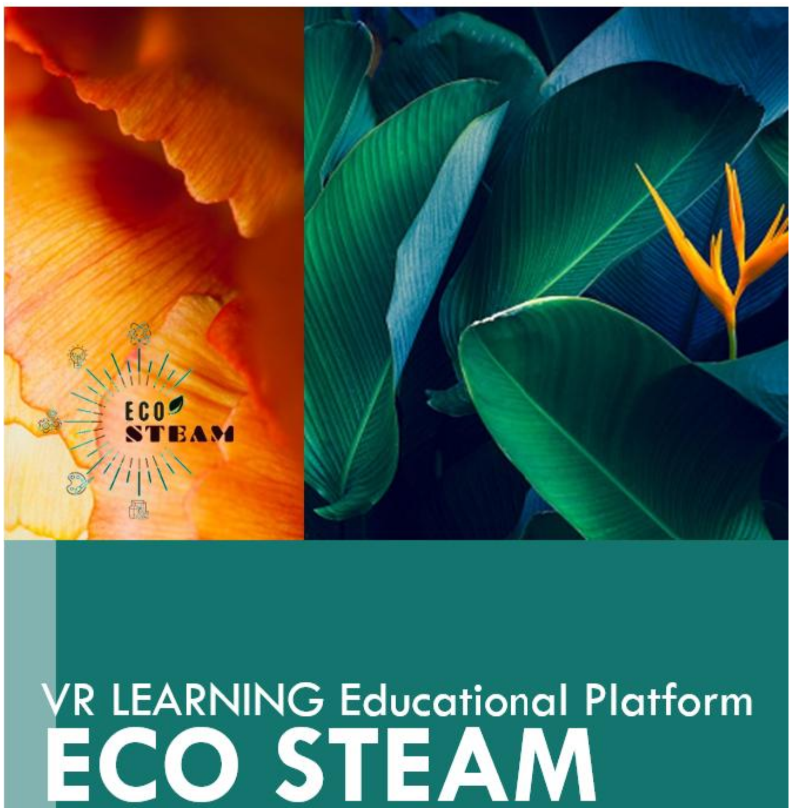
EcoSTEAM VR Learning Platform
Pre–Post Teacher Survey Analysis Report

Erasmus+ KA220-SCH Project: ECO-STEAM (2023-1-SE01-KA220-SCH-000158067)

Date: 19 January 2026



The "Eco STEAM VR Learning Platform" is an Erasmus+ KA2 framework that blends immersive Virtual Reality (VR) experiences with Generative AI (G-AI) tools to enhance STEAM (Science, Technology, Engineering, Arts, Mathematics) education in a comprehensive and transformative manner align with environmental sustainability.

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Contents

1. Executive Summary

This report presents a comprehensive analysis of two teacher surveys conducted within the framework of the **EcoSTEAM Erasmus+ project**, focusing on the design, implementation, and perceived impact of the **EcoSTEAM VR Learning Platform**. The analysis draws on data collected through a **pre-implementation survey** (n = 38) and a **post-implementation survey** (n = 21), capturing teacher expectations, experiences, and reflections before and after the use of the platform in educational contexts across participating countries.

The report adopts a three-layered analytical approach:

(i) **descriptive statistical analysis**, supported by visualisations;
(ii) **analytical interpretation**, identifying trends, key drivers, and explanatory factors; and
(iii) **strategic recommendations**, oriented towards project steering, scaling, and long-term sustainability.

Key headline findings

Baseline context and digital readiness

The pre-implementation data indicate a heterogeneous baseline in terms of digital maturity. Only **13.2% of teachers** reported prior experience using **virtual reality in classroom settings**, confirming that VR remains an emerging pedagogical practice for most participants. In contrast, **55.3%** reported previous use of **AI-based tools for educational content creation**, suggesting higher familiarity with AI than with immersive technologies at project entry. This asymmetry has important implications for onboarding, support needs, and differentiated adoption pathways.

Expectations prior to implementation

Teacher expectations regarding the pedagogical potential of the EcoSTEAM VR Learning Platform were already high at baseline. **57.9% of respondents** anticipated a **high or very high positive impact on student engagement**, reflecting both openness to innovation and perceived alignment between immersive STEAM approaches and student-centred learning models.

Reported outcomes and added value

Post-implementation data indicate that perceived outcomes not only met but, in several dimensions, **exceeded initial expectations**.

- **81.0% of teachers** reported that student engagement increased **moderately or significantly** following the use of the platform.
- **90.5%** observed a **moderate or strong increase in student interest** in learning activities.
- **81.0%** reported **moderate to significant improvements in students' conceptual understanding**, suggesting that immersive and experiential learning contributed positively to meaning-making and comprehension, particularly in STEAM-related topics.

AI tools and innovation potential

The platform's integrated AI tools emerged as a particularly strong value proposition. **95.2% of respondents** rated these tools as **moderately or very useful**, highlighting their role in supporting content creation, adaptation, and pedagogical flexibility. This finding reinforces the strategic relevance of combining immersive VR environments with AI-enabled pedagogical support.

Integration and implementation conditions

While overall integration was perceived positively - **76.2% of teachers** reported that platform integration was **moderately or very easy** - a non-trivial minority experienced difficulties. Qualitative feedback and trend analysis indicate that these challenges are primarily associated with **infrastructure reliability**, **time constraints**, and **teacher confidence**, rather than with the pedagogical concept of the platform itself.

Overall assessment

Taken together, the survey evidence points to **strong perceived pedagogical value** of the EcoSTEAM VR Learning Platform, particularly in relation to **student engagement, interest, and conceptual understanding**. At the same time, the findings underline the importance of strengthening **implementation conditions** to maximise impact and ensure sustainability. Key areas for further development include **technical reliability**, **structured onboarding and professional development**, **explicit curriculum mapping**, and **differentiated support pathways** for teachers with varying levels of digital and pedagogical experience.

*These insights provide a robust evidence base to inform **strategic decision-making**, guide future project iterations, and support the **scaling and long-term integration** of the EcoSTEAM VR Learning Platform within diverse educational systems.*

2. Project Context

The **EcoSTEAM VR Learning Platform** was developed within the framework of an **Erasmus+ KA2 Cooperation Partnership**, addressing European priorities related to **digital transformation in education**, **innovation in teaching and learning**, and **education for sustainable development**. The project responds directly to the need for pedagogical models that integrate **technology-enhanced learning**, **interdisciplinary STEAM approaches**, and **ecological sustainability**, while remaining accessible and adaptable across diverse educational systems.

At its core, EcoSTEAM is grounded in an **interdisciplinary ECO-STEAM paradigm**, which extends traditional STEM/STEAM education by explicitly embedding **environmental awareness, sustainability challenges, and real-world socio-ecological problems** into learning activities. The use of immersive **virtual reality (VR)** environments is intended to provide learners with experiential, situated learning contexts, enabling them to explore complex systems, environments, and scenarios that are otherwise difficult or impossible to access within conventional classroom settings.

Pedagogical and technological architecture

The EcoSTEAM VR Learning Platform combines **immersive VR learning experiences** with **generative AI-based support tools**, forming a hybrid pedagogical ecosystem that supports both teaching and learning processes. This dual architecture reflects a deliberate design choice: VR is used to enhance **experiential learning, engagement, and conceptual understanding**, while AI tools are leveraged to reduce teacher workload, support pedagogical design, and facilitate contextual adaptation.

Within this framework, the platform supports teachers across three interrelated dimensions:

1. **Access and orchestration of VR learning experiences**

   Teachers are provided with structured access to immersive VR scenarios aligned with ECO-STEAM themes. These experiences are designed to promote inquiry-based learning, systems thinking, and exploration of ecological and technological challenges in a safe, controlled digital environment.

2. **Design and adaptation of learning activities**

   The platform enables teachers to design, customise, or adapt learning activities and lesson plans to their specific curricular contexts, age groups, and learning objectives. This flexibility is particularly relevant in the Erasmus+ context, where curricular frameworks, teaching traditions, and institutional constraints vary significantly across partner countries.

3. **AI-supported authoring and customisation**

   Integrated generative AI tools—such as lesson plan generation, activity scaffolding, and **CoSpaces[1] scripting support**—are intended to accelerate the authoring process and lower the entry barrier for teachers with limited technical or programming experience. By supporting rapid prototyping and pedagogical iteration, these tools aim to enhance teacher agency and foster innovation rather than impose rigid instructional models.

Strategic relevance within Erasmus+ priorities

The EcoSTEAM VR Learning Platform aligns closely with key Erasmus+ priorities, including:

- **Digital education and innovation**, through the integration of VR and AI technologies;
- **Green transition and sustainability**, by embedding ecological themes and environmental problem-solving at the core of learning scenarios;
- **Teacher professional development**, by equipping educators with tools and methodologies that support modern, student-centred pedagogies;
- **Inclusion and adaptability**, by offering differentiated pathways for teachers with varying levels of digital competence.

By positioning teachers not only as users but also as **co-designers of learning experiences**, the project aims to promote long-term adoption, pedagogical ownership, and scalability beyond the project lifecycle.

Role of teacher feedback in project evaluation

*Within this context, the collection of **pre- and post-implementation teacher surveys** plays a central role in evaluating the platform's effectiveness, usability, and perceived pedagogical value. The surveys capture expectations prior to implementation, lived experience during use, and reflective assessments of impact, thereby providing critical evidence to inform iterative development, quality assurance, and strategic decision-making at project and partnership level.*

[1] Actually the platform change the name to Delightex Edu

3. Methodology

This report is based on the analysis of two datasets derived from teacher surveys conducted within the EcoSTEAM Erasmus+ project: a **pre-implementation survey** and a **post-implementation survey**, both administered to participating teachers across partner countries. The methodological approach was designed to balance **analytical rigour** with the **pragmatic constraints** of applied educational innovation projects.

Data sources

The primary data sources consist of **two Excel exports** containing anonymised teacher survey responses:

- **Pre-implementation survey** (n = 38), capturing baseline context, prior experience, and expectations before the use of the EcoSTEAM VR Learning Platform.
- **Post-implementation survey** (n = 21), capturing teacher experiences, perceived outcomes, and reflections following platform use.

Both surveys included a combination of **closed-ended quantitative items** and **open-ended qualitative questions**, enabling a mixed-methods analytical approach.

Quantitative analysis

Closed-ended survey items were analysed using **descriptive statistical techniques**, primarily:

- **Frequency distributions** and percentage breakdowns for each response category;
- **Ordinal mapping** of Likert-type scales (typically on a 1–4 scale), allowing the computation of **simple average indices** to support comparative interpretation across dimensions such as engagement, usability, and perceived impact.

These indices are used as **interpretative aids**, not as inferential statistics. Given the exploratory and evaluative nature of the project, no claims of statistical significance are made.

Where appropriate, visual representations (bar charts and distributions) are used to enhance transparency and accessibility of findings for a broad stakeholder audience, including project partners, the National Agency, and the wider educational community.

Qualitative analysis

Open-ended responses were analysed through a **lightweight thematic coding process**, appropriate to the scale and purpose of the dataset. This process involved:

- Keyword-based categorisation of recurring concepts (e.g., engagement, technical constraints, ease of use, time, training needs);
- Identification of **recurrent patterns and convergent themes** across responses;
- Manual interpretative review to contextualise quantitative trends and provide explanatory depth.

This approach prioritises **interpretive validity** and clarity over exhaustive qualitative coding, in line with the evaluative and applied focus of Erasmus+ cooperation projects.

Comparative logic and analytical constraints

A key methodological consideration is the **difference in sample size** between the pre-implementation (n = 38) and post-implementation (n = 21) surveys, as well as the possibility that respondents may not fully overlap between the two datasets. As a result:

- Comparisons between pre- and post-implementation findings are conducted **primarily at the aggregate level**;
- Changes observed across surveys are interpreted as **directional trends** rather than causal or statistically verified effects;
- Any inferred evolution between expectations (pre) and outcomes (post) is treated as **indicative**, not definitive.

This limitation is explicitly acknowledged to avoid overinterpretation and to ensure methodological transparency.

Validity and reliability considerations

Despite these constraints, the methodology provides a **credible and informative evidence base** for evaluating the EcoSTEAM VR Learning Platform. The combination of:

- baseline expectation data,
- post-implementation experiential feedback,
- convergent quantitative and qualitative patterns,

supports **construct validity** in assessing perceived pedagogical value, usability, and implementation conditions.

The methodology is therefore well suited to its purpose: informing **project steering**, guiding **iterative improvement**, and supporting **strategic decision-making** regarding scaling and sustainability, rather than producing generalisable or statistically inferential conclusions.

4. Pre-Implementation Findings

This section presents the findings of the **pre-implementation teacher survey**, which was designed to establish a baseline understanding of participants' prior experience, digital readiness, and expectations before engaging with the EcoSTEAM VR Learning Platform. The pre-implementation data provide essential contextual information for interpreting post-implementation results and for assessing the degree of alignment between initial expectations and subsequent outcomes.

The analysis focuses on three main dimensions:

(i) **teachers' prior exposure to virtual reality and AI-based educational tools**; (ii) **perceived readiness and openness towards innovative digital pedagogies**; and (iii) **anticipated pedagogical impact**, particularly in relation to student engagement, motivation, and learning outcomes within an ECO-STEAM framework.

Understanding this baseline is particularly important given the innovative nature of the platform. Virtual reality remains a relatively novel instructional technology in most school contexts, while AI-based authoring and pedagogical support tools are unevenly adopted across educational systems. As such, pre-implementation perceptions reflect not only individual teacher attitudes but also broader systemic conditions, including infrastructure availability, professional development opportunities, and institutional support for innovation.

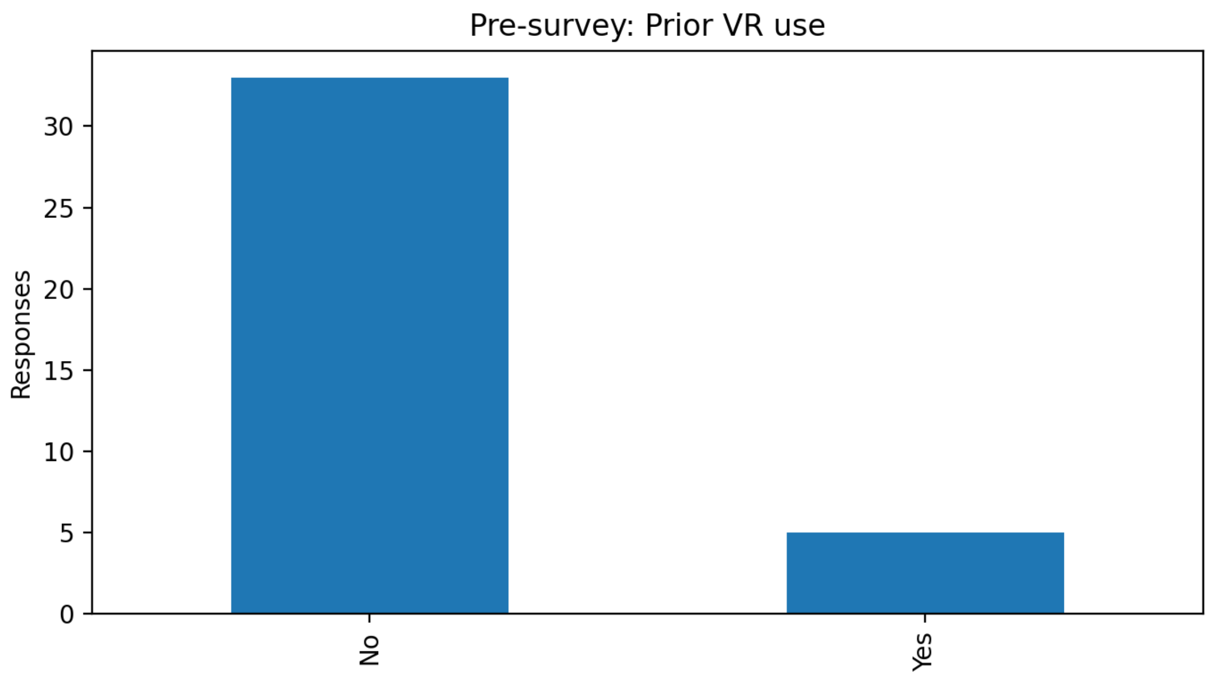
The findings presented in this section therefore serve a dual purpose. First, they document the **starting point** from which teachers approached the EcoSTEAM VR Learning Platform. Second, they establish a **reference framework** against which post-implementation perceptions and reported outcomes can be meaningfully interpreted. This baseline perspective is critical for distinguishing between genuinely transformative effects and outcomes that may primarily reflect pre-existing positive attitudes towards educational technology.

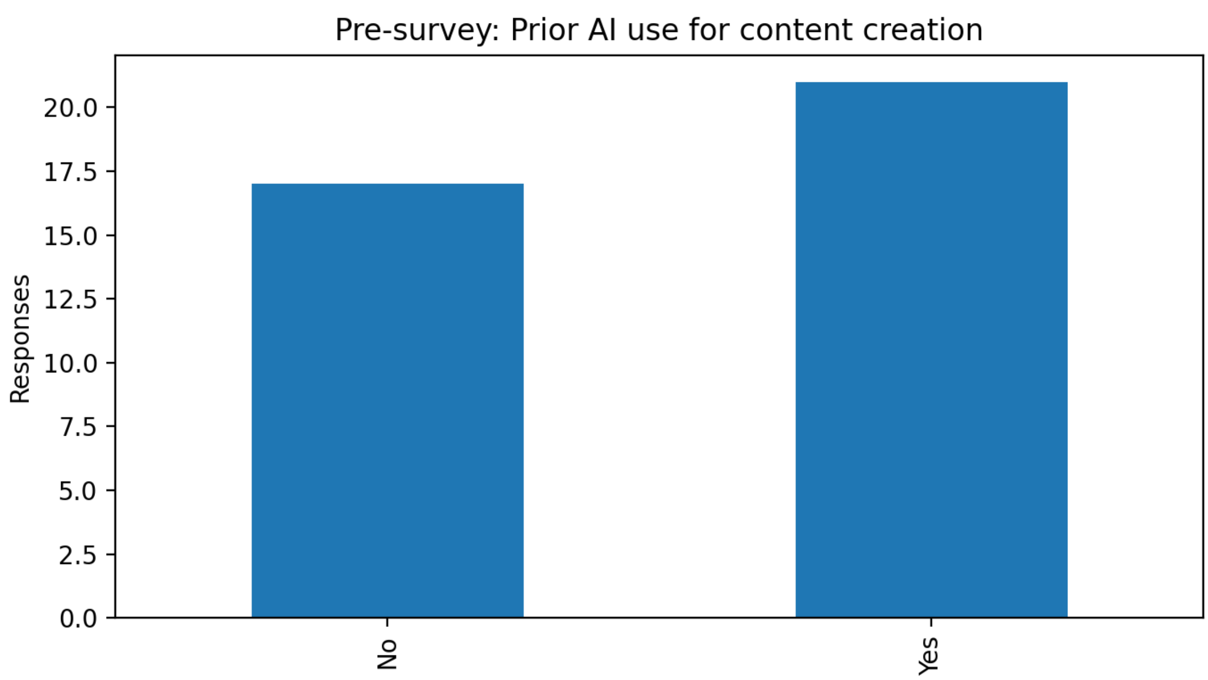
4.1 Respondent Profile

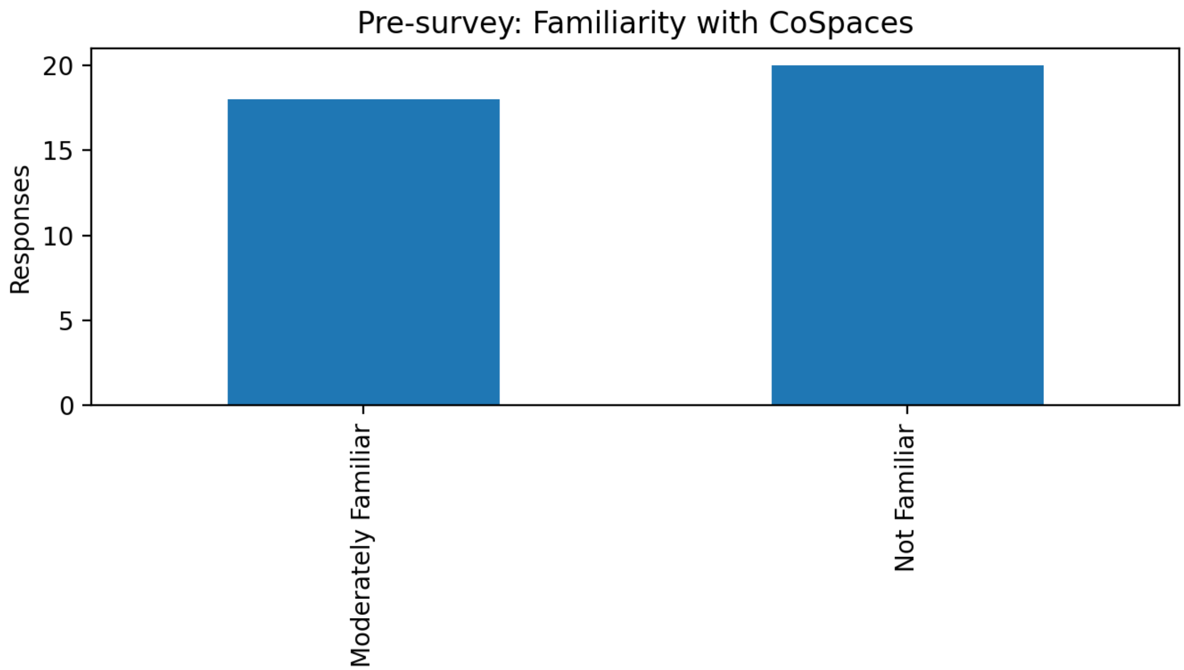
Country	Responses	Share
Turkey	10	26.3%
Sweden	9	23.7%
Italy	7	18.4%
Greece	5	13.2%

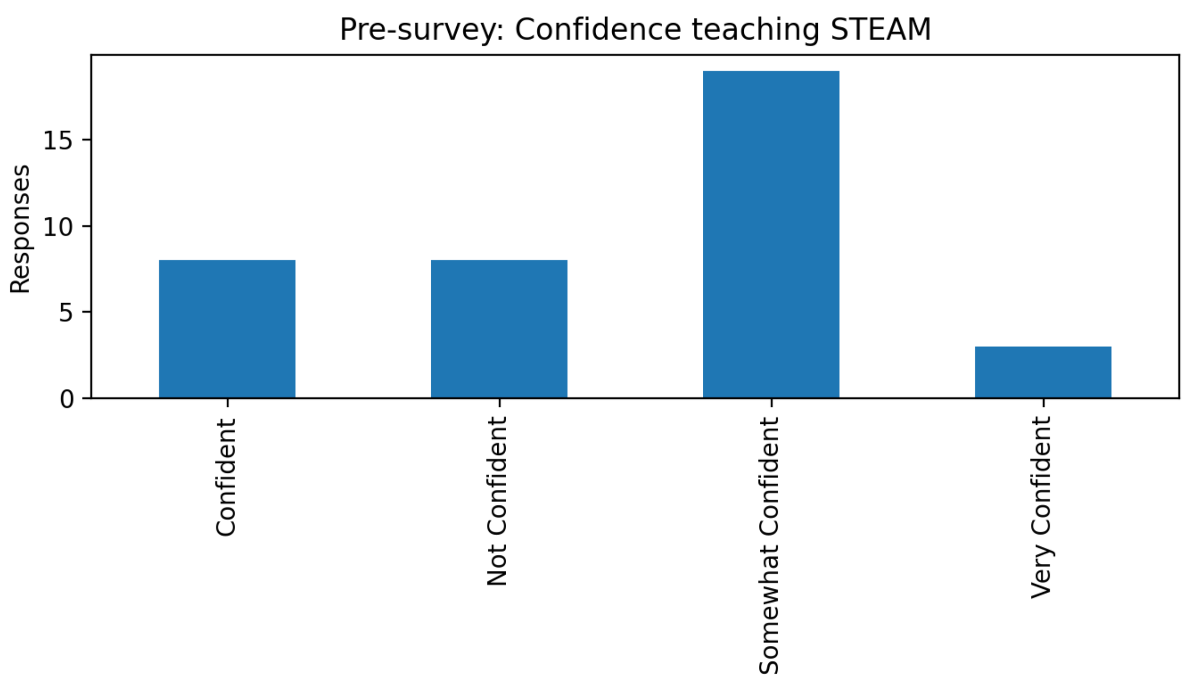
Latvia	4	10.5%
Ireland	3	7.9%

Baseline readiness indicators are shown in the charts below.









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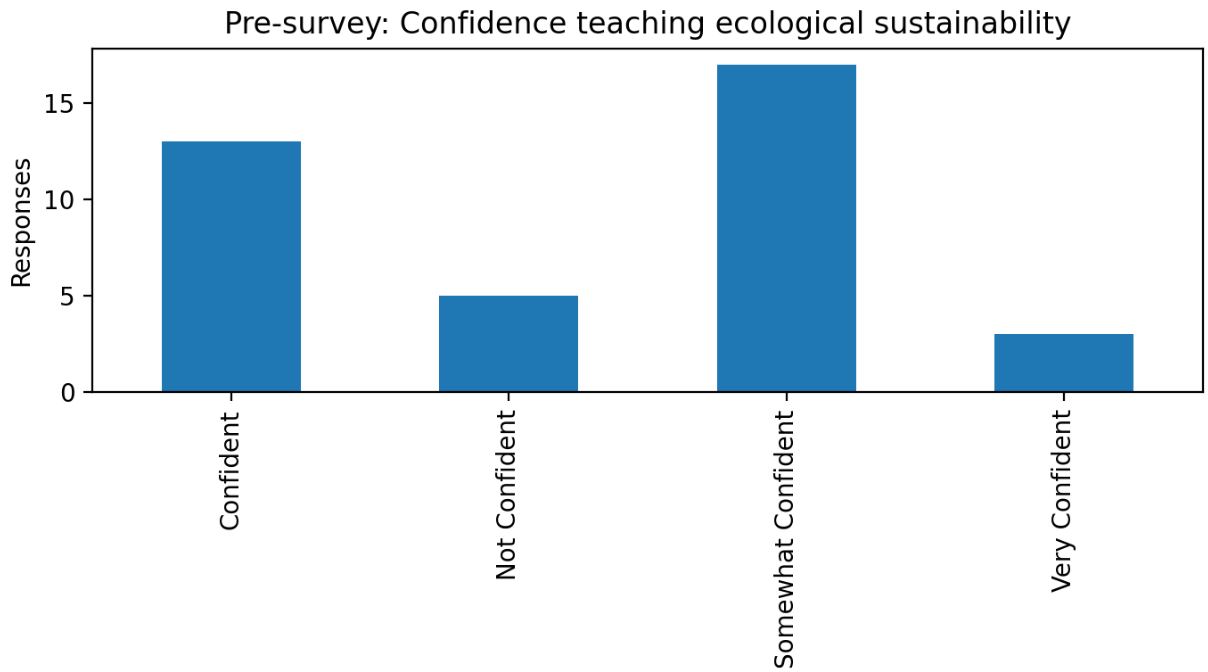
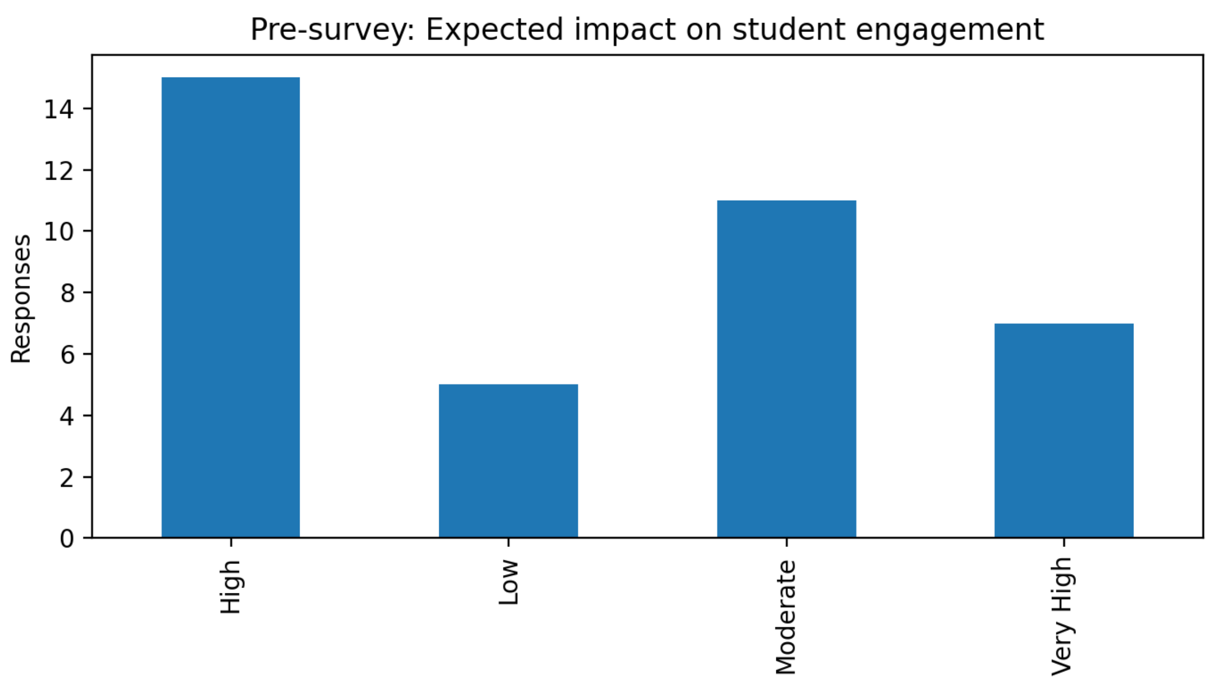
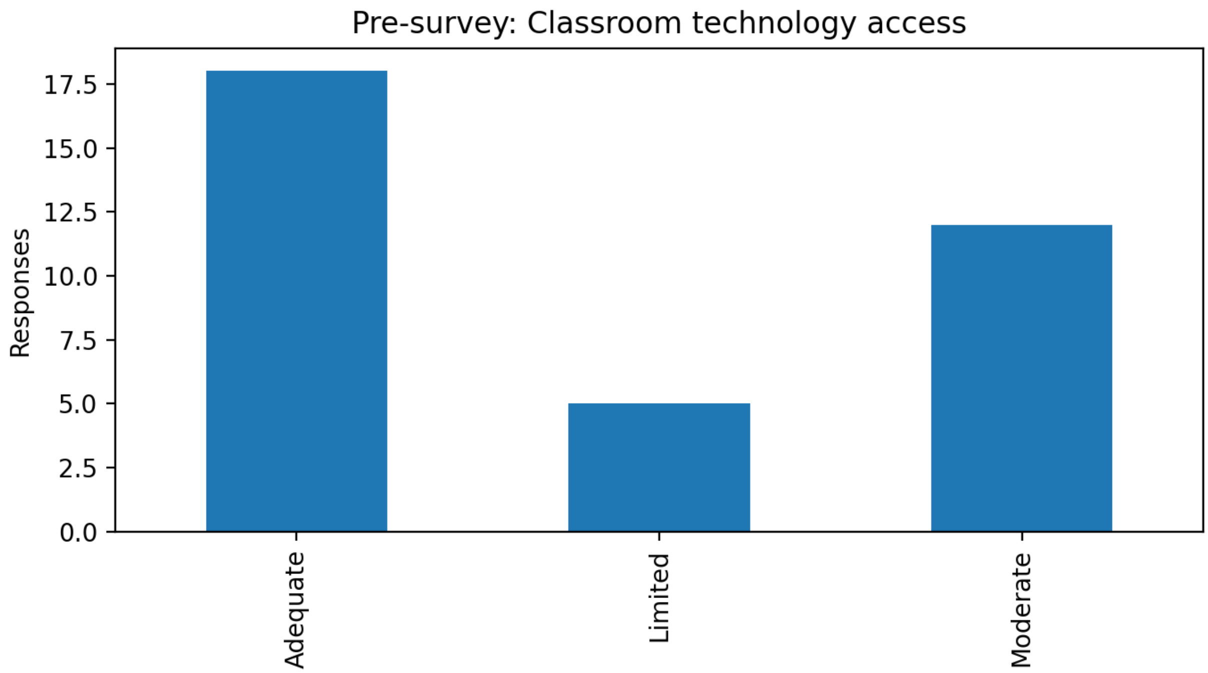

Pre-survey: Confidence teaching ecological sustainability
Responses
0
5
10
15
Confident
Not Confident
Somewhat Confident
Very Confident


Pre-survey: Expected impact on student engagement
Responses
0
2
4
6
8
10
12
14
High
Low
Moderate
Very High



4.2 Key Insights (Pre)

The pre-implementation survey results reveal a **clear asymmetry in teachers' prior exposure to advanced educational technologies**, with important implications for platform adoption and support strategies.

Limited prior experience with VR, contrasted with higher AI familiarity

As illustrated in the baseline readiness charts, **virtual reality experience in classroom settings was very limited** at project entry. Only **5 out of 38 teachers (13.2%)** reported having previously used VR with students, while the large majority indicated no prior hands-on classroom experience with immersive technologies. This confirms that, for most participants, VR represented a **novel pedagogical and technical practice**, rather than an incremental extension of existing teaching methods.

By contrast, prior exposure to **AI tools for educational content creation** was substantially higher. **21 out of 38 teachers (55.3%)** reported having used AI-based tools before joining the project. The distribution shown in the corresponding chart highlights that AI technologies were already perceived as accessible and relevant within teachers' professional practice, even before the introduction of the EcoSTEAM platform.

This divergence suggests that the **AI component of the EcoSTEAM VR Learning Platform functions as a potential adoption accelerator**, lowering entry barriers and increasing teacher confidence during the initial engagement phase. Conversely, the VR component

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requires **additional technical, pedagogical, and organisational scaffolding**, particularly for teachers encountering immersive learning for the first time.

Confidence levels in STEAM and ecological sustainability topics

Pre-implementation confidence levels, as reflected in the confidence distribution charts, were **predominantly clustered around "Somewhat Confident"** for both **STEAM-related topics** and **ecological sustainability themes**. While this indicates a generally positive baseline disposition, it also reveals a **non-negligible proportion of teachers reporting low confidence ("Not Confident")**, especially in relation to interdisciplinary STEAM integration and sustainability-focused content.

This pattern suggests that teachers entered the project with **conceptual openness but uneven pedagogical assurance**. The data point to an important distinction between *interest* and *instructional confidence*: teachers may recognise the relevance of ECO-STEAM approaches without yet feeling fully equipped to design, implement, and assess learning activities in these domains.

Implications for project design and professional development

Taken together, these pre-implementation findings underline the need for **structured and differentiated pedagogical support**. The baseline charts suggest that a "one-size-fits-all" onboarding approach would be suboptimal. Instead, the data support the design of **tiered professional development pathways**, addressing:

- foundational VR literacy and classroom orchestration for novice users;
- pedagogical integration of ECO-STEAM concepts for teachers with moderate confidence;
- advanced authoring and co-design opportunities for more experienced or digitally confident teachers.

In this sense, the pre-implementation findings do not indicate resistance to innovation, but rather a **capacity gap**, one that the EcoSTEAM project is well positioned to address through targeted training, curated examples, and AI-supported pedagogical scaffolding.

4.3 Training Needs and Anticipated Challenges (Pre)

The most frequent training need's themes included:

(i) teacher training time and ongoing support, **(ii)** AI tool usage for lesson planning/scripting, **(iii)** CoSpaces/VR authoring skills, and **(iv)** curriculum integration.

Theme (training needs)	Mentions (approx.)
Teacher confidence & training time	7
AI tools & prompt/coding support	7
CoSpaces / VR authoring skills	3
Pedagogy & curriculum integration	3

4.4 Illustrative examples

To complement the quantitative indicators and thematic frequency analysis, selected anonymised excerpts from open-ended responses are presented below. These illustrative examples provide qualitative depth and contextual nuance, helping to explain why certain training needs and anticipated challenges emerged in the pre-implementation phase.

The excerpts were chosen because they are representative of recurring patterns observed across responses rather than isolated or exceptional cases. They highlight teachers perceived gaps in technical skills, pedagogical integration, and confidence, as well as their expectations regarding practical support, training formats, and usability. Together, these examples help bridge descriptive data and analytical interpretation, offering concrete insight into teachers' lived perspectives prior to engaging with the EcoSTEAM VR Learning Platform

CoSpaces / VR authoring skills:

- More help with coding basics, step by step tutorials for beginners and experts
- CoSpaces training and VR integration
- Having the opportunity to train myself to create in Cospaces

Pedagogy & curriculum integration:

- CoSpaces training and VR integration
- Being able to tailor the lesson plans and activities according to the class ability
- manual, demonstration method

Teacher confidence & training time:

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- CoSpaces training and VR integration
- Ideas, workshop to learn more about how to code Cospaces
- More training in programming

AI tools & prompt/coding support:

- CoSpaces training and VR integration
- Being able to tailor the lesson plans and activities according to the class ability
- Having the opportunity to train myself to create in Cospaces

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5. Post-Implementation Findings

This section presents the findings of the **post-implementation teacher survey**, which captures teachers' experiences and reflections after using the EcoSTEAM VR Learning Platform in real classroom settings. The post-implementation data provide critical insight into the **perceived pedagogical impact**, **usability**, and **implementation conditions** associated with the platform, complementing and extending the baseline evidence collected prior to implementation.

The analysis focuses on three interrelated dimensions:

(i) **perceived student outcomes**, particularly in terms of engagement, interest, and conceptual understanding;
(ii) **teacher experience and platform usability**, including the perceived value of integrated AI tools; and
(iii) **implementation challenges and enabling conditions**, such as technical reliability, time demands, and pedagogical integration.

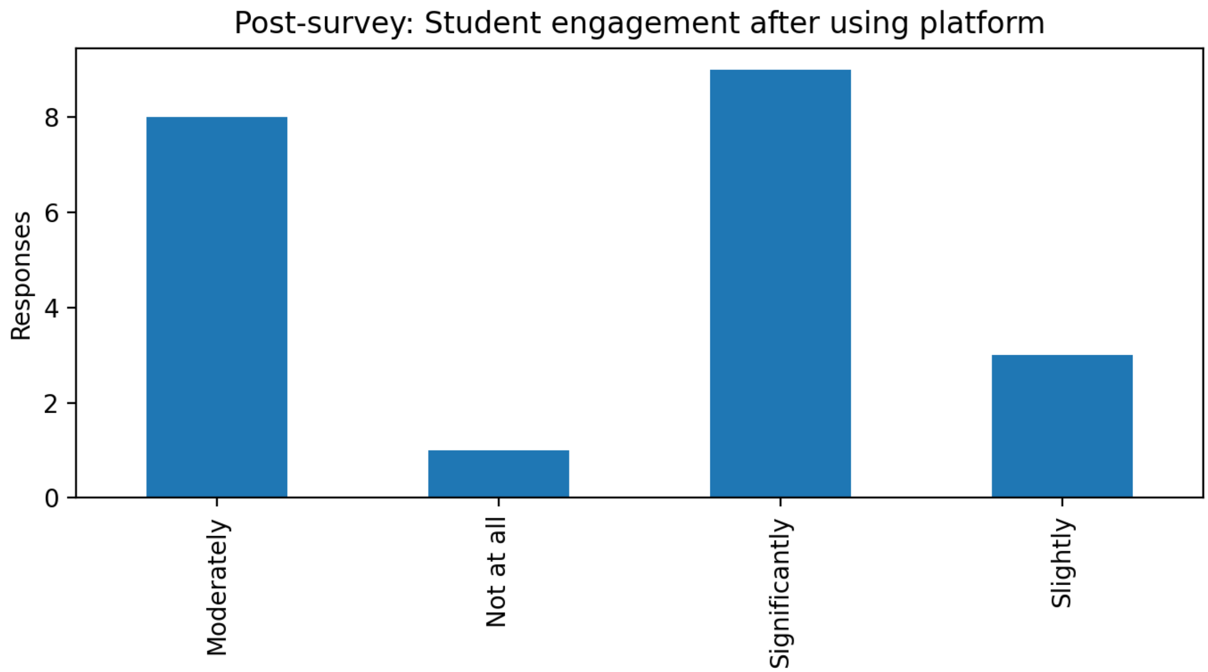
By examining teacher-reported outcomes after practical use, this section moves beyond expectations to assess how the EcoSTEAM VR Learning Platform functioned in authentic educational contexts. The findings are therefore central to evaluating the extent to which the platform's design assumptions translated into meaningful classroom value.

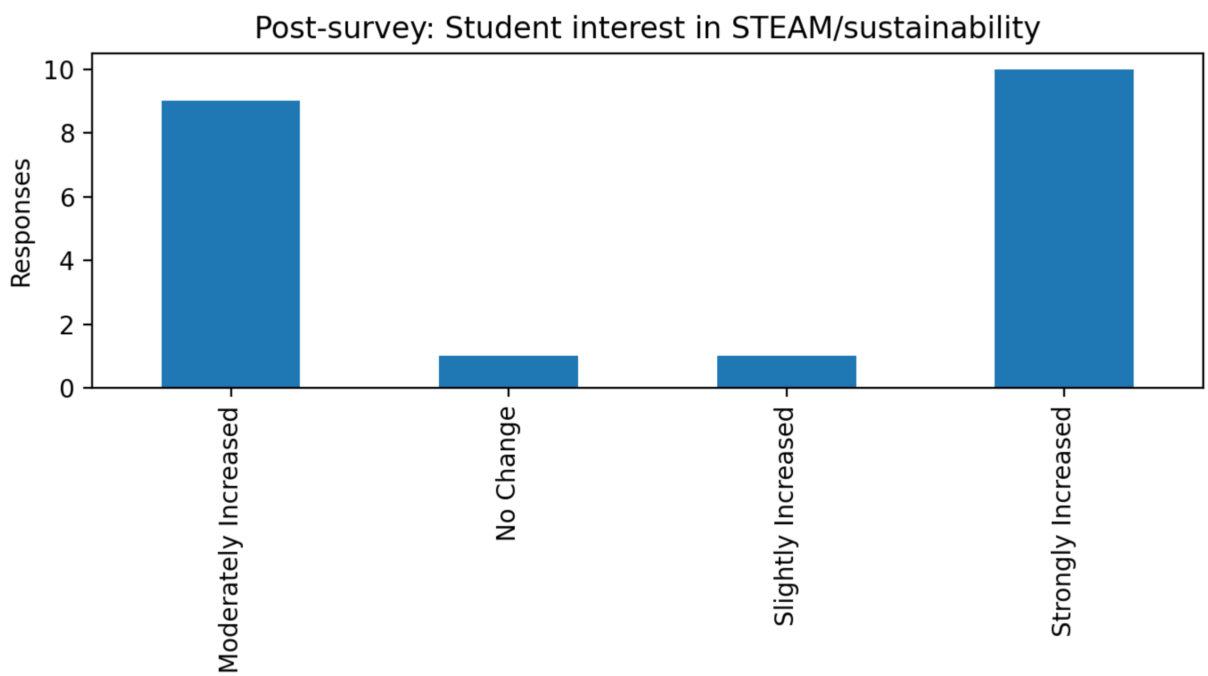
The post-implementation results are interpreted in relation to the pre-implementation baseline, while explicitly acknowledging differences in sample size and respondent overlap. Together, these findings inform both **project-level quality assurance** and **strategic considerations** related to future scaling, sustainability, and professional development within the EcoSTEAM initiative.

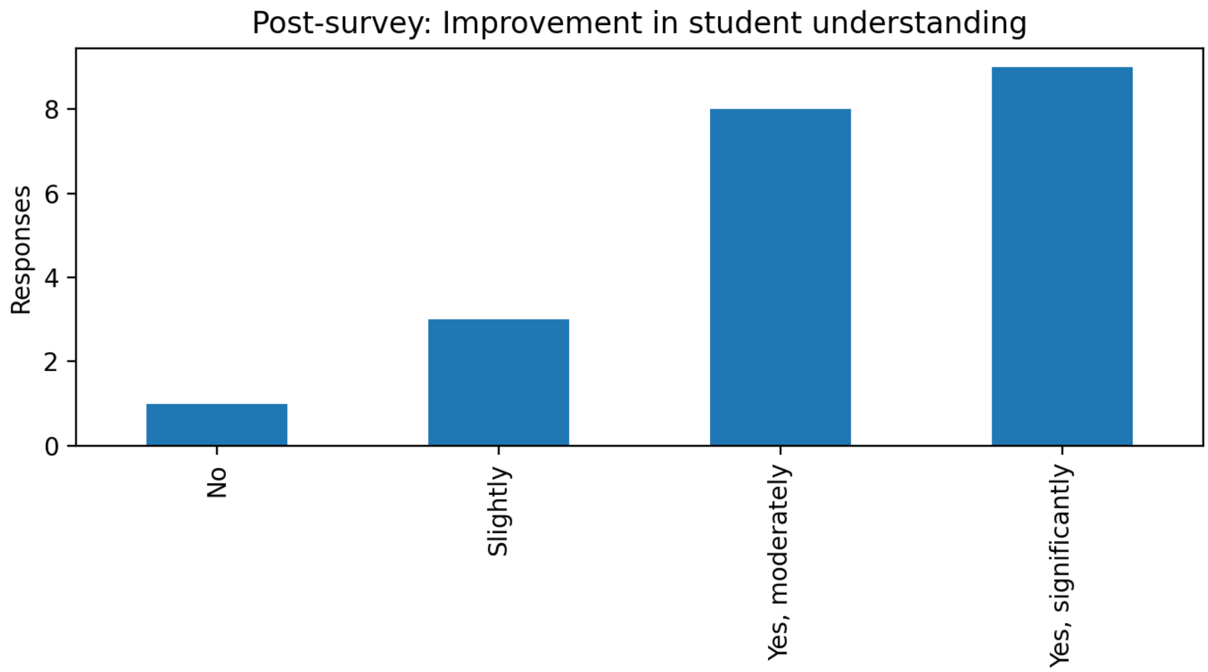
5.1 Respondent Profile

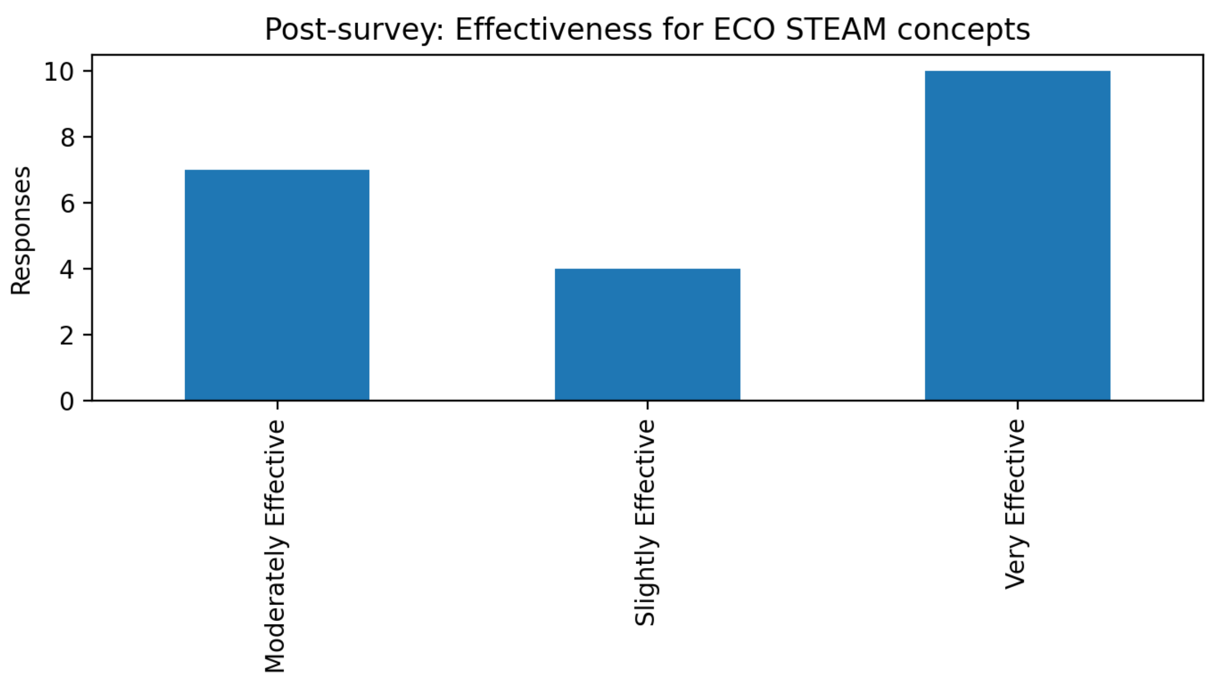
Country	Responses	Share
Italy	6	28.6%
Greece	5	23.8%
Latvia	4	19.0%
Turkey	2	9.5%
Sweden	2	9.5%
Spain	1	4.8%
Ireland	1	4.8%

Outcome indicators are shown in the charts below.









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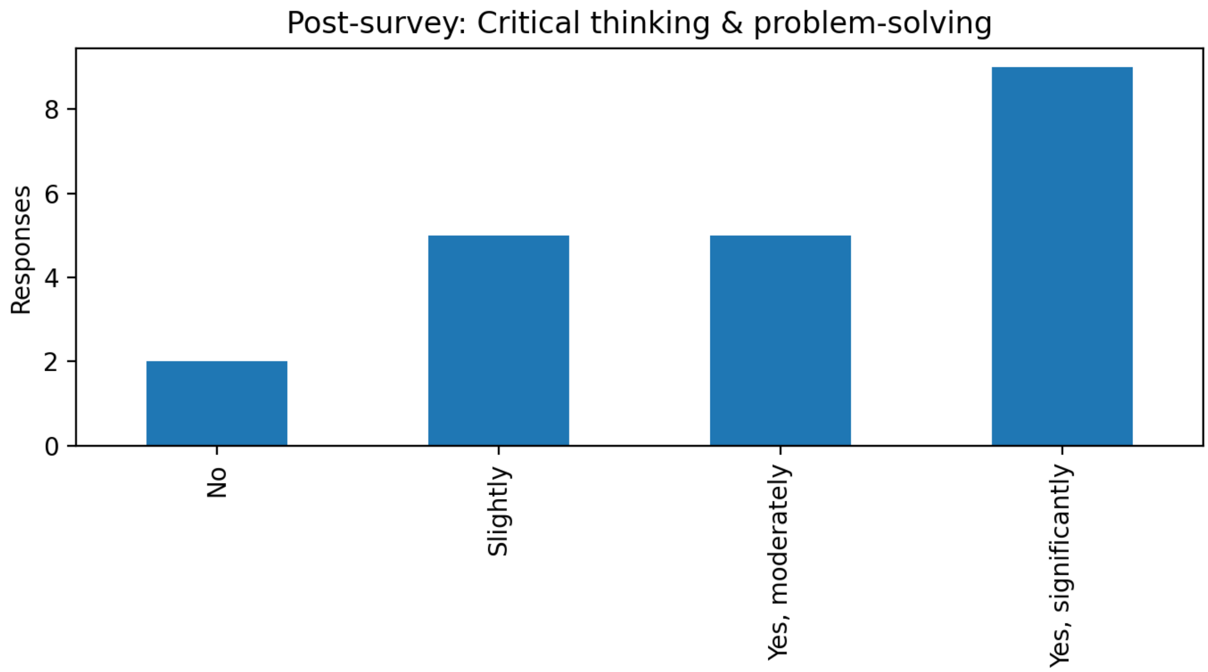

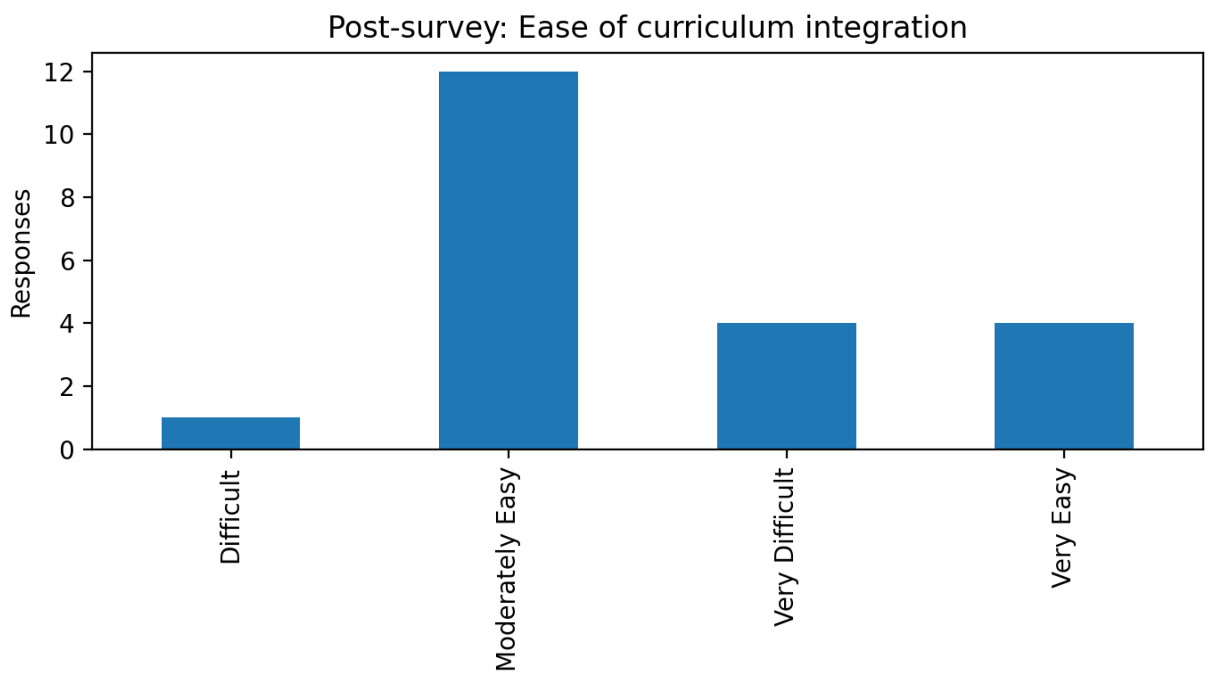

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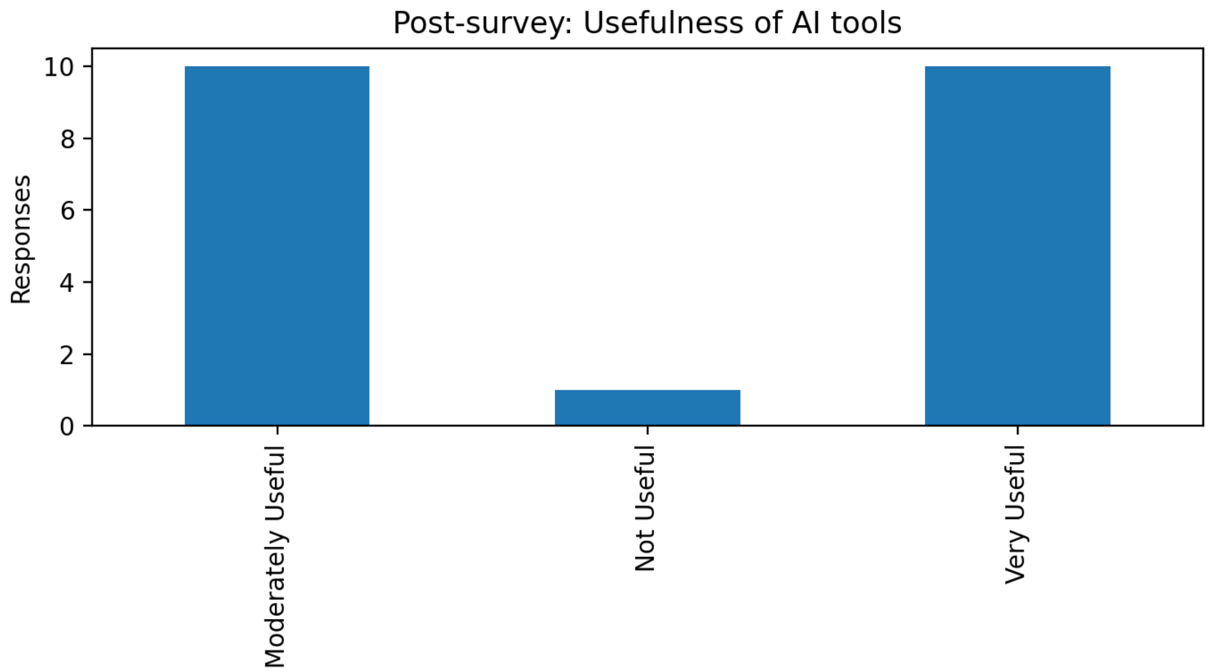
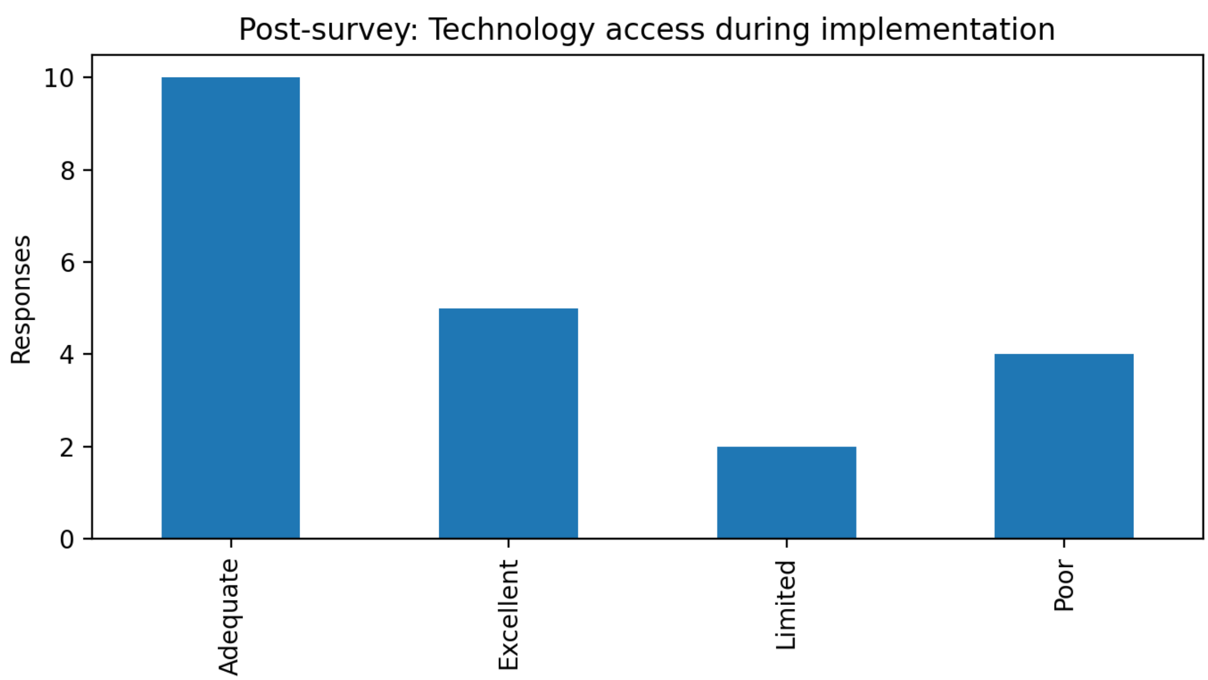
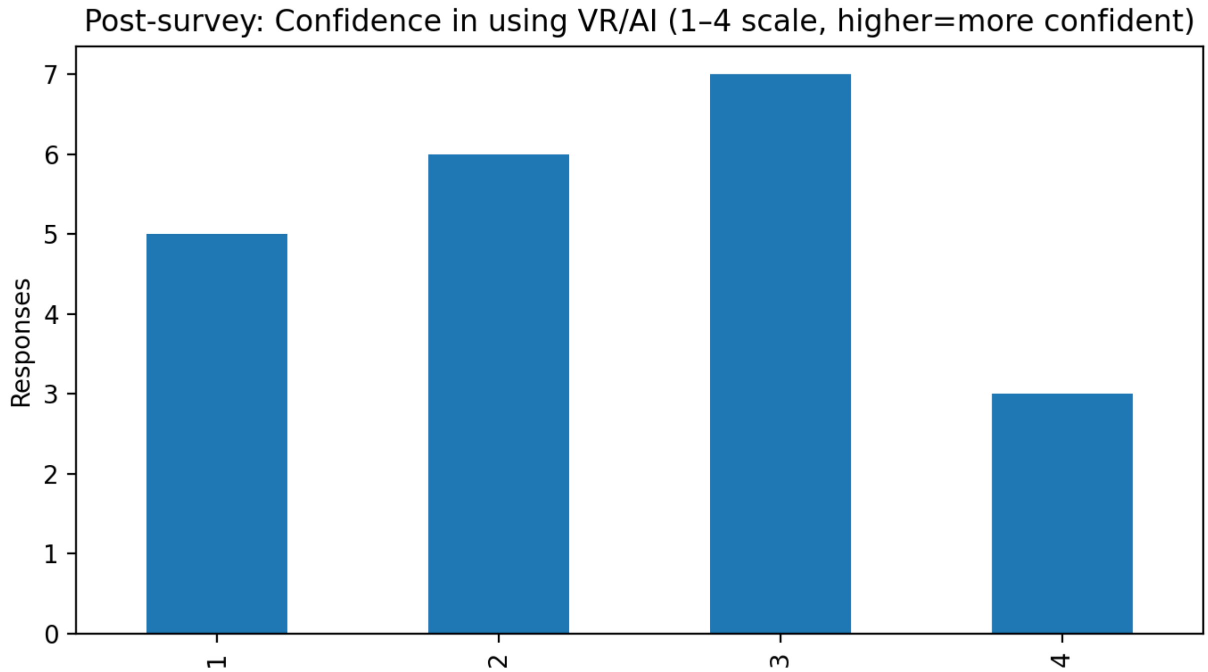

Post-survey: Usefulness of AI tools
Responses
0
2
4
6
8
10
Moderately Useful
Not Useful
Very Useful


Post-survey: Technology access during implementation
Responses
0
2
4
6
8
10
Adequate
Excellent
Limited
Poor



5.2 Key Insights (Post)

The post-implementation survey results provide a coherent and convergent picture of the **perceived pedagogical impact** of the EcoSTEAM VR Learning Platform, particularly in relation to student engagement, interest, and conceptual understanding. Across these dimensions, teachers reported predominantly positive outcomes, with relatively few neutral or negative responses.

Student engagement as a primary impact driver

As shown in the engagement outcome charts, **student engagement emerged as the most consistently and strongly reported benefit** of platform use. A large majority of teachers (**81.0%**) indicated that student engagement increased **moderately or significantly** following the implementation of EcoSTEAM VR activities. *Notably, the proportion of responses in the "significant increase" category is materially higher than in the pre-implementation expectation distributions, suggesting that immersive VR experiences acted as a stronger engagement catalyst than initially anticipated.*

This pattern aligns with well-documented mechanisms of immersive learning: novelty, sensory immersion, and interactive exploration appear to have captured student attention effectively, creating favourable conditions for participation, discussion, and sustained focus during learning activities.

Student interest and motivation

Closely linked to engagement, **student interest in learning activities** was also reported to increase substantially. According to the post-implementation distributions, **90.5% of teachers** observed a **moderate or strong increase in student interest**. The concentration of responses at the higher end of the scale indicates that VR-based ECO-STEAM scenarios were perceived not merely as engaging "add-ons", but as meaningful learning experiences that stimulated curiosity and motivation.

Teachers' qualitative feedback suggests that contextualised, real-world ecological scenarios helped students connect abstract concepts to tangible situations, reinforcing relevance and intrinsic motivation.

Conceptual understanding and learning depth

Beyond engagement and interest, teachers also reported **positive effects on students' conceptual understanding**. **81.0% of respondents** indicated **moderate to significant improvements** in students' understanding of the addressed topics. While this dimension shows slightly more dispersion than engagement and interest, the overall trend remains clearly positive.

This finding supports an **"engagement-first" impact pathway**, whereby immersive experiences initially increase attention and curiosity, which in turn facilitate deeper discussion, reflection, and conceptual processing. Importantly, the data suggest that VR use did not remain at a superficial motivational level, but was perceived to contribute to learning quality when appropriately integrated into lesson structures.

Perceived value of AI tools

The integrated AI tools represent one of the platform's strongest differentiating features, and this is clearly reflected in post-implementation feedback. As shown in the corresponding chart, **95.2% of teachers** rated the AI tools as **moderately or very useful**. Very few respondents selected low-utility categories.

Open-ended responses indicate that perceived value is concentrated in three areas:

- **Acceleration of lesson planning and preparation**;
- **Support for ideation and adaptation of activities**;
- **Reduction of technical barriers**, particularly in scripting or authoring VR scenarios.

These findings suggest that AI tools played a **facilitative and enabling role**, supporting teacher agency rather than replacing pedagogical decision-making.

Overall interpretation

Taken together, the post-implementation findings indicate that the EcoSTEAM VR Learning Platform delivered **strong perceived value in authentic classroom contexts**, particularly by enhancing engagement and interest while also supporting conceptual understanding. The convergence between quantitative outcomes and qualitative feedback strengthens confidence in these conclusions.

At the same time, the distribution patterns suggest that **impact is contingent on implementation quality**. Where technical conditions, time allocation, and teacher confidence were sufficient, reported outcomes were consistently strong. This reinforces the importance of addressing implementation conditions in parallel with further pedagogical development.

5.3 Implementation Challenges, Technical Issues, and Improvement Requests (Post)

Challenges mentioned post-implementation cluster around infrastructure reliability (especially internet connectivity and device availability), teacher familiarity/experience (onboarding), and time to design and integrate activities.

Theme (implementation challenges)	Mentions (approx.)
Teacher confidence & training time	4
Technical setup & infrastructure	3
Pedagogy & curriculum integration	2

5.4 Illustrative examples

To complement the quantitative post-implementation results and thematic frequency analysis, selected anonymised excerpts from teachers' open-ended responses are presented below. These examples provide qualitative insight into how the EcoSTEAM VR Learning Platform was experienced in real classroom contexts, helping to contextualise reported outcomes and implementation challenges.

The excerpts were selected because they reflect recurring patterns observed across responses rather than isolated cases. They illustrate teachers' perceptions of student engagement and learning, the practical value of AI-supported authoring tools, and the operational constraints encountered during implementation. Together, these qualitative insights enrich the interpretation of the post-implementation findings by linking statistical trends to concrete classroom experiences and professional reflections.

Technical setup & infrastructure:

- I don't have internet in all classes
- I didn't feel confident using the VR headset in the beginning
- No headset but used cardboard

Pedagogy & curriculum integration:

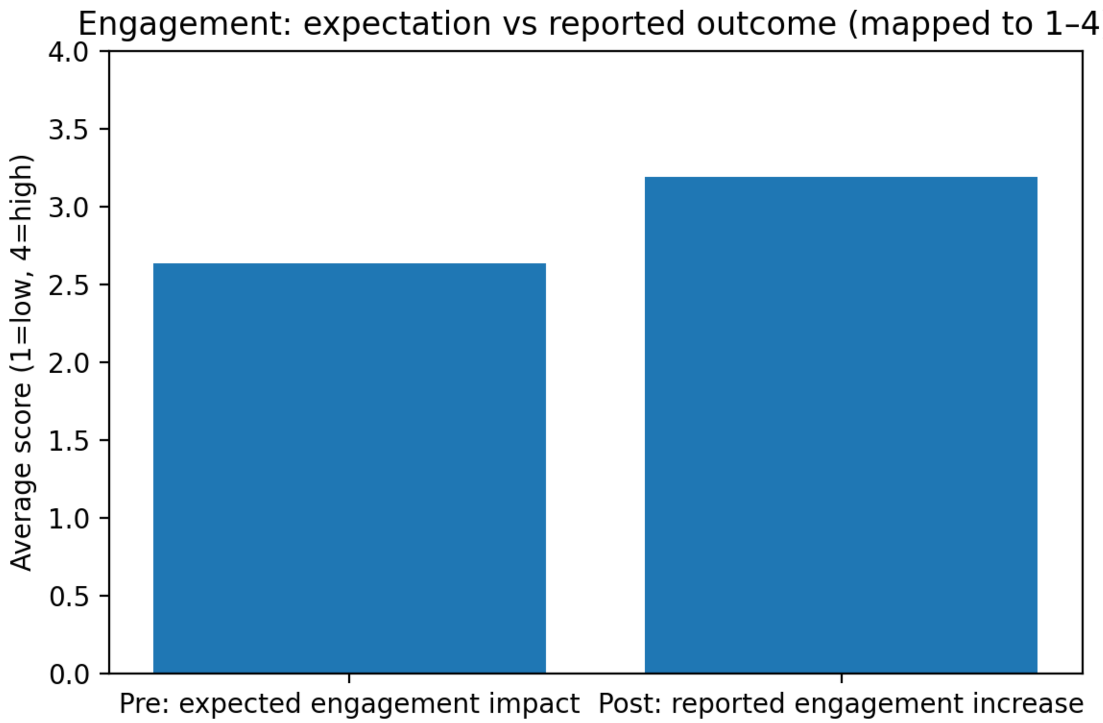
- Limited lesson time, technical issues at the beginning
- Teachers' pedagogical adaptation and time investment in learning new methods. Lessons need to be planned differently, incorporating VR experiences, reflection and discussions that require careful preparation. Students' different learning needs and ability to concentrate in a virtual environment should also be taken into account.

Teacher confidence & training time:

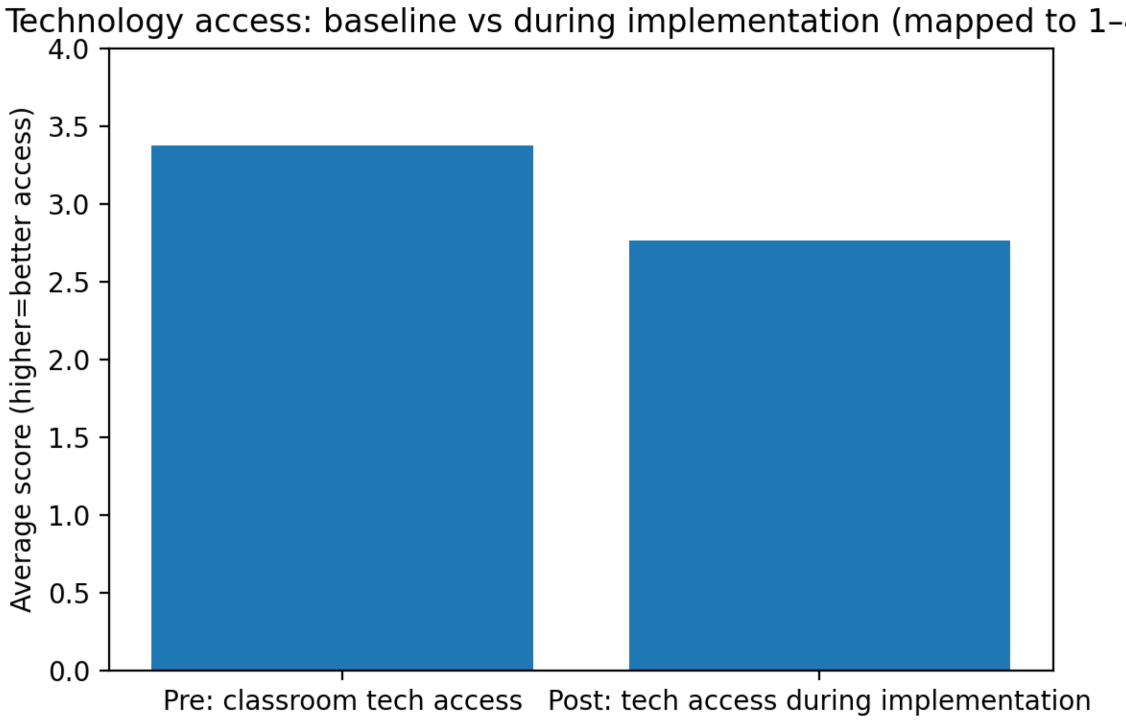
- Limited lesson time, technical issues at the beginning
- Learning new things takes time, time consisting of focus and concentration. I have felt that sometimes I am short of time and would have liked to play around more to get new inspiration.
- Everything was fine, but very time-consuming.

6. Comparative Analysis (Pre vs Post)

Given different sample sizes and partial respondent overlap, comparisons are interpreted as directional signals. Two high-level indices are used to compare baseline expectations and implementation outcomes.



Engagement index mapping suggests a higher average post-implementation engagement outcome (3.19/4) than the average pre-implementation expectation (2.63/4). This is consistent with the qualitative feedback that VR experiences acted as a strong engagement catalyst.



Technology access appears lower during implementation (2.76/4) than baseline classroom access (3.37/4). This may reflect the additional infrastructure demands of VR rollout (headsets, compatibility, bandwidth, device logistics) compared to general classroom technology availability.

6.1 From Expectations to Outcomes

Pre-survey responses show strong expectations regarding engagement impact. Post-survey results indicate that teachers generally perceived the platform to deliver on (and often exceed) these expectations. The gap is most visible in the 'significant engagement increase' category, which is materially represented in post responses.

6.2 Change Mechanisms (Interpretation)

Across open-ended feedback, the following mechanism pattern emerges:

1) Immersive VR scenarios increase attention, curiosity, and discussion.

2) This engagement supports exploration of ecological sustainability concepts in concrete contexts.

3) AI tools lower preparation and authoring barriers (lesson plans, scripts), supporting teacher adoption.

4) Constraints are primarily operational: connectivity, device management, and time for integration.

7. Recommendations (Project Steering & Scaling)

This section translates the empirical findings from the pre- and post-implementation surveys into **actionable recommendations** to support informed decision-making, effective project steering, and the sustainable scaling of the EcoSTEAM VR Learning Platform. The recommendations are grounded in the combined quantitative trends and qualitative insights presented in earlier sections and are aligned with Erasmus+ priorities related to **quality assurance, innovation uptake, and long-term impact**.

Rather than focusing solely on technological enhancement, the recommendations adopt a **system-level perspective**, addressing pedagogical design, teacher professional development, infrastructure readiness, and governance conditions. This approach reflects the evidence that the platform's perceived impact is strongly influenced not only by its technical features, but also by the **quality of implementation environments** and the support structures available to teachers.

The recommendations are organised to:

- strengthen **short-term project delivery and implementation quality**;
- support **medium-term adoption and institutional integration**;
- enable **long-term sustainability and scalability** beyond the project lifecycle.

By explicitly linking evidence to strategic action, this section aims to support the EcoSTEAM partnership in consolidating gains achieved during the project and in positioning the platform for wider dissemination, policy relevance, and durable educational impact.

8. Limitations

While the findings presented in this report provide a robust and informative evidence base, several methodological limitations should be acknowledged to ensure **transparent interpretation** and avoid overgeneralisation.

Sample size and respondent overlap

The **pre-implementation (n = 38)** and **post-implementation (n = 21)** surveys differ in sample size, and the respondent groups may not fully overlap. As a result, observed differences between pre- and post-survey findings cannot be interpreted as direct within-subject change. Comparisons are therefore conducted at the **aggregate level** and should be understood as **directional and indicative**, rather than causal or statistically inferential.

This limitation is typical of applied educational innovation projects implemented across multiple countries and institutional contexts, where participation levels may vary over time due to scheduling, workload, or implementation conditions.

Qualitative analysis depth

Open-ended survey responses were analysed using a **lightweight thematic keyword-based coding approach**, complemented by manual interpretation of recurring patterns. While this method is appropriate for exploratory and evaluative purposes, it does not constitute a full qualitative research design. In particular, more advanced procedures, such as multi-rater coding, inter-rater reliability analysis, or in-depth narrative analysis, were not applied.

As a result, qualitative findings are presented as **illustrative and explanatory**, supporting the interpretation of quantitative trends, rather than as standalone qualitative evidence.

Overall implication of limitations

Taken together, these limitations do not undermine the **internal coherence or practical relevance** of the findings. Rather, they define the **scope and evidentiary status** of the results: *the report provides a credible, experience-based evaluation of perceived impact, implementation conditions, and adoption dynamics, well suited to informing **project steering, iterative improvement, and strategic scaling decisions**.*