.A.R.E.N.E.S.S., Malta); freshwater ecosystem health and nutrient dynamics (NEMU, Belgium); sustainable toy-lending and marine plastic reduction (reBLUE 4.0, Cyprus); river and stream water quality assessment (SLW, Slovakia; Guardians of the Streams, Belgium); the hydrological journey of freshwater through a national landscape (LoveWater, Slovenia); sea turtle monitoring and conservation awareness (FEKRUNA, Malta); and ocean and water storytelling as a vehicle for environmental communication (ECSTAO, Cyprus). This diversity reflects ProBleu's deliberate design choice not to prescribe a single scientific methodology or environmental focus, instead providing schools with the flexibility to connect ocean and water literacy to their contexts, curricula, and community interests.

Despite their diversity, all projects share a common structure: a school or cluster of schools as the primary implementing organisation; students as the primary citizen scientists; a teacher or coordinator as project lead; a modest budget (between €2,500 and €10,000) from ProBleu; and a defined investigation and dissemination phase. This shared architecture makes cross-project comparison meaningful even where the specific scientific themes and methods differ substantially.

Table 1: Overview of manually-assessed ProBleu school projects

ID	Project Name	Country	Focus	ProBleu Grant (€)	Assessment Completion (%)
150	A.W.A.R.E.N.E.S.S.	Malta	Plastic elimination, ocean energy, algae	2,500	95
151	NEMU	Belgium	Freshwater ecosystems, nutrient loads, and molecular biology	5,000	100
152	reBLUE 4.0	Cyprus	Toy lending, plastic reuse, and marine pollution	10,000	27 (excluded)
153	SLW (Looking for Living Water)	Slovakia	River water quality, macroinvertebrates	2,500	98
154	LoveWater	Slovenia	Freshwater-to-sea connectivity, water worlds	5,000	97
155	FEKRUNA	Malta	Sea turtle monitoring and conservation	5,000	89

156	ECSTAO	Cyprus	Ocean storytelling, environmental communication	5,000	98
157	Guardians of the Streams	Belgium	Stream ecology, macroinvertebrate monitoring	7,500	100

Note: reBLUE 4.0 (ID 152) is included in the table for completeness but is excluded from the manual cross-project analyses due to insufficient assessment completion. Budget figures refer to ProBleu grant funding.

The geographic distribution of the assessed projects reflects some clustering: two projects each from Malta, Belgium, and Cyprus, and one each from Slovakia and Slovenia. This is a product of which schools engaged with the voluntary MICS assessment process rather than a reflection of the broader ProBleu project, which includes funded projects from a wider set of EU and associated countries. No single country emerges as a clear outlier in terms of impact performance across all domains, though country-level comparisons with such small sub-group sizes would not be statistically robust. The Belgium projects (NEMU, Guardians of the Streams) tend to display more balanced profiles across domains, while the Malta projects (A.W.A.R.E.N.E.S.S., FEKRUNA) show particularly high participant activeness and environmental scores.

Budget does not emerge as a strong predictor of overall impact scores within this cohort. A.W.A.R.E.N.E.S.S., with the smallest ProBleu grant of €2,500, achieves the highest total score (282/420), while reBLUE 4.0, with the largest grant of €10,000, did not complete its assessment. Among the seven analysed projects, NEMU (€5000) ranks third by total score (267/420), and SLW (€2,500) ranks last (204/420). This suggests that the quality of project leadership, community engagement, and scientific design are more significant determinants of impact than financial resources alone, a finding consistent with the broader citizen-science literature (Shirk et al., 2012; Conrad & Hilchey, 2011).

4. Impact assessment results

The following sections present the manual impact assessment results for the seven ProBleu school projects that completed substantive MICS assessments, analysed domain-by-domain. Within each domain, individual indicator scores are compared against the MICS platform average, patterns of variation across the seven projects are examined, and the thematic content of MICS-generated recommendations is synthesised. Domain means are calculated as the unweighted arithmetic mean of the two constituent indicator scores across the seven-project cohort.

4.1 Society: Activeness and Involvement

The Society domain encompasses two indicators, *Activeness* and *Involvement*, which together assess the degree to which a project generates genuinely active, engaged participation from its target audience and the breadth of *interested parties and actors* (IPAs) involved.

Activeness measures the extent to which participants engage in substantive activities, such as data collection, fieldwork, analysis, and dissemination. Across the seven projects, the mean *Activeness* score is **37/42**, compared with a MICS platform average of 22, representing a differential of +15 points (a 68% premium over the benchmark). Critically, all seven projects exceed the platform average on this indicator, reflecting a uniformly high level of active participant engagement across the cohort. Four projects, A.W.A.R.E.N.E.S.S., NEMU, FEKRUNA, and Guardians of the Streams, score 40, within two points of the maximum. The lowest *Activeness* score in the cohort is 32, recorded by two projects, which nonetheless remain comfortably above the platform benchmark.

This consistently high performance is not coincidental. ProBleu's pedagogical model, grounded in open-schooling principles, citizen-science practice, and active student inquiry, is specifically designed to move students from passive recipients of environmental information to active agents of investigation. Field visits, water sampling, organism identification, data entry, and project communication are integral to virtually all funded school projects, and the MICS scores confirm that this design intent is being translated into measurable participant activeness. This finding is consistent with existing research demonstrating that participation in citizen science enhances student engagement, scientific agency, and motivation to learn (Ballard et al., 2017).

Involvement measures the breadth and depth of community IPAs engagement, the degree to which projects actively recruit, consult, and collaborate with external partners, local communities, families, and other institutions. The mean *Involvement* score across the seven projects is **27/42**, against a platform average of 17 (+10). Six of the seven projects exceed the platform average, demonstrating that ProBleu schools are achieving above-average IPAs reach. NEMU and SLW achieve the highest *Involvement* scores within the cohort (31 each), reflecting strong connections with parents, local NGOs, and scientific institutions in their respective contexts.

The exception is ECSTAO (Cyprus), which records the lowest *Involvement* score of any project in the cohort (13/42), despite achieving above-platform scores on virtually every other indicator. This is attributable to ECSTAO's distinctive approach: as a storytelling-based project focused on producing creative outputs (narratives, videos, presentations) about ocean issues, it may generate fewer of the structured multi-IPAs engagement activities, such as community monitoring events, data-sharing workshops, or external scientific partnerships, that the *Involvement* indicator is designed to measure. ECSTAO's low *Involvement* score is therefore more likely a reflection of indicator-activity mismatch than a genuine deficit in community engagement, and should be interpreted accordingly.

The **Society domain mean** across the seven projects is **32/42**, compared with a platform average of 20 (+12). This is the second-strongest domain in absolute terms (after Environment) and represents one of the most robust areas of ProBleu's impact. The MICS recommendations generated for projects in this domain typically acknowledge strong existing levels of participant awareness and responsibility, whilst suggesting that projects with more modest *Involvement* scores could benefit from formalising their IPAs engagement strategies, for example, by establishing advisory groups, creating systematic feedback mechanisms, or documenting community partnerships more explicitly.

4.2 Science and Technology: *Scientific productivity* and *Interdisciplinary science*

The Science and Technology domain presents the most analytically complex picture of any domain, characterised by exceptionally strong performance on *Interdisciplinary science*, coexisting with markedly weak performance on *Scientific productivity*. Understanding this divergence is essential to developing appropriate responses.

Interdisciplinary science measures the degree to which a project crosses traditional disciplinary boundaries by integrating natural science with social science, the humanities, the arts, technology, or other fields in its design, methods, and outputs. Across the seven projects, the mean *Interdisciplinary science* score is **33/42**, compared with a platform average of 21 (+12 points, a 58% premium). All seven projects exceed the platform average, with scores ranging from 31 (FEKRUNA) to 34 (NEMU, SLW, LoveWater, Guardians of the Streams). This near-uniform high performance reflects the inherently cross-curricular character of school-based citizen science, which naturally integrates biology, geography, chemistry, environmental studies, mathematics, and often communication and civic education within a single project framework. Such interdisciplinary approaches are increasingly recognised as essential for equipping learners with the competencies needed to address complex sustainability challenges (OECD, 2018).

Scientific productivity, by contrast, measures the extent to which a project generates formal scientific outputs, such as datasets submitted to public repositories, contributions to peer-reviewed publications, data shared with research institutions, or presentations at scientific conferences. Across the seven projects, the mean *Scientific productivity* score is **9/42**, compared with a platform average of 18 (–9 points). This is the single lowest indicator mean across all five domains, and five of the seven projects score below the already modest platform average. The two projects that exceed the platform average are Guardians of the Streams (20/42) and ECSTAO (19/42), both of which appear to have developed more systematic approaches to data recording and external communication than their peers.

At the lower end, A.W.A.R.E.N.E.S.S. scores 3, SLW scores 1, and LoveWater scores 1, figures that suggest these projects generated minimal or no formal scientific outputs in the forms measured by MICS. FEKRUNA (6) and NEMU (10) occupy an intermediate position, with NEMU's molecular biology approach giving it slightly more scope for data formalisation than purely observational projects.

The underlying explanation for this is structural rather than motivational. School-based citizen science projects are primarily designed to achieve educational outcomes, to develop scientific literacy, environmental awareness, and inquiry skills in students, rather than to generate publishable research. They typically lack the institutional infrastructure (academic affiliations, data management systems, publication support) that enables research-grade scientific outputs. Teachers and school coordinators are not professional researchers, and the time and technical resources required to prepare data for submission to scientific repositories or contribute to peer-reviewed publications are generally beyond what can be expected within a school project of limited duration and budget.

The MICS platform, designed with a broader range of citizen science projects in mind, including professional research programmes and well-resourced community science initiatives, assigns significant weight to formal scientific outputs in its *Scientific productivity* indicator. This creates a systematic structural disadvantage for school-based projects that is important to acknowledge when benchmarking their performance. The low *Scientific productivity* scores should be interpreted not as a failure of ambition or commitment, but as a reflection of the structural realities of school-based citizen science within the ProBleu's model.

Nonetheless, the gap between the rich data assets generated by these projects and the minimal formal scientific outputs they produce represents a genuine untapped potential. Frameworks for public participation in scientific research highlight the importance of designing projects that intentionally connect data collection activities with meaningful scientific outputs (Shirk et al., 2012). The data collected by schools on water quality, macroinvertebrates, turtle sightings, and plastic pollution have scientific value that, with appropriate support, could be leveraged more effectively. The MICS recommendations generated for most projects in this domain consistently emphasise the importance of data quality protocols, open data practices, and linking school datasets to broader national or European monitoring programmes.

The **Science and Technology domain mean** is **21/42**, compared with a platform average of 20 (+1). This modest positive differential conceals the internal divergence described above, and the aggregate figure should not be interpreted as indicating adequate performance across both indicators.

4.3 Environment: *Environmental awareness and Environmental footprint*

The Environment domain is unambiguously the strongest across all seven ProBleu school projects, achieving the highest domain mean score and the largest positive differential above the platform average of any domain. This finding is both expected, given that all projects are fundamentally about water and ocean environments, and significant, as it provides quantitative confirmation that the environmental impact dimension of ProBleu's school citizen science model is both genuine and substantial.

Environmental awareness measures the extent to which a project increases participants' knowledge, understanding, and concern about environmental issues, and whether it contributes to changes in attitudes or behaviour. Direct engagement with nature and environmental issues during childhood has been shown to significantly influence long-term pro-environmental attitudes and behaviours (Chawla, 2020). The mean *Environmental awareness* score across the seven projects is **37/42**, compared with a platform average of 21 (+16 points, a 76% premium). All seven projects exceed the platform average, and three projects, FEKRUNA (42), ECSTAO (42), and Guardians of the Streams (42), achieve the maximum possible score of 42. A.W.A.R.E.N.E.S.S. (33), NEMU (33), SLW (33), and LoveWater (33) score at a level that still substantially exceeds the platform average. The uniformity of high performance on this indicator is remarkable and reflects the centrality of environmental awareness as a stated objective of virtually all ProBleu-funded projects.

Environmental footprint measures the extent to which the project itself operates in an environmentally responsible manner, minimising its own negative environmental impacts, promoting sustainable practices within the implementing organisation, and actively contributing to positive environmental change. The mean *Environmental footprint* score is **35/42**, compared with a platform average of 13 (+22 points). This is the largest positive differential among all indicators in the assessment, representing a 170% premium over the platform benchmark. All seven projects exceed the platform average on this indicator, with scores ranging from a minimum of 21 (SLW) to a maximum of 42, achieved by both A.W.A.R.E.N.E.S.S. and NEMU.

The exceptional performance on environmental footprint is particularly noteworthy. It suggests that ProBleu school projects are not merely studying environmental problems from the outside but are actively integrating pro-environmental practices into their own operations, through reduced plastic use, waste management, use of public transport for field activities, and promotion of sustainability norms within their school communities. This positive environmental footprint is both an impact in its own right and a powerful pedagogical signal, demonstrating to students that the behavioural changes associated with environmental protection are practicable within everyday school life.

The **Environment domain mean** is **36/42**, compared with a platform average of 17 (+19). It is the strongest domain by both absolute score and differential. MICS recommendations for projects in this domain tend to focus on sustaining and deepening existing strong practices rather than identifying fundamental gaps, for example, by embedding environmental audits into school annual planning, formalising linkages between project activities and biodiversity monitoring frameworks, or developing school-wide environmental action plans that extend beyond the funded project period.

4.4 Economy: *Economic productivity and Financial sustainability*

The Economy domain presents the most heterogeneous picture of any domain, with one indicator showing near-universal strength and the other characterised by extreme polarisation between projects.

Financial sustainability measures whether a project has a credible model for sustaining its activities over the longer term, including diversified funding sources, institutional support from the host organisation, and plans for continuing activities after the initial grant period. The mean *Financial sustainability* score across the seven projects is **30/42**, compared with a platform average of 19 (+11 points). All seven projects exceed the platform average, with scores ranging from a minimum of 21 (NEMU) to a maximum of 42 (A.W.A.R.E.N.E.S.S.), with the majority clustered in the 28–33 range.

This strong performance is attributable to three structural factors. First, ProBleu's school-based model operates within the context of established educational institutions (schools) that provide an inherently stable institutional base, with existing staff, facilities, and organisational continuity that citizen science projects based in less formalised community structures typically

lack. Second, the ProBleu grant itself, combined in several cases with additional external co-funding, provides a documented and diversified funding base that the MICS financial sustainability indicator responds to positively. Lastly, the schools are integrated into the NEBS as part of the ProBleu project, and are certified as Blue Schools; this also supports sustainability.

Economic productivity, by contrast, is the most polarised indicator in the entire assessment. It measures whether a project generates economic value, through training and employment, knowledge transfer, economic capacity strengthening in communities, or by contributing to the green and blue economy. Across the seven projects, the mean score is **12/42**, just below the platform average of 13 (–1 point), but this modest aggregate conceals extreme variation. Three projects, A.W.A.R.E.N.E.S.S. (42), NEMU (21), and ECSTAO (21), score well above the platform average, while four projects, SLW, LoveWater, FEKRUNA, and Guardians of the Streams, score zero.

The zero scores on economic productivity reflect the reality that these school projects are non-profit educational initiatives with no explicit economic mandate. They do not generate employment, charge for services, or produce marketable outputs. The MICS economic productivity indicator, which was designed with a broader range of citizen science models in mind, effectively assigns a floor score to projects that operate entirely outside the market economy. The three projects that do score reflect specific features: A.W.A.R.E.N.E.S.S. achieves a perfect score (42) largely through its engagement with economic alternatives (algae-based products, renewable energy), which give the project an explicit connection to economic futures; NEMU (21) and ECSTAO (21) achieve moderate scores through activities that have training, capacity-strengthening, or knowledge dissemination dimensions.

The **Economy domain mean** is **21/42**, compared with a platform average of 16 (+5). This positive differential is driven primarily by the strong *Financial sustainability* scores and the high outlier scores of A.W.A.R.E.N.E.S.S. on *Economic productivity*.

4.5 Governance: *Policy* and *SDGs*

The Governance domain is the weakest domain in the ProBleu impact profile, with a mean score of 13/42 against a platform average of 15. The domain encompasses two indicators with markedly different performance patterns: *Policy*, which is the single weakest indicator in the entire assessment, and *SDGs* (alignment with the UN Sustainable Development Goals), which is modest but positive. Citizen science is increasingly recognised as a valuable contributor to monitoring and achieving the Sustainable Development Goals, particularly in environmental domains (United Nations, 2015).

Policy measures the extent to which a project engages with, informs, or influences formal policy processes, for example, by communicating findings to local or national authorities, contributing to regulatory consultations, engaging with elected officials, or informing environmental management plans. Across the seven projects, the mean *Policy* score is **6/42**, compared with a platform average of 13 (–7 points, a 57% shortfall below the benchmark). Five of the seven

projects score below the platform average, and four score 0 or 1: FEKRUNA (0), Guardians of the Streams (0), SLW (1), and A.W.A.R.E.N.E.S.S. (1).

The sole project to exceed the platform average on *Policy* is ECSTAO (Cyprus), with a score of 18/42. ECSTAO's storytelling and communication approach, which involves producing accessible narratives, videos, and presentations about ocean issues for public audiences, gives it a distinctive policy-communication dimension that the other, more science-focused projects do not share. By creating content designed to reach beyond the school community and inform wider public understanding, ECSTAO generates the kinds of societal-level messaging that MICS associates with policy influence. LoveWater (6) and NEMU (13) also score at or near the platform average, with NEMU's direct connection to freshwater quality monitoring giving it potential to engage with water management authorities.

The structural explanation for the near-universally low *Policy* scores across ProBleu school projects is straightforward: schools, as institutional actors, typically lack established channels to influence formal policy processes. Teachers and students lack the institutional standing, the formal relationships with policy makers, and the technical capacity (in terms of policy communication skills and knowledge of governance structures) to translate their project findings into policy influence. This is not a failure unique to ProBleu; it reflects a well-documented challenge across school-based citizen science globally (Hecker et al., 2018). However, the magnitude of the gap, with four projects scoring zero, suggests that policy engagement is not merely underdeveloped but essentially absent from most ProBleu school projects. This reflects a broader challenge identified in citizen science practice, where strong participation and knowledge generation are not always translated into policy engagement or governance influence (European Citizen Science Association, 2020).

SDGs measure the alignment of a project's objectives and activities with the UN Sustainable Development Goals, and whether the project explicitly frames its contributions in relation to the global sustainability agenda. The mean SDG alignment score across the seven projects is 20/42, compared with a platform average of 16 (+4 points). Six of the seven projects exceed the platform average, with ECSTAO scoring highest (26) and FEKRUNA lowest (14). The modest positive differential reflects the natural thematic alignment of water and ocean projects with SDG 14 (Life Below Water) and SDG 6 (Clean Water and Sanitation), which most ProBleu projects address directly. However, the relatively low absolute scores, the maximum within the cohort is 26, suggest that projects do not consistently frame their contributions in relation to the broader SDG architecture, nor do they systematically connect their outcomes to targets under SDG 4 (Quality Education), SDG 13 (Climate Action), or SDG 17 (Partnerships for the Goals), all of which are potentially relevant to their activities.

The **Governance domain mean** is 13/42, the weakest domain in the assessment and the only domain where ProBleu school projects fall below the platform average (-2). MICS recommendations generated for projects in this domain invariably emphasise the importance of developing formal policy communication strategies, engaging with local authorities, and adopting explicit SDG mapping as part of project planning. These recommendations are developed further in Section 9.

5. Cross-domain analysis

The domain-by-domain analysis presented in Section 4 establishes the performance profile of ProBleu school projects across five impact dimensions. This section synthesises that profile, examining synergies between domains where strong performance in one area reinforces another, tensions where emphasis on one dimension may come at the cost of another, and broader patterns across the project cohort that cut across individual domain findings (as seen in Table 2).

Table 2: Domain and indicator means (ProBleu cohort versus platform average)

Domain	Indicator	ProBleu mean (n=7)	Platform average	Difference
Society	Activeness	37	22	+15
	Involvement	27	17	+10
	Domain mean	32	20	+12
Science and Technology	Scientific productivity	9	18	-9
	Interdisciplinary science	33	21	+12
	Domain mean	21	20	+1
Environment	Environmental awareness	37	21	+16
	Environmental footprint	35	13	+22
	Domain mean	36	17	+19
Economy	Economic productivity	12	13	-1
	Financial sustainability	30	19	+11
	Domain mean	21	16	+5
Governance	Policy	6	13	-7
	SDGs	20	16	+4
	Domain mean	13	15	-2

5.1 Synergies between domains

Several robust synergies emerge from the cross-domain analysis, illuminating how the ProBleu project generates its characteristic impact profile.

The most powerful synergy is between **Environment and Society**. The consistently high environmental awareness scores across all seven projects are closely correlated with the consistently high activeness scores: projects in which students are genuinely active participants in environmental investigation are, by design, projects that generate strong environmental awareness. The two indicators reinforce each other; hands-on fieldwork and data collection

are the mechanisms through which environmental knowledge and concern are cultivated, motivated, and active student engagement that results from personal environmental experience sustains participation. This Environment–Society synergy is the core strength of ProBleu's model and represents the clearest evidence that its pedagogical approach achieves its intended outcomes.

The next notable synergy exists between ***Interdisciplinary science and Environment***. The high *Interdisciplinary science* scores reflect the cross-curricular character of school projects that integrate scientific observation with geography, data analysis, art and communication, and sometimes social inquiry. This interdisciplinary embedding is both a product of and a contributor to environmental understanding. When students approach water and ocean issues through multiple disciplinary lenses simultaneously, they develop a more nuanced appreciation of environmental complexity than single-subject instruction can provide. Conversely, it is the richness of the environmental subject matter, which connects ecology, chemistry, physics, social systems, and human values, that makes cross-disciplinary integration both necessary and natural.

The more structural synergy is between ***Financial sustainability and the ability to maintain environmental and participatory activities***. The above-platform *Financial sustainability* scores reflect schools' access to institutional resources and diversified funding, which enable sustained, multi-year engagement with water-literacy themes. Projects with stronger financial foundations are better placed to repeat fieldwork, maintain equipment, and build on previous years' data, all of which contribute to the depth of environmental impact that can be achieved.

5.2 Trade-offs and tensions

The cross-domain analysis also reveals several important trade-off patterns in which the model's strengths in some areas appear to be associated with weaknesses in others.

The most significant tension is between ***Activeness and Scientific productivity***. The ProBleu model maximises student engagement by making the process of scientific inquiry accessible, enjoyable, and community embedded. This necessarily means simplifying data-collection protocols, prioritising student agency, and focusing on the educational experience rather than on research output. The result is consistently high *Activeness* scores alongside consistently low *Scientific productivity* scores. This reflects a deliberate prioritisation of educational impact. However, it represents an opportunity cost: the data generated by highly engaged student citizen scientists could, in principle, be structured and quality-assured to the point of scientific usefulness with appropriate support.

A second tension exists between ***policy engagement and the other dimensions of impact***. The low *Policy* scores for most projects suggest that there is no systematic connection between the strong environmental, social, and scientific activities of ProBleu schools and any policy-making or governance engagement. The energy generated by student activeness, the environmental awareness developed through fieldwork, and the interdisciplinary understanding cultivated across curricula do not, in the current model, find expression in formal civic or political

channels. For projects whose explicit educational goals include developing active citizenship, this gap is particularly notable.

A third pattern is the relationship between **Economic productivity and other domains**. The projects that scored zero on *Economic productivity* achieve some of the strongest scores on environmental, social, and scientific dimensions. This inverse relationship partly reflects that projects most intensively focused on environmental investigation and educational participation have the least capacity or motivation to engage in economic value generation. It indicates that a different model of school-environment engagement, one oriented towards green entrepreneurship, sustainable product development, or ecosystem services valuation, could generate economic impacts whilst preserving environmental strengths.

While the preceding analysis is based on the seven manually completed MICS assessments that constitute the available self-reported evidence, the limited uptake of MICS among the wider ProBleu cohort raises the question of whether these patterns are representative of ProBleu-funded projects more broadly. To address this, an additional AI-assisted assessment was undertaken across all 111 ProBleu-funded projects using project documentation as the evidentiary basis. Section 6 presents the findings of this expanded analysis.

6. AI-assisted analysis of project-level impacts

The analysis presented in Section 4 draws on the seven manually completed MICS assessments that constitute the self-reported evidence available for ProBleu. Of the 111 school projects funded across the four ProBleu calls, only this small minority engaged fully with the MICS platform. To extend the evidence base to all ProBleu-funded projects, an additional, complementary analysis was undertaken: an AI-assisted MICS assessment was carried out for all 111 funded projects, including the seven that had also completed the manual assessment. The aim was to provide a reference frame of all ProBleu-funded projects, against which the seven-project findings could be situated and tested. The AIs used were Claude Chat Opus 4.7 and Claude Cowork Opus 4.8.

6.1 Rationale and methodology

The AI-assisted methodology operated as follows. For each of the 111 funded projects, the available project documentation (the original project proposal and, where available, the final report) was supplied as the evidence base. Each of the 222 questions in the MICS questionnaire was then answered using only the predefined answer options published on the MICS platform, with a written justification linking the selected option to specific evidence in the documentation (for example, “The project used scientific/technical learning outputs, such as monitoring, sampling, analysis, digital resources, educational materials, reports, maps, films or datasets. Students researched microplastic pollution in Latvian lakes, visited a research laboratory, conducted field sampling, processed and analysed data, and produced an educational film and learning materials”). Where the documentation did not provide enough information to determine an answer with confidence, the predefined answer “I don’t know” was used rather than imposing an inference unsupported by the source material. The output

for each project was a structured spreadsheet covering all five MICS domains (Society, Science and Technology, Environment, Economy and Governance) plus the General questions, with full traceability between each predefined answer and the supporting document evidence.

The AI-assisted approach has both strengths and limitations. Its strengths are scale, consistency, and full coverage of ProBleu-funded projects, with every project assessed against the same instrument using the same evidentiary standard. Its limitations are equally important: the assessments are inference-based rather than self-reported and depend entirely on documented evidence. Activities not described in proposals or final reports are therefore invisible to the analysis.

Because the AI-assisted answers have been scored through the same rules-based formulas as the manual assessment, the two modes are reported below in two complementary ways: as a numeric comparison of indicator and domain scores on the shared 0–42 scale (Section 6.2 and the project-level calibration in Section 6.6), and as a proportional analysis of individual response patterns across the 111 projects (the share of projects giving a particular answer), which exposes structural features that aggregate scores can obscure. The numeric comparison should be read with the evidentiary asymmetry between the two modes firmly in mind: the manual scores are self-reported by school teams, whereas the AI-assisted scores are inferred solely from project documentation, so exact agreement is neither expected nor required for the comparison to be informative.

A small number of projects were assessed primarily based on their proposal because final reports were not yet available at the time of analysis, this was the case for Call 4 projects. The interpretation of these projects' answers is necessarily more cautious, since proposals describe planned rather than realised activities.

6.2 Cross-domain findings

Across the 111 AI-assisted assessments, a consistent and robust pattern emerges that closely mirrors the profile observed in the seven manually assessed projects, both in terms of which domains are strongest and weakest and in terms of the structural characteristics underlying these results (Figure 1).

At the domain level, the numeric scores confirm this convergence. Table 3 sets the mean domain scores of the full 111-project AI-assisted cohort alongside the seven-project manual cohort and the MICS platform average. The two ProBleu cohorts produce a very similar overall profile: Society and Environment are the strongest domains under both methods, and Governance is the weakest under both. The AI-assisted cohort scores somewhat higher than the manual cohort on Governance, Economy and Science and Technology, and slightly lower on Environment. The Economy difference is the largest and is examined directly in the project-level calibration in Section 6.6; it arises mainly from the Economic-productivity indicator, where the AI-assisted assessment, working only from documentation, frequently could not substantiate the self-reported value that schools recorded manually.

Table 3: Mean domain scores (out of 42): AI-assisted 111-project cohort, manual seven-project cohort, and MICS platform average

Domain	AI-assisted (111 projects)	Manual (7 projects)	MICS platform average
Society	31	32	20
Governance	14	13	14
Economy	26	21	16
Science and Technology	25	21	20
Environment	32	36	17

Society is, alongside Environment, one of the two strongest domains. Every assessed project (111 of 111) is recorded as offering multiple project activities and as differentiating levels of participant involvement. Active engagement in the substantive phases of project work is near-universal: participants are involved in data collection in 110 of 111 projects, in data analysis in 106 of 111, and in the sharing of outputs in 104 of 111. The dominant model is collaborative citizen science (107 of 111), with participants making substantive contributions to design, data and dissemination, but with overall scientific direction held by the school or partner organisation. The pattern of “yes, but it has not been measured” responses is extremely common in this domain, particularly for indicators of attitudinal change, behaviour change and participant satisfaction: changes in participant values and perspectives are reported for 97 of 111 projects, but formally measured for only a small minority. This indicates that the activeness observed in the manual cohort is also observed through the AI-assisted assessment; similarly, the systematic absence of formal measurement of social outcomes is also observed throughout.

Environment is the second strength domain, and the AI-assisted findings reinforce the manual results without ambiguity. All 111 projects are coded as protecting or enhancing natural resources and as explicitly sharing information on sustainable development or lifestyles. The vast majority (110 of 111) take measures to decrease their material footprint and to reduce polluting emissions, and most (102 of 111) are recorded as increasing environmental stewardship among participants. Marine water (77 of 111) and responsible consumption and production (82 of 111) are the most frequently addressed environmental challenges, followed by climate action (68 of 111), reflecting the thematic alignment between ProBleu and the EU Mission “Restore our Ocean and Waters by 2030”. As in the manual cohort, more demanding environmental indicators, such as ambient air-quality monitoring or contributions to the medium- and long-term conservation of plant and animal genetic resources, are essentially absent across the projects, which is structurally consistent with the projects’ educational mandate.

Science and Technology displays the same characteristic tension identified in Section 4.2: strong interdisciplinarity coexisting with very limited formal scientific output. Every project is recorded as explicitly promoting interdisciplinary working, and the great majority (103 of 111) build on existing citizen-science expertise. Linking participants to experts is universal (111 of 111), as is the use of a formal dissemination strategy (111 of 111). Against this, the indicators most closely associated with research-grade scientific productivity are weak: 92 of 111 projects produced no academic publications, 95 of 111 do not provide their data via APIs, and 82 of the 104 projects that answer the relevant question do not develop new technology. The

tension between active scientific participation and minimal formal scientific output, identified in the manual cohort as a defining feature of school-based citizen science, is therefore generalised across all ProBleu projects.

Economy is, similarly to the manual cohort, the most heterogeneous domain in the analysis. Several economy-related strengths are widely shared: 101 of 111 projects have explicit plans to sustain their activities after the current funding period, 87 have co-funding from the host organisation, and 75 have already generated, or are in the process of generating, related follow-on projects, which together provide a robust signal of financial sustainability across the projects. Conversely, indicators tied to commercial value generation are systematically low: 102 of 111 do not generate new jobs within the implementing organisations, all 111 are coded as not generating jobs in external organisations, 109 have no intellectual-property-rights strategy, and all 111 lack a formal exploitation plan. As argued in Section 4.4, these weak commercial-economic indicators reflect the educational, non-profit nature of school projects rather than poor performance, and are reproduced across all ProBleu projects with notable consistency.

Governance is the weakest domain in the AI-assisted analysis, as it is in the manual one. The pattern observed in the seven manually assessed projects, strong IPAs networking but limited formal policy translation, is reproduced almost exactly. All 111 projects are coded as fostering new relationships among IPAs, 110 collaborate with other initiatives, 107 have explicit links with public authorities, and all 111 are aware of and aligned with the Sustainable Development Goals, most commonly Quality Education (SDG 4), Clean Water and Sanitation (SDG 6), Partnerships for the Goals (SDG 17), Climate Action (SDG 13) and Life Below Water (SDG 14). The connection from project activity to formal policy process is weak: 75 of 111 projects do not explicitly inform any governmental policy process, 88 do not increase the political engagement of participants, 101 have not yet supported authorities in enforcing existing regulations or laws, and 109 do not contribute data to the official reporting of any SDG indicator. Data-governance and ethics processes are also frequently described as not visible in the documentation: 88 of 111 do not state procedures for ensuring lawful data processing in the materials reviewed, 92 do not describe a code of ethics, and 88 do not describe a risk-management plan. Some of these gaps reflect a genuine absence; others reflect under-documentation in the project materials available, and the difference between the two cannot always be inferred from the source documents alone, a limitation specific to inference-based assessment.

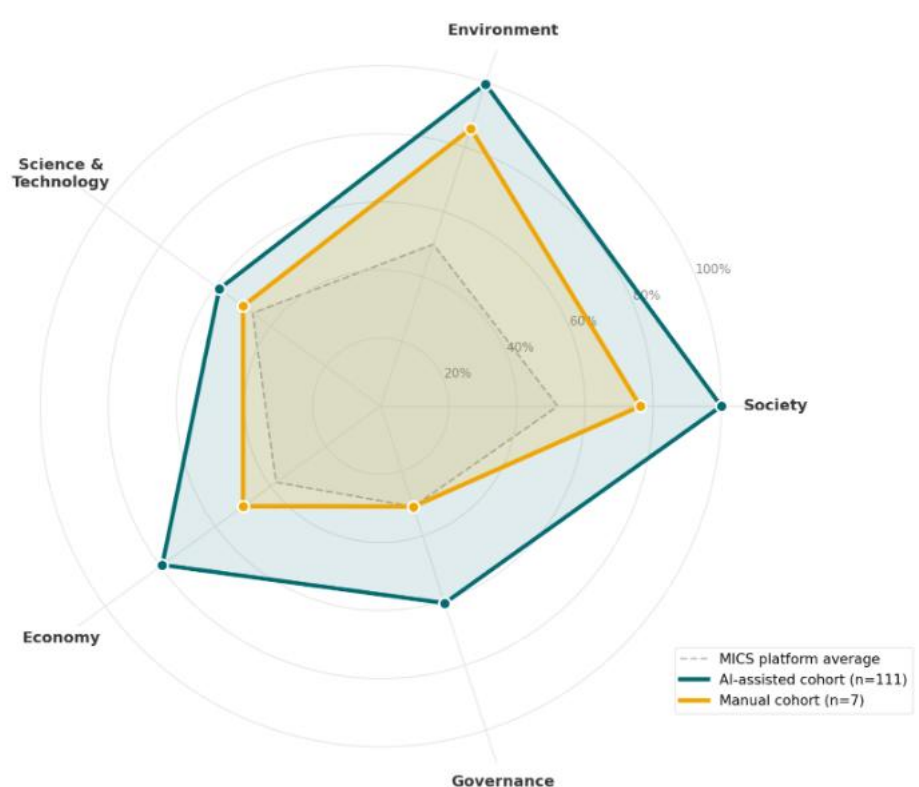


Figure 1 - Manual 7-project cohort vs. AI-assisted 111-project cohort: domain-level comparison (manual: mean score as % of 42-point max; AI: % of 111 projects with positive response)

6.3 Common forms of knowledge creation

A particularly clear finding from the AI-assisted analysis concerns the type of knowledge ProBleu projects create (Figure 2). All 111 projects are coded as generating new data, in either quantitative or qualitative form, derived from school-led observation, monitoring, sampling, surveys or creative outputs. All 111 are also coded as generating new methodologies, predominantly in the form of educational and engagement methods, citizen-science protocols adapted for school settings, and practical pedagogical tools (workbooks, lesson plans, hands-on activities, communication products). A large majority (96 of 111) are also recorded as generating new analyses, typically applying established analytical approaches to newly collected local data. Only a very small number of projects (2 of 111) are coded as generating new theoretical concepts or frameworks. The dominant knowledge profile of ProBleu is therefore that of a programme producing locally generated data and replicable educational methodologies, rather than novel scientific theory, an observation that is wholly consistent with its design intent and with the manual cohort findings on interdisciplinarity and scientific productivity.

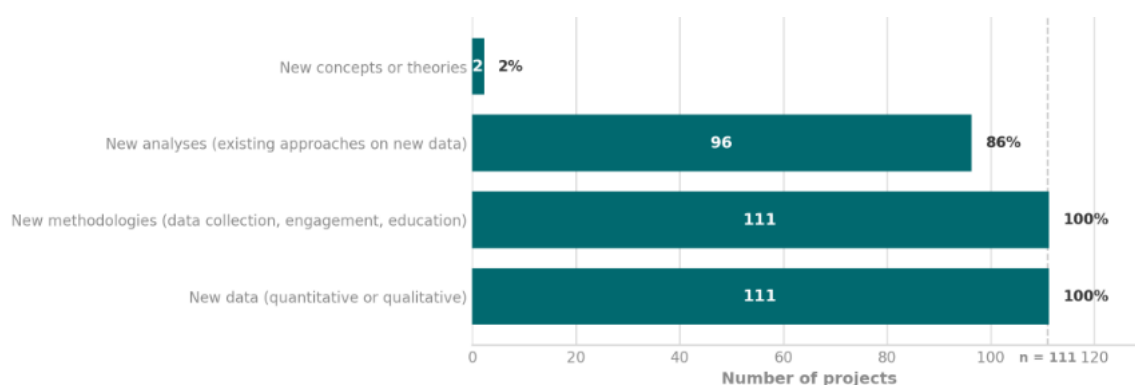


Figure 2 – Forms of knowledge created across all 111 ProBleu projects

Awareness and engagement outputs are similarly near-universal across ProBleu projects: 99 of 111 projects produce data visualisations such as graphs, maps or animations; 100 of 111 transfer or disseminate information about environmentally sound technologies; and 87 of 111 are coded as increasing participants' scientific literacy. Educational outputs are therefore the most consistently and visibly delivered form of knowledge across the projects.

6.4 Recurring success factors

Several characteristics recur across projects that show the broadest cross-domain activity. These are offered as qualitative observations rather than statistical predictors: although comparable indicator scores are now available for all 111 projects, the analysis has no independent outcome measure against which candidate success factors could be formally tested, and the recurring features below are identified from the documentation of projects showing the strongest evidence of activity across multiple domains.

The first is the design of multiple, differentiated participant activities. Every project that documented multiple activity strands, with different levels of engagement available to different cohorts, was recorded as showing strong activeness and involvement.

The second is the embedding of the school project within a network of external partners, particularly research-performing organisations (recorded for 73 of 109 projects answering this question), public bodies and other school or community organisations. Projects with documented multi-organisational delivery consistently showed broader institutional and educational engagement.

The third is explicit alignment with broader EU and global policy frameworks, particularly the EU Mission Ocean, the SDGs, and national or regional environmental strategies. Projects whose proposals or final reports made these connections explicit were also more likely to record activities under the Governance and Environment domains beyond minimum educational engagement.

The fourth is the integration of pro-environmental practice into project operations themselves. Where projects took explicit measures to reduce their own material footprint, polluting emissions and consumption (the dominant pattern across the projects), this was associated with stronger Environment-domain coverage overall, reflecting the same Environment–Society synergy identified in Section 5.1.

6.5 Recurring limitations

The AI-assisted analysis also reveals recurring limitations that are systemic rather than confined to particular projects (Figure 3).

		Confirmed (measured)	Reported (unmeasured)	Uncertain / undocumented	No / absent
Attitude / value change (Society)	Society	14	97	0	0
Behaviour change (Society)		1	110	0	0
Satisfaction with process (Society)		13	73	25	0
Environmental stewardship (Environment)	Environment	9	102	0	0
Positive attitude to nature (Environment)		34	77	0	0
Scientific literacy increase (S&T)	Science & Technology	88	13	10	0
Interest in science careers (S&T)		0	97	14	0
Data interoperability (Governance)	Data Governance	5	0	106	0
Code of ethics (Governance)		10	0	92	9
Risk management plan (Governance)		11	0	88	12
Political participation of citizens (Gov)	Policy	0	13	10	88
Informs government policy (Gov)		24	0	12	75
Contributes to SDG reporting (Gov)		0	0	2	109

Figure 3 – Heat map: response patterns on key impact indicators across 111 ProBleu-funded projects (cell values = number of projects; colour intensity = proportion of 111)

The most common limitation is the absence of formal measurement of self-reported impacts. Across the Society, Environment and Science and Technology domains, attitudinal change, behavioural change, satisfaction, scientific literacy gains and increased interest in scientific careers are very commonly reported as occurring but with the qualifier “yes, but it has not been measured” attached. This indicates that ProBleu projects routinely deliver the activities that would be expected to produce these effects, but routinely lack the methodological infrastructure to evidence them.

A second recurring limitation concerns data governance. Indicators relating to data interoperability (where 106 of 111 are coded “I don’t know”), to whether the project follows defined procedures to ensure lawful data processing (88 of 111 “I don’t know”), to the existence of a code of ethics (92 of 111 “I don’t know”), and to risk-management planning (88 of 111 “I don’t know”) are very rarely answerable on the basis of the documentation alone. Some of this is genuine absence; some is documentation gap. Either way, it indicates that data governance is the dimension of ProBleu projects that is least visible in the formal record.

A third recurring limitation, and the most strategically significant, is the systematic weakness of formal policy translation. Despite the strong IPA-networking signal, few projects translate their findings into formal policy influence or contribute their data to official reporting against SDG indicators. The pattern observed in the manual cohort, in which a single project (ECSTAO) achieved above-platform *Policy* scores by virtue of a distinctive communications-led design, is

consistent with the AI-assisted finding: with very few exceptions, formal policy engagement is not part of the school-based citizen-science model unless it is explicitly designed in.

A fourth recurring limitation is the near-absence of formal scientific outputs. The AI-assisted analysis confirms what the manual cohort suggested: that the substantial data and methodological assets generated by school projects are not being routed into channels, peer-reviewed publications, open scientific repositories, contributions to data aggregators, that would make them visible to the wider scientific community.

6.6 Project-level calibration against the manual assessment

Because seven projects were assessed both manually and via the AI-assisted method, and because both sets of answers were scored on the same 0–42 scale, it is possible to calibrate the two methods directly at the level of individual projects. Table 4 reports, for each MICS indicator, the mean signed difference (AI-assisted minus manual) and the mean absolute difference across the seven projects.

Across all seventy paired indicator scores, the AI-assisted and manual assessments agree closely on average: the mean signed difference is –1.7 points on the 42-point scale and the mean absolute difference is 6.9 points, with 33 of the 70 paired scores falling within five points of each other. The small negative mean indicates a mild tendency for the AI-assisted method to score below the schools' own self-assessment, consistent with its reliance on documented rather than reported activity.

The level of agreement is, however, strongly indicator-dependent, and this is the most useful output of the calibration. Agreement is closest for *Interdisciplinary science* (mean absolute difference 1.9) and *Involvement* (4.0), indicators whose evidence is typically explicit in project documentation. It is weakest for *Economic productivity* (12.0) and *Activeness* (8.3). The *Economic productivity* gap is systematic and directional: for the matched projects the AI-assisted method recorded near-zero scores because the documentation did not evidence improvements in economic productivity, whereas several schools selected a positive option manually. The AI-assisted method also scores somewhat higher than the manual assessment on SDGs (+6.3), reflecting the tendency of proposals to enumerate SDG alignment explicitly. These differences are not noise; they map precisely onto the evidentiary asymmetry between the two methods, and they indicate where AI-assisted scores should be interpreted with most caution.

Table 4: Project-level calibration of AI-assisted against manual MICS scores across the seven dual-assessed projects (differences in points on the 0–42 scale; positive = AI-assisted higher)

MICS indicator	Mean signed difference (AI – manual)	Mean absolute difference
Activeness	–7.7	8.3
Involvement	+2.3	4.0
Policy	+0.1	7.3
SDGs	+6.3	8.6
Economic productivity	–12.0	12.0
Financial sustainability	–6.3	7.7
Scientific productivity	–1.6	6.4

Interdisciplinary science	+1.9	1.9
Environmental footprint	+1.9	7.0
Environmental awareness	-1.6	6.1
All indicators	-1.7	6.9

Note: Mean signed difference keeps the plus/minus sign, so positive and negative gaps cancel out. It tells the *direction and bias*: is the AI systematically scoring higher or lower than the manual assessment overall? The -1.7 means that, on average, the AI lands slightly below the schools' self-assessment. A value near zero means no consistent bias in either direction.

Mean absolute difference strips the sign first (treats -8 and +8 both as 8), then averages. It tells the *typical size of disagreement* regardless of direction: how far apart the two scores tend to be on any given indicator. The 6.9 means a typical paired score differs by about 7 points on the 42-point scale.

The gap between the two numbers is informative in itself. Signed -1.7 but absolute 6.9 means the disagreements are fairly large individually but point in *both* directions, so they mostly cancel when you average with sign. If the AI were biased consistently one way, the two numbers would be close together (e.g. signed -6, absolute 6.5).

Economic productivity is the one indicator where they're equal (signed -12.0 and absolute 12.0) because *every* project's gap was negative (AI always scored lower). When all the gaps share a sign, signed and absolute become identical. That equality is the statistical fingerprint of a systematic, one-directional disagreement rather than scatter.

Three of the seven dual-assessed projects are Call 4 projects whose AI-assisted assessment used a reduced version of the MICS questionnaire that omits three of the five Scientific-productivity sub-questions (publication citations, journal impact factor and support for student theses). The Scientific-productivity comparison in Table 4 is therefore the least reliable of the ten indicators and should be treated as indicative only. This, together with the documentation-only basis of the AI-assisted scores and the small calibration sample of seven projects, is the principal limitation of the numeric comparison and a priority for the future methodological work noted in Section 6.7.

6.7 Reinforcing and challenging the manual findings

Taken as a whole, the AI-assisted analysis **reinforces** the principal findings of the seven-project manual analysis presented in Sections 4 and 5 (Figure 1). The Environment and Society domains are confirmed as the strongest dimensions of ProBleu's impact across all 111 funded projects. The Governance domain, and within it the *Policy* indicator, is confirmed as the weakest, with the pattern of strong IPAs networking but minimal formal policy translation visible across virtually all ProBleu projects. The tension between exceptional interdisciplinarity and very limited formal scientific output, identified as a defining feature of the school-based citizen science model, is shown to be a project-wide structural feature rather than an artefact of the small manual cohort. The strong financial-sustainability signal alongside weak commercial-economic productivity is similarly confirmed to be a systemic, model-level pattern rather than a feature of the seven projects that happened to engage with the manual MICS process.

The AI-assisted analysis also extends these findings in three respects. First, it demonstrates that the seven manually assessed projects are not unrepresentative of the wider set of funded projects in the structural patterns they reveal: the manual cohort's domain profile is broadly reproduced across the full 111-project list (Table 3). Second, the project-level calibration (Section 6.6) quantifies how far the two methods agree, showing close average agreement (mean absolute difference of 6.9 points on the 42-point scale) together with specific, interpretable divergences, most notably on *Economic productivity*, that follow directly from the

methods' different evidentiary bases. Third, it makes more clearly visible the systemic character of the under-documentation problem, particularly around data governance and formal measurement, which the manual cohort can only suggest through its own incompleteness.

The AI-assisted analysis does not materially **challenge** the manual findings on any major point. Where it produces a more equivocal picture, this is concentrated in elements that are heavily dependent on documentation (notably ethics, risk management and data governance), where the difference between absence in practice and absence in the record cannot be reliably distinguished. These cases are flagged in this section rather than treated as substantive findings.

The combined evidence of seven manually completed assessments, which provide the most reliable self-reported account of impact, and an AI-assisted assessment of all 111 projects, which provides a comparable project-wide reference, supports a stronger statement of ProBleu's collective impact than either source alone could underwrite. The patterns identified in Section 4 are not artefacts of which schools chose to engage with MICS; they are characteristic features of school-based ocean and water citizen science as ProBleu has implemented it. The recommendations developed in Section 9 should therefore be read as recommendations for the model, not for an unrepresentative sample.

7. Key findings

The following key findings summarise the principal conclusions of the impact assessment analysis:

- Environment is the strongest impact domain across all ProBleu school projects. The Environment domain mean of 36/42 (platform average 17; +19) is the highest of any domain, driven by universally above-platform scores on both environmental awareness and environmental footprint. Three projects achieved the maximum score of 42 on environmental awareness.
- Participant activeness exceeds the platform benchmark by 68%. A mean *Activeness* score of 37/42 against a platform average of 22, with all seven projects scoring above the benchmark, confirms that ProBleu's pedagogical model is highly effective in generating active student engagement.
- Policy influence is the single largest gap in ProBleu's impact profile. A mean Policy score of 6/42 against a platform average of 13 (–7) represents the most significant underperformance in the entire assessment. This is the area requiring the most urgent strategic attention.
- *Scientific productivity* represents a major untapped potential. Strong data collection activities and universal above-platform scores on interdisciplinary science (33/42 vs 21) demonstrate that the scientific foundations are present, yet formal scientific outputs are minimal (mean 9/42 vs 18). The gap between data generation and data formalisation is addressable with appropriate support.
- *Interdisciplinary science* is a universal strength. All seven projects score above the platform average on this indicator (range 31–34 vs platform 21), confirming that

school-based citizen science naturally integrates multiple disciplines and that ProBleu's flexible project design enables and rewards this integration.

- *Financial sustainability* is robustly above-platform for all projects. The institutional stability of schools and the diversified funding model supported by ProBleu generate a mean Financial sustainability score of 30/42 versus a platform average of 19 (+11).
- Assessment completion rates are critical to the validity of impact measurement. The exclusion of one project due to a 27% completion rate, combined with the non-completion of assessments by three of the eleven trained school representatives, means that the current evidence base covers only 8% of the 111 ProBleu-funded school projects. Although only a small proportion of schools completed manual MICS assessments, the AI-assisted analysis enabled broader cross-project pattern identification across all ProBleu-funded projects.
- The storytelling and communication approach appears to generate distinctive governance impacts. One project achieved an above-platform *Policy* score (18 vs 13), exceeding the governance benchmark, attributable to its communications-centred design. This finding suggests that policy engagement can be strengthened without requiring schools to participate directly in formal policy processes by developing their capacity for public-interest communication.
- *Economic productivity* is structurally low for most school-based citizen science projects. The projects that score zero on *Economic productivity* are not performing poorly; they are operating outside the economic value-generation framework the MICS indicator was designed to measure. This finding underlines the importance of contextualising MICS scores against the structural characteristics of the project type being assessed.
- The AI-assisted analysis confirms that school-based citizen science projects have a distinctive impact profile compared with broader citizen science initiatives. Across all ProBleu-funded projects, strong Environment, Society, and Interdisciplinary science impacts consistently coexist with comparatively weak Scientific productivity and Policy scores, reflecting the structural characteristics of school-based citizen science rather than anomalies within the manually assessed cohort.

8. Lessons learned

The experience of conducting MICS impact assessments across ProBleu-funded school projects, from the design of the training session through to the synthesis of results, yields several substantive lessons that are relevant both for the remaining activities of ProBleu and for future initiatives of a similar character.

On the applicability of the MICS tool to ProBleu-funded schools. The MICS framework, developed for citizen science, is broadly applicable to school-based projects but exhibits systematic biases when applied in an educational context. Indicators designed to measure formal scientific productivity and policy influence implicitly assume institutional conditions, academic publishing infrastructure, and policy access channels that schools do not possess. This does not invalidate the use of MICS in this context; its cross-domain coverage and

platform benchmarking capability remain valuable. However, it does suggest that interpreting MICS scores for school projects requires careful contextualisation.

On training and support for assessment completion. The transition from training attendance to completed assessment was imperfect: only 8 of the 11 trained representatives submitted assessments, and of those, only 7 provided data adequate for analysis. This attrition reflects the real barriers associated with asking busy teachers and school coordinators to engage with a detailed online assessment tool in addition to their regular professional responsibilities. The training session, whilst informative, may not have been sufficient to sustain motivation through the completion process. Training should be supplemented by personalised follow-up support, including facilitated check-in sessions, peer-support mechanisms, and clear timelines with institutional accountability.

On the gap between environmental engagement and governance influence. One of the most instructive findings of this assessment is the systematic disconnect between strong environmental and participatory impacts, where ProBleu schools clearly excel, and the near-total absence of policy or governance engagement. This gap reflects a broader challenge in the design of school citizen science programmes: the activities that build the strongest environmental and social impacts (fieldwork, data collection, school-community engagement) do not, without deliberate intervention, create connections to the policy processes that could act on the knowledge generated. Building such connections requires explicit design choices and dedicated support from programme coordinators, not merely an expectation that schools will find their own pathways to governance engagement.

On the importance of assessment design from the outset. The fact that only 8 of 111 ProBleu-funded school projects engaged with MICS assessment reflects an evaluation design choice; impact assessment was offered as a voluntary activity rather than embedded as a programme requirement. This decision means that the evidence base for D5.3 covers a small and potentially non-representative fraction of total programme activity. The lesson for future funded programmes is for impact assessment frameworks to be integrated into project design from the outset, with clear expectations, practical support, and, where feasible, proportionate incentives for completion.

On the use of AI-assisted assessment methods. The AI-assisted analysis demonstrated that structured evidence-tracing approaches can extend impact assessment coverage across large project cohorts where full self-reported assessment participation is impractical. While such approaches cannot replace direct project self-reporting, they can provide a valuable complementary evidence base for identifying programme-wide trends, triangulating findings, and highlighting systematic documentation gaps.

A final lesson concerns the intellectual value of the MICS framework itself as an analytical instrument. By assessing impact simultaneously across society, science, environment, economy, and governance, the framework surfaces patterns, the Environment-Society synergy, and the activeness-scientific productivity tension that a single-domain evaluation would entirely miss. The multi-domain perspective provided by MICS has been essential to producing a nuanced and actionable account of ProBleu's impacts, and strongly argues for the continued use of integrated impact assessment frameworks in similar programmes.

9. Recommendations

9.1 For schools

The most significant gap in the current impact profile is policy engagement. Schools are encouraged to identify the local, regional, or national governance contexts most relevant to their project theme, such as municipal water management plans, coastal area management programmes, or national biodiversity strategies and to explore practical ways of connecting their project findings to those contexts. This does not require formal lobbying activity; it may be as straightforward as presenting project results to a local councillor, contributing data to a regional environmental monitoring programme, or submitting a summary of findings to a local authority consultation. Schools that have not yet established any policy communication channel should treat this as a priority for the final phase of their projects.

Schools that have collected substantial datasets are encouraged to work with affiliated research institutions to assess whether their data meets the quality standards required for submission to a citizen science data aggregator (such as iNaturalist, the European Biodiversity Observation Network, or national biological records centres). Even modest contributions to public data repositories would significantly improve Scientific productivity scores and, more importantly, increase the genuine scientific value generated by school fieldwork.

The strong environmental footprint scores reflect genuinely positive practices that should be sustained and, where possible, extended beyond the project period and institutionalised as part of normal school operations. Schools are encouraged to maintain records of the pro-environmental measures adopted during their projects, with a view to contributing to school-wide environmental management policies.

Schools that have begun but not completed MICS assessments are strongly encouraged to do so. Assessment completion is an opportunity for structured, evidence-based reflection on project impact that can inform improvements to project design for future activities.

9.2 For future projects and funders

The ProBleu experience demonstrates that policy engagement does not happen organically in school-based citizen science; it must be deliberately designed in. Future funded programmes would require applicants to identify at least one policy-relevant actor and describe how they plan to engage with them as part of their project design. Evaluation criteria could include an assessment of planned governance impact pathways, in addition to scientific and educational outputs.

Future funders of schools could consider including a requirement for data deposit in a named repository as a condition of funding, supported by clear guidance on what this entails. The expectation should be proportionate. A small, well-documented dataset submitted to an open repository is more valuable than an ambitious but unrealised publication plan. and accompanied by training and technical support.

The value of multi-domain impact assessment for school citizen science programmes has been clearly demonstrated by this analysis. Future programmes should either adopt MICS or design equivalent frameworks covering society, science, environment, economy, and governance, and could embed their use into programme design and reporting requirements from the outset.

The attrition from training to completed assessment observed in ProBleu points to the limits of one-off instruction as a mechanism for capacity strengthening. Future programmes could invest in ongoing mentoring support, including peer learning networks, dedicated impact assessment advisors, and facilitated reflection sessions, rather than relying on an initial training session alone. The most persistent limitation of the current assessment is the structural misalignment between certain MICS indicators (particularly *Scientific productivity* and *Policy*) and the institutional realities of school-based citizen science.

10. Conclusion

ProBleu was designed to foster ocean and water literacy in school communities across Europe, and the evidence assembled in this deliverable confirms that it has achieved this goal with considerable effectiveness in its strongest domains. The 111 school projects funded under four calls have collectively mobilised a significant number of young people and their educators in active, hands-on engagement with local marine and freshwater environments. The 7 projects for which complete MICS impact data are available demonstrate that ProBleu's school citizen science model generates robust, measurable impacts in environmental awareness, participant activeness, interdisciplinary learning, and financial sustainability, all consistently and substantially above the platform benchmarks for citizen science projects globally.

The strength of the Environment domain, with a mean score of 36/42 against a platform average of 17, is the most significant and unambiguous finding of this assessment. It confirms that school-based citizen science, when designed around authentic environmental investigation, is an effective vehicle for generating genuine environmental awareness and for embedding pro-environmental practices within school institutions. The Society domain findings reinforce this conclusion: ProBleu schools are not merely raising awareness but actively engaging students as citizen scientists, building the habits of inquiry, observation, and evidence-based reasoning that the EU's Mission Ocean ambitions depend upon.

At the same time, policy engagement is the most significant structural gap: the near-absence of Policy impact scores across the measured projects reflects an untapped dimension of civic impact that, if addressed, could substantially enhance the long-term contribution of school citizen science to ocean and water governance. Scientific productivity, while structurally constrained by the realities of school-based implementation, offers an accessible opportunity to generate greater scientific value from the substantial data assets generated by student citizen scientists.

The ProBleu project concludes having developed and tested a suite of pedagogical resources, and demonstrated the viability and value of school-based ocean and water citizen science at scale. The lessons learned about impact, governance engagement, and scientific output, documented in this deliverable, provide a practical evidence base for the design of successor

programmes under Mission Ocean and beyond. The evidence strongly supports continued investment in school-based ocean and water literacy as a cost-effective, high-engagement, and genuinely impactful component of EU and associated countries' environmental education and citizen science infrastructure.

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Annexes

Annex 1: Individual project score summary table

Table A1: MICS indicator and domain scores for all assessed ProBleu school projects

Note: reBLUE 4.0 (ID 152) is included for completeness. Due to a 27% completion rate, its scores largely reflect missing data and are excluded from cohort statistical analysis. All scores are on a 0–42 scale. Platform average is the global mean score across all projects registered on the MICS platform.

	A.W.A.R.E.N.E.S. S. (150)	NEMU (151)	reBLUE 4.0 (152)*	SLW (153)	LoveWater (154)	FEKRUN A (155)	ECSTAO (156)	Guardians (157)	ProBleu (project)	Cohort Mean (n=7)	Platform Avg
Country	Malta	Belgium	Cyprus	Slovakia	Slovenia	Malta	Cyprus	Belgium	—	—	—
Completion %	95%	100%	27%*	98%	97%	89%	98%	100%	94%	—	—
SOCIETY											
Activeness	40	40	0*	32	32	40	34	40	32	36.9	22
Involvement	26	31	0*	31	30	28	13	27	26	26.6	17
Domain mean	33.0	35.5	—	31.5	31.0	34.0	23.5	33.5	29.0	31.7	19.5
SCIENCE & TECHNOLOGY											
Scientific productivity	3	10	4*	1	1	6	19	20	7	8.6	18
Interdisciplinary science	33	34	32*	34	34	31	32	34	32	33.1	21

Domain mean	18.0	22.0	—	17.5	17.5	18.5	25.5	27.0	19.5	20.9	19.5
ENVIRONMENT											
Environmental awareness	33	33	0*	33	33	42	42	42	40	36.9	21
Environmental footprint	42	42	0*	21	36	32	42	32	42	35.3	13
Domain mean	37.5	37.5	—	27.0	34.5	37.0	42.0	37.0	41.0	36.1	17.0
ECONOMY											
Economic productivity	42	21	0*	0	0	0	21	0	42	12.0	13
Financial sustainability	42	21	0*	33	22	32	31	28	26	29.9	19
Domain mean	42.0	21.0	—	16.5	11.0	16.0	26.0	14.0	34.0	20.9	16.0
GOVERNANCE											
Policy	1	13	0*	1	6	0	18	0	9	5.6	13
SDGs	20	22	0*	18	20	14	26	18	20	19.7	16
Domain mean	10.5	17.5	—	9.5	13.0	7.0	22.0	9.0	14.5	12.6	14.5
TOTAL	282	267	—	204	214	225	278	241	276	245.7 avg	—

Scores for reBLUE 4.0 marked with * reflect incomplete data; this project is excluded from all cohort means. Cohort mean column shaded blue; Platform average column shaded yellow.

Annex 2: MICS indicator descriptions

Activeness measures the extent to which participants in a citizen science project undertake substantive activities – including data collection, fieldwork, analysis, and public communication – as opposed to passive information consumption. Higher scores reflect more active, multi-stage participant engagement.

Involvement measures the breadth and depth of IPA engagement achieved by a project, including the active involvement of community members, partner organisations, local institutions, and the general public in project activities, governance, or dissemination.

Scientific productivity measures the extent to which a project generates formal scientific outputs – including contributions to open data repositories, peer-reviewed publications, datasets shared with research institutions, and presentations at scientific events. Higher scores reflect more formalised integration into scientific knowledge production.

Interdisciplinary science measures the degree to which a project crosses disciplinary boundaries, integrating multiple academic fields and knowledge domains – including natural sciences, social sciences, arts and humanities, and technology – in its design and execution.

Environmental awareness measures the extent to which a project increases participants' knowledge, understanding, and concern about environmental issues, and whether it is associated with attitude or behaviour change in relation to the environment.

Environmental footprint measures the extent to which a project operates in an environmentally responsible manner, minimises its own negative environmental impacts, and actively promotes pro-environmental practices within its host institution and community.

Economic productivity measures whether a project generates measurable economic value – through employment, training, knowledge transfer, capacity strengthening, or contributions to the green or blue economy.

Financial sustainability measures the robustness of a project's financial model – including the diversity of its funding sources, the degree of institutional support from the host organisation, and the credibility of plans for continuing activities after initial funding ends.

Policy measures the extent to which a project engages with, informs, or influences formal policy processes – including communication of findings to authorities, participation in regulatory consultations, engagement with elected officials, or contributions to environmental management plans.

SDGs measures the alignment of a project's objectives and activities with the UN Sustainable Development Goals, and whether it explicitly frames its contributions in relation to the global sustainability agenda.

See [<https://about.mics.tools/indicators>] for more details.

Annex 3: MICS domain questions summary

The MICS questionnaire, administered through the MICS.tools platform, comprises a total of 222 questions, distributed across five thematic domains and a General category. The distribution is as follows:

Domain	Number of Questions
Society	67
Governance	43
Science and Technology	39
Economy	31
Environment	30
General	13
Total	223

Note that not all questions are presented to all respondents; the platform employs branching logic whereby certain questions are conditional on prior responses, meaning that the effective number of questions experienced by a given project depends on the nature of its activities. The completion percentages reported for each project (see Table 1 and Annex 1) are calculated as the proportion of applicable questions answered relative to the total number of questions the system determined to be relevant for that project.