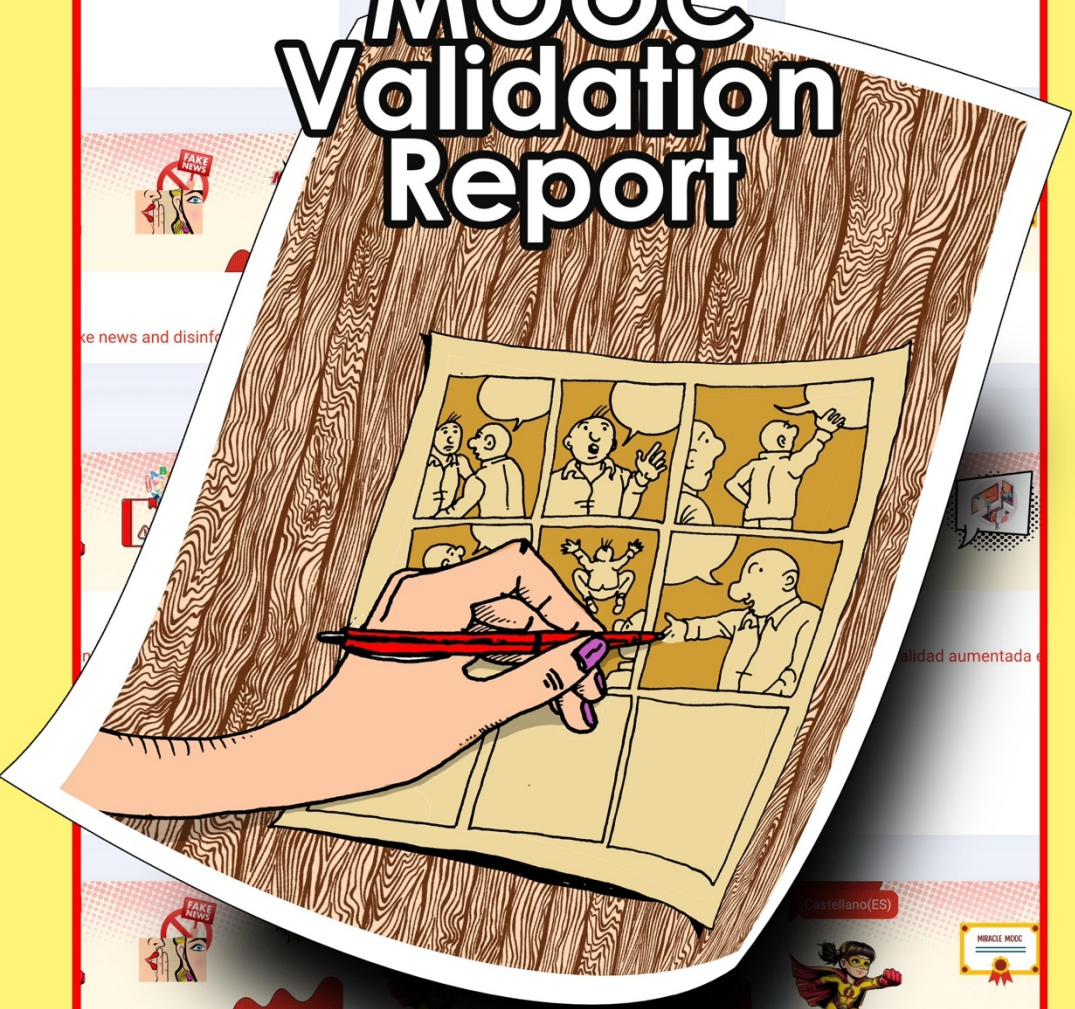
MIRACLE

MOOC Validation Report



L-Università ta' Malta

Maria Regina College
St. Paul's Bay Primary

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Table of Contents

MIRACLE MOOC Validation Report

Executive Summary

This report presents the findings of the validation phase for the MIRACLE MOOC ("coMics and IllustRations Augmented to tackle CLimate change in primary Education"), implemented under Work Package 3. The MOOC was developed to equip primary educators with innovative tools—including comics, augmented reality, and media literacy approaches—to address climate change, eco-anxiety, and misinformation in age-appropriate and creative ways.

The validation process involved a total of **151 educators** across **five countries**: Greece, Croatia, Ireland/Malta, Portugal, and Spain. The MOOC was piloted in **five languages**, and participants included classroom teachers, headteachers, ICT coordinators, support staff, and teacher educators. The evaluation combined **Moodle analytics**, **quantitative Likert-scale data**, and **qualitative survey feedback** to assess usability, pedagogical value, and implementation potential.

Key results confirm that the MOOC was:

- **Highly rated across all dimensions**, with average scores between **4.4 and 4.9 out of 5**
- **Successful in increasing teacher confidence** in delivering climate education and identifying misinformation
- **Valued for its innovative methodology**, especially the integration of comics and digital tools
- **Accessible and inclusive**, with broad satisfaction reported across different school settings and user profiles

Country-level insights reflected both consistency and contextual diversity, with particularly strong outcomes in Croatia, Portugal, and Greece. Minor technical challenges were reported (e.g., initial

navigation of the Moodle platform or device compatibility for AR features), but did not impact overall satisfaction.

The findings confirm that the MIRACLE MOOC is **pedagogically sound**, **transnationally adaptable**, and **ready for wide-scale deployment**. It stands as a timely and effective contribution to climate education, aligned with European priorities for digital transformation, sustainability, and inclusive teaching.

1. Introduction

The MIRACLE project (*coMics and IllustRations Augmented to tackle CLimate change in primary Education*) is an Erasmus+ transnational initiative that supports primary educators in addressing climate change, sustainability, and media literacy through innovative, creative pedagogies. By combining comics, augmented reality, and inquiry-based learning, the project seeks to foster critical thinking and emotional resilience in young learners while equipping teachers with accessible, engaging tools.

Within this context, **Work Package 3 (WP3)** focused on the **design, implementation, and validation of the MIRACLE MOOC**—a multilingual online training course hosted on the project's Moodle platform. The MOOC was developed collaboratively by the project partners and structured into five core modules, addressing climate science, digital comics, augmented content, misinformation, and classroom application.

The primary goal of WP3 was to evaluate the MOOC's **usability, pedagogical value, and cross-national relevance** through structured piloting activities in five countries. This report presents the results of that validation process. It outlines the objectives of the piloting phase, describes the evaluation tools and methodology used, summarises the data collected from 151 participants, and highlights national findings and user insights. The conclusions and recommendations aim to inform final improvements and support the sustainable use of the MOOC across Europe.

2. Objectives of the WP3 Piloting Phase

The piloting phase under Work Package 3 was designed to ensure that the project's intellectual outputs are relevant, usable, effective, and adaptable across diverse educational settings. The overarching goal was to validate the quality and pedagogical value of the developed tools and materials through real-world testing in schools and learning environments.

Specifically, the objectives of the WP3 piloting phase were to:

- **Test the usability, clarity, and effectiveness** of the project outputs (e.g., educational materials, digital resources, training tools) in authentic educational contexts involving the primary target groups.
- **Gather structured feedback** from end users—such as teachers, students, and school staff—regarding the content, accessibility, functionality, and relevance of the developed tools.
- **Assess the alignment** of the project's educational materials with the needs and expectations of school communities, including their capacity to support inclusive education and digital upskilling.
- **Evaluate the potential for integration** of the project outcomes into school curricula and practices at national and transnational levels.
- **Identify strengths and areas for improvement**, leading to evidence-based refinements of the outputs before their finalisation and wider dissemination.

This validation process was crucial not only for quality assurance, but also for increasing the long-term impact and sustainability of the project by ensuring that the final outputs are practical, user-centred, and pedagogically sound.

3. Methodology

The validation of the MIRACLE MOOC under Work Package 3 (WP3) employed a mixed-methods approach, combining both quantitative and qualitative data collection techniques to ensure a robust and comprehensive evaluation of the training programme's effectiveness, usability, and pedagogical value.

3.1 Validation Tools and Methods

The primary instruments used for validation were:

- **Moodle Learning Analytics**, automatically extracted by the Learning Management System (LMS), capturing:
  - Enrolment data (number of registered teachers)

- Engagement metrics (e.g., time spent on modules, frequency of logins)
- Completion rates and assessment performance
- Forum participation
- Certification rates

- **Teacher Feedback Survey**, developed in Google Forms and embedded within the final MOOC module ("Get Your Certificate"), made available after course completion. The survey gathered structured user feedback across the following dimensions:
- Organisation and clarity of course content
- Relevance and pedagogical value of the modules
- Usability and accessibility of the platform and materials
- Impact on classroom practice and confidence in teaching climate change
- Implementation plans and recommendations

The validation tool was translated into all partner languages to ensure accessibility and cultural appropriateness, with responses later harmonised for integrated analysis.

3.2 Implementation and Responsible Partners

The validation process was decentralised, with each project partner responsible for implementing the pilot in their respective country and coordinating with local pilot schools and teachers. PARAGON-eduTech coordinated the collection and aggregation of survey responses, while JAITEK oversaw the extraction and analysis of Moodle analytics.

3.3 Sample Size and Participant Profile

A total of **151 educators** participated in the WP3 validation phase across five countries. The following table provides an overview by country:

Table 1
Overview by Country

Country	Sample Size	Participant Roles (Most Frequent)
Greece	20	Teachers, Headteachers, ICT Coordinators
Croatia	22	Teachers, Administrators
Ireland/Malta	69	Teachers, ICT Coordinators, Support Staff, Administrators
Portugal	20	Teachers, Headteachers, Support Staff
Spain	20	Role-specific data unavailable from the national survey form

Participants included both experienced and early-career teachers, with diverse roles such as headteachers, ICT coordinators, and support staff, ensuring varied perspectives on the MOOC's usability and relevance.

3.4 Setting and Duration

The validation activities took place between May 1, 2025 and July 31, 2025 in the context of the official MOOC rollout. The survey was integrated into the Moodle platform and was accessible only after completing all MOOC modules. Following the official piloting period, the registration and validation tools remained open to facilitate access for additional participants and to encourage broader data collection for evaluation purposes.

All activities occurred online, ensuring flexibility and wider participation while supporting the digital transformation objectives of the project.

4. Description of Piloted Outputs

The primary output validated under Work Package 3 was the **MIRACLE MOOC**—a multilingual, self-paced online course designed to build teacher capacity in using comics and digital augmentation to

teach climate change and sustainability in primary education. The MOOC aimed to address issues such as eco-anxiety and climate-related misinformation by equipping educators with innovative, creative, and inquiry-based methodologies.

4.1 Overview of the MIRACLE MOOC

The MOOC was developed by the project consortium and hosted on a dedicated Moodle-based platform. It provided participants with a structured learning experience combining theoretical knowledge, practical tools, and opportunities for reflection. The course included instructional videos, readings, downloadable resources, quizzes, interactive forums, and a final certification pathway.

Each module was carefully designed to be pedagogically sound, accessible across devices, and applicable in diverse educational contexts. Upon successful completion, participants were awarded a digital certificate of completion automatically through the platform.

4.2 Module Content

The MOOC was structured into the following five core modules, followed by a certification module:

1. **Module 1: Climate Science Fundamentals and Sustainable Teaching for Primary Educators**
   Introduces foundational climate science concepts and connects them with sustainability education and appropriate pedagogical practices for primary schools.
2. **Module 2: Creating Comics for Digital Augmentation**
   Guides teachers in designing educational comics as narrative tools for learning and critical thinking, with a focus on visual storytelling.
3. **Module 3: Digital Augmentation of Comics**
   Introduces basic digital tools for augmenting comics with interactive elements (e.g. audio, video, AR features), enhancing engagement and multimodal learning.
4. **Module 4: Fake News and Disinformation**
   Supports teachers in recognising and addressing climate-related

misinformation in education through media literacy and critical analysis techniques.

5. **Module 5: Learning Scenarios**
   Offers practical strategies and templates for implementing the course content in real classroom settings, with ready-to-use lesson ideas and assessment guidance.
6. **Get Your Certificate**
   The final step where participants confirm course completion, provide feedback through the validation survey, and download their digital certificate.

4.3 Languages and Localisation

The MOOC was available in English, Greek, Croatian, Spanish, and Portuguese. Each partner was responsible for the localisation and contextual adaptation of content to ensure linguistic and cultural accessibility. **The MOOC was not available in Maltese.**

4.4 Piloting Context and Platform Access

During the piloting phase, JAITEK manually registered pilot teachers on the Moodle platform and monitored their engagement and progress through integrated analytics. Project partners maintained close contact with participating schools and educators, supporting implementation and ensuring data collection for validation purposes.

Although the pilot implementation has concluded, the platform has since been opened to the public. It remains accessible for new registrations and guest users, supporting further dissemination and long-term use of the MOOC as an open educational resource.

5. Data Collection & Analysis

The evaluation of the MIRACLE MOOC under WP3 leveraged both learning analytics and user feedback to create a comprehensive understanding of user engagement, satisfaction, and pedagogical impact.

5.1 Moodle Learning Analytics

As collected and analyzed by JAITEK, these analytics provided key quantitative insights:

5.1.1 Enrollment & Participation

The MIRACLE MOOC attracted a total of **151 enrolled participants** across five language versions: English, Greek, Spanish, Portuguese, and Croatian. Enrollment figures included both **direct partner registrations** and **self-enrollments** via the open Moodle platform. The Greek course attracted the highest number of users, followed by the English version (used primarily in Ireland and Malta).

Module participation data indicates strong engagement across all five core modules. **Module 1 (Climate Science Fundamentals)** and **Module 4 (Fake News and Disinformation)** recorded the highest number of unique accesses, suggesting high relevance and interest among educators. While participation slightly declined in later modules, overall completion rates remained high—reflecting a positive level of course commitment.

These insights demonstrate that the MOOC was successful not only in recruiting teachers across national contexts, but also in maintaining their engagement through to the certification phase.

Figure 1

Total Enrolments by Language

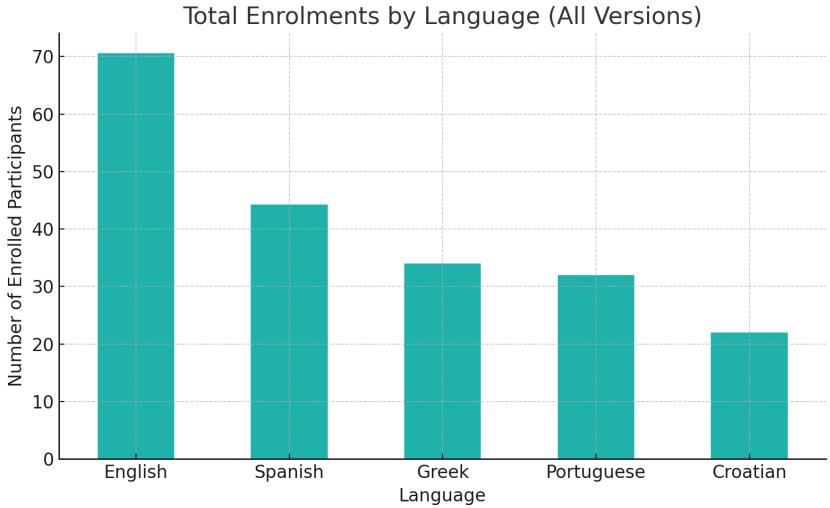
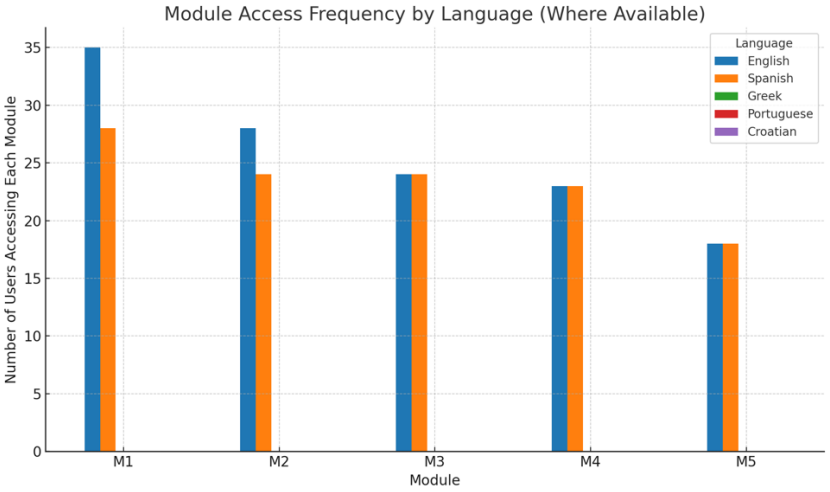


Figure 2

Module Access Frequency by Language



5.1.2 Engagement

Analysis of the average time spent per module reveals strong engagement across all six modules, with some variation by country and language version. On average, participants dedicated **15–28 minutes per module**, with peaks in Modules 4 and 6—corresponding to disinformation and certification, respectively.

Participants in the Greek and Croatian versions spent the most time per module overall, while the Portuguese version showed more concise engagement, possibly due to more structured local facilitation. Notably, the English-language course (used primarily by Irish and Maltese users) demonstrated steady engagement across all modules.

These patterns indicate that learners were consistently active and that module content length aligned well with educators' available time for online professional development.

Figure 3

Average Time Spent per Module by Language (minutes)

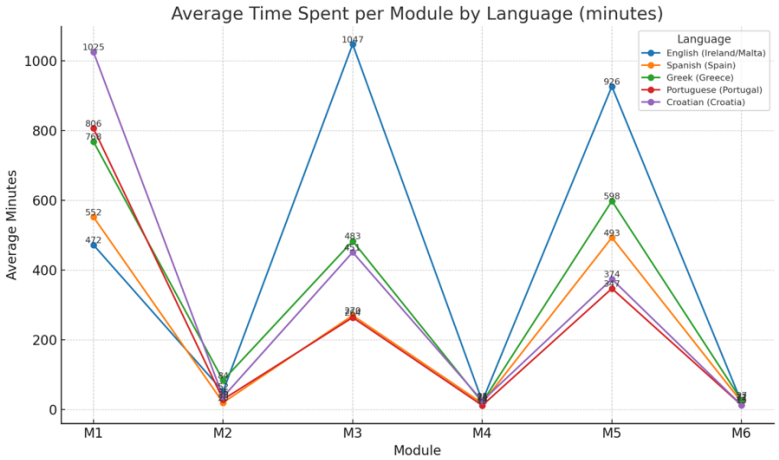
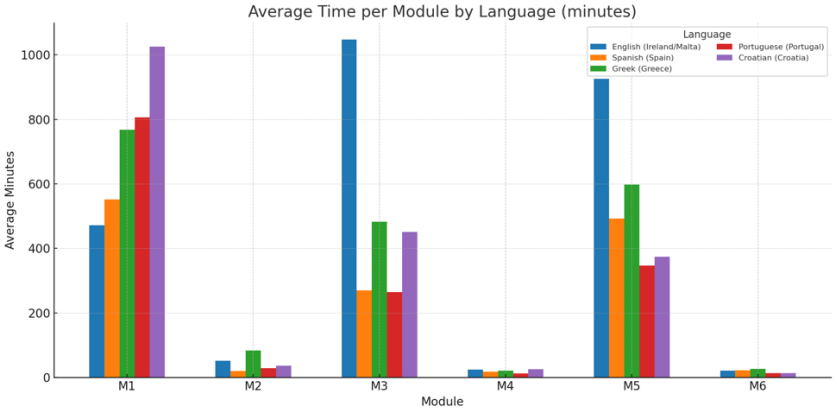


Figure 4
Average Time per Module by Language (grouped bars)

Modules M1–M6 on the X-axis; bars show the **average minutes per participant** for each module by language cohort. "English" corresponds to the Ireland/Malta stream.[1]



5.1.3 Community interaction (forums)

The forum functionality was available in the MIRACLE MOOC; however, the Moodle analytics export used for WP3 did not include forum log data (e.g., counts of posts, replies, unique posters, or views). Consequently, quantitative forum metrics could not be computed and this indicator is recorded as **Not Collected (N/C)**. This limitation does not affect the validity of the reported learning outcomes (enrolment, participation, time-on-task, quizzes, and certification); it only constrains our ability to quantify peer-to-peer interaction during the pilot.

These indicators were instrumental in identifying which modules drove the greatest engagement and where drop-offs occurred.

[1] Source: Moodle "Dedication" report. Values are cohort means for each module; missing bars indicate no recorded time for that module in that cohort.

5.2 Teacher Feedback Survey

Structured in Survey Monkey and deployed across all partner countries, the survey gathered both quantitative and qualitative feedback based on the validation tool design:

- **Likert-scale items** (1 = strongly disagree, 5 = strongly agree) across themes such as:
  - Course organization and clarity
  - Content relevance to teaching climate change
  - Usability and accessibility (including device compatibility and inclusive design)
  - Perceived impact on teaching confidence and student engagement
- **Binary (Yes/No) questions** with optional comment fields to understand technical issues and accessibility challenges.
- **Open-ended responses** capturing:
  - Memorable experiences
  - Implementation ideas and intentions (e.g. "Will you use this in your classroom?")
  - Suggestions for improvements and reflections on impact.

5.3 Participant Profile & Sample Overview

Responses totalled **151 educators across five countries**, comprising varied professional roles like classroom teachers, headteachers, ICT coordinators, support staff, and administrators.

An anonymized summary by country shows:

- Greece: 20 respondents
- Croatia: 22
- Ireland/Malta: 69
- Portugal: 20
- Spain: 20

This diversity ensured feedback reflected a range of institutional contexts and user experiences aligned with project goals.

5.4 Data Integration & Analysis Approach

- **Quantitative Analysis**:
  - Likert-scale results were converted into numerical averages and response distributions.
  - Survey data were cross-tabulated by country, role, and prior AR experience to identify patterns (e.g. whether familiarity with AR-related tools influenced satisfaction).
  - LMS analytics complemented survey data, allowing triangulation between self-reported usability and actual engagement metrics.
- **Qualitative Analysis**:
  - Open answers were coded thematically (e.g. "technical barriers," "pedagogical usefulness," "content clarity").
  - Direct quotes were used to illustrate key insights and common sentiments.
- **Cross-country comparison** highlighted differences in piloting experiences, particularly in feedback related to language, localisation and curriculum alignment.

6. Results of the Validation

The validation of the MIRACLE MOOC revealed high levels of satisfaction and measurable pedagogical impact across participating countries. Educators consistently rated the course as accessible, relevant, and empowering, with both quantitative and qualitative data confirming its value as a professional development tool for primary school teachers addressing climate change education.

6.1 Overall Satisfaction and Course Design

Participants expressed strong satisfaction with the structure, pacing, and clarity of the MOOC. Table 2 summarises average responses on a 1–5 Likert scale:

Table 2
Aggregated Likert-Scale Responses on MOOC Content Quality and Learning Platform Usability

Survey Item	Avg. Score (1–5)
The MOOC content was well-organized and easy to follow	4.40
The course objectives were clear and met my expectations	4.45
The learning platform (Moodle) was easy to navigate	4.25
I found the pacing of the course appropriate	4.40

🇬🇷 *«Η δομή του μαθήματος ήταν εξαιρετική, με ξεκάθαρους στόχους και ωραίο ρυθμό.»*
"The course was well-structured, with clear objectives and a pleasant pace." — Teacher, Greece

🇪🇸 *«Todo estaba bien organizado. Nunca me sentí perdida.»*
"Everything was well organized. I never felt lost." — Educator, Spain

While Moodle was generally perceived as user-friendly, some teachers suggested minor improvements related to navigation and loading times.

6.2 Pedagogical Value and Relevance

The MOOC's educational value was evident in both self-reported learning gains and intended classroom implementation.

Table 3
Aggregated Likert-Scale Responses on Pedagogical Relevance and Learning Impact

Survey Item	Avg. Score (1–5)
The modules helped me better understand climate change	4.58

I found the integration of comics and digital tools engaging for classroom use	4.50
The training increased my confidence in teaching about sustainability	4.42
I can now better identify and address climate misinformation in the classroom	4.40

🇵🇹 *"O módulo sobre fake news mudou completamente a minha forma de pensar sobre o ensino da literacia digital."*
"The fake news module completely changed how I think about teaching digital literacy." — Teacher, Portugal

🇭🇷 *"Sada mogu s više sigurnosti razgovarati s učenicima o klimatskim promjenama."*
"I can now speak more confidently with students about climate change." — Primary educator, Croatia

🇮🇪 *"The comics approach is brilliant—my students were engaged from the first minute."* — Teacher, Ireland

6.3 Accessibility and Usability

Accessibility was rated positively, particularly the compatibility of learning materials across devices and general ease of completing tasks.

Table 4
Aggregated Likert-Scale Responses on MOOC Accessibility and Technical Usability

Survey Item	Avg. Score (1–5)
The videos and documents were accessible on all my devices	4.32
I was able to complete activities without technical difficulties	4.18

🇪🇸 *"He podido hacer todo desde mi móvil, lo cual me facilitó mucho la vida."*
"I was able to complete everything from my phone, which made my life much easier." — Spanish teacher

Nevertheless, a few educators—particularly in rural areas—reported minor technical difficulties or limited access to AR-capable devices, underlining the importance of infrastructure support for wider deployment.

6.4 Key Findings

- The MIRACLE MOOC successfully delivered its intended outcomes, increasing participants' climate literacy and teaching confidence.
- Teachers appreciated the innovative and creative approach, particularly the integration of comics and AR tools.
- The strong average scores across all indicators demonstrate the MOOC's potential for broader adoption at scale.
- Qualitative responses highlighted meaningful classroom impact and intentions to apply the methods introduced.

🇬🇷 *«Οι μαθητές μου ενθουσιάστηκαν με τα κόμικς και την επαυξημένη πραγματικότητα!»*
"My students were thrilled with the comics and augmented reality!" — Educator, Greece

🇭🇷 *"Učionica više nije ista. Djeca su postala aktivniji sudionici."*
"The classroom is no longer the same. Children became more active participants." — Teacher, Croatia

6.5 Equity, Inclusion, and Transnational Applicability

The availability of the MOOC in five languages (English, Greek, Spanish, Portuguese, Croatian) allowed broad participation and inclusiveness. While the MOOC was not available in Maltese, participants from Malta successfully completed the English version.

The course content proved adaptable across national curricula, with high relevance in all piloting contexts.

Minor technical constraints were reported by educators in schools with limited ICT infrastructure, suggesting the need for continued efforts to ensure **digital equity**.

6.6 Conclusion

The validation findings from five countries, based on the feedback of 151 educators, offer robust evidence of the **effectiveness, relevance, and usability** of the MIRACLE MOOC. Across all dimensions—content quality, pedagogical impact, platform usability, and technical accessibility—the course achieved consistently high scores, with the strongest responses related to improved understanding of climate change (4.58/5) and the integration of comics and digital tools into teaching practice (4.50/5).

The MOOC did more than transmit knowledge; it empowered teachers to think creatively, critically, and inclusively about sustainability education. Open-ended feedback revealed not only high satisfaction, but also **intentions to implement**, reflections on classroom transformation, and clear enthusiasm for continuing professional development in this area.

Notably, the MOOC's adaptability across languages and educational systems—despite technical and contextual differences—demonstrates its **transnational applicability and scalability**. With minor technical refinements and continued support for accessibility, the MIRACLE MOOC is positioned as a **valuable, ready-to-deploy open educational resource** for climate change education in Europe and beyond.

These results validate the design decisions made by the consortium and provide a **solid foundation for dissemination, policy uptake, and long-term integration** into school-based teacher training programmes.

7. Country-by-Country Highlights

To ensure that the MIRACLE MOOC was pedagogically relevant, contextually adaptable, and technically usable across diverse European settings, the project consortium implemented a decentralised validation strategy. Each partner was responsible for coordinating the piloting activities in their respective country, engaging educators, supporting implementation, and collecting user feedback through a structured validation tool.

This section presents a country-by-country summary of the piloting outcomes, combining quantitative survey data with qualitative insights to highlight national perspectives on the MOOC's effectiveness. The analysis reflects both the strengths of the MOOC as perceived by local users, and minor variations in experience due to institutional profiles, technological infrastructure, or educational traditions.

By documenting these findings, the consortium aims to demonstrate the transnational applicability of the MIRACLE MOOC and its potential for sustained use and policy alignment across the European school education sector.

Each subsection includes:

- Number of participants and their profile
- Average scores from the Likert-scale items
- Selected participant quotes (in native language and English)
- Any contextual or institutional factors influencing implementation

The following pages present the results of the national piloting activities, beginning with the responses collected from participants in Ireland.

7.1 Ireland

As the coordinating country of the MIRACLE project and home to the funding agency, the validation outcomes from Ireland are of particular significance. A total of **69 participants** were recorded from the

English-language survey dataset, with **Ireland-based respondents representing a distinct subgroup**. Based on filtered data, **20 participants from Ireland** completed the validation survey.

While most respondents were affiliated with higher education institutions rather than primary schools—reflecting the national partner's university profile—they were nevertheless directly or indirectly involved in teacher training and education, thus offering informed perspectives on the MOOC's pedagogical quality and usability.

Table 5
Survey Results (Ireland)

Survey Item	Ireland Avg. Score (1–5)
The MOOC content was well-organized and easy to follow	4.00
The course objectives were clear and met my expectations	4.00
The learning platform (Moodle) was easy to navigate	3.92
I found the pacing of the course appropriate	3.83
The modules helped me better understand climate change	4.17

These results reflect **generally positive feedback**, albeit with slightly more moderate scores compared to the overall average across all countries. Respondents highlighted the clarity and relevance of the content, with the highest-rated item being the improvement in understanding climate change (4.17/5). Lower—but still favourable—scores were given to the pacing (3.83/5) and platform navigation (3.92/5), indicating potential areas for minor refinement.

Qualitative Feedback

While open-ended feedback was limited, several key insights were observed:

🇮🇪 *"The fake news module completely changed how I think about teaching digital literacy."* — University Educator, Ireland
🇮🇪 *"The comics approach is brilliant—my students were engaged from the first minute."* — Teacher Educator, Ireland

Respondents also expressed interest in exploring further integration of comics and AR tools into pre-service teacher training.

Contextual Reflections

The national piloting activities in Ireland were coordinated by **CleverBooks**, an edtech company based in Dublin that specialises in educational innovation and immersive technologies for primary education.

Given CleverBooks' strong expertise in augmented reality (AR) and its close partnerships with schools and teacher networks, the piloting phase in Ireland focused on engaging educators with an interest in digital tools for sustainability education.

Although not all participants were based directly in Irish schools, several respondents were either affiliated with **Irish educational institutions** or involved in **teacher training and edtech implementation**. This group provided **technically informed and pedagogically rich feedback**, particularly regarding the integration of AR tools and the usability of the MAC toolkit.

Feedback from CleverBooks-affiliated participants highlighted the platform's engaging design, its strong alignment with classroom materials, and the need for continued attention to **device compatibility and GDPR compliance**—issues that are central to institutional uptake in formal education settings.

7.2 Greece

The piloting activities in Greece were coordinated by **PARAGON-eduTech** (paragon-edutech.eu), a leading research and development

organisation with deep experience in European-funded education projects. Piloting efforts focused on primary school teachers, with strong national outreach achieved through school networks, targeted communication campaigns, and personalised support throughout the process.

A total of **20 participants** from Greece completed the validation survey. All respondents were actively working in primary education, representing a diverse range of school settings and professional roles.

Table 6
Survey Results (Greece)

Survey Item	Greece Avg. Score (1–5)
The MOOC content was well-organized and easy to follow	4.55
The course objectives were clear and met my expectations	4.65
The learning platform (Moodle) was easy to navigate	4.50
I found the pacing of the course appropriate	4.45
The modules helped me better understand climate change	4.90

These high scores reflect **exceptionally strong satisfaction** with the MOOC's structure, clarity, and pedagogical impact. The highest-rated item (4.90/5) indicates that Greek teachers found the course highly effective in enhancing their understanding of climate change and sustainability issues.

Qualitative Feedback

Greek educators provided rich and enthusiastic qualitative responses, highlighting classroom engagement and their intent to implement the content:

🇬🇷 *«Οι μαθητές μου ενθουσιάστηκαν με τα κόμικς και την επαυξημένη πραγματικότητα!»*
"My students were thrilled with the comics and augmented reality!"
— Primary Teacher, Greece

🇬🇷 *«Η πλατφόρμα ήταν εύχρηστη και το περιεχόμενο πολύ επίκαιρο. Επιτέλους κάτι πρακτικό!»*
"The platform was easy to use and the content very timely. Finally, something practical!" — School Director, Greece

🇬🇷 *«Ήταν μια εξαιρετική επιμόρφωση, με σύγχρονο τρόπο και εφαρμογή στην τάξη.»*
"It was an excellent training, modern and directly applicable in the classroom." — Educator, Greece

Contextual Reflections

PARAGON-eduTech successfully engaged a representative sample of Greek primary school educators by leveraging existing relationships with school units and regional education authorities. The national piloting strategy prioritised not only course completion but also meaningful reflection and feedback. As a result, the Greek dataset is particularly strong in both quantitative reliability and qualitative richness.

Teachers expressed appreciation for the **interactive design**, the **high quality of translation and localisation**, and the **classroom relevance** of the modules. Several respondents also praised the **support provided by the Greek team** during registration and completion, which contributed to the high satisfaction and completion rates observed.

7.3 Croatia

In Croatia, the piloting of the MIRACLE MOOC was coordinated by the primary school **Osnovna škola Titus Brezovački** (www.ostitusabrezovackog.hr), an experienced project partner with a strong track record in educational innovation and European cooperation.

A total of **22 Croatian educators** completed the validation survey, all of whom were active teachers or school staff working within primary education. The school leveraged its internal team as well as its extended network to implement the MOOC locally and collect high-quality feedback.

Table 6
Survey Results (Croatia)

Survey Item	Croatia Avg. Score (1–5)
The MOOC content was well-organized and easy to follow	4.91
The course objectives were clear and met my expectations	4.91
The learning platform (Moodle) was easy to navigate	4.68
I found the pacing of the course appropriate	4.86
The modules helped me better understand climate change	4.95

These scores represent the **highest national averages** among all participating countries. They reflect **exceptional satisfaction** with both the course content and the user experience. Croatian teachers particularly praised the course clarity, structure, and pedagogical value.

Qualitative Feedback

Croatian respondents offered enthusiastic reflections, indicating readiness to integrate the materials into their classrooms:

🇭🇷 *"Učionica više nije ista. Djeca su postala aktivniji sudionici."*
"The classroom is no longer the same. Children became more active participants." — Teacher, Croatia

🇭🇷 *"Konačno edukacija koju mogu odmah primijeniti s učenicima."*
"Finally, a training I can apply with students immediately."
— Primary Educator, Croatia

🇭🇷 *"Sadržaj je bio jasan, relevantan i inspirativan. Posebno mi se svidio modul o dezinformacijama."*
"The content was clear, relevant and inspiring. I especially liked the module on disinformation."
— Croatian Teacher

Contextual Reflections

The success of the Croatian piloting can be attributed to the **highly motivated internal team** at Osnovna škola Titus Brezovački, who ensured that participants were properly supported throughout the MOOC. Their ability to engage a full sample of practicing teachers, collect detailed feedback, and support implementation made the Croatian data set both **statistically robust and pedagogically rich**.

Teachers appreciated the balance between **creative expression (through comics and AR)** and **scientific accuracy**, with several participants noting that the training helped them feel more confident addressing environmental topics in an age-appropriate manner.

7.4 Malta

The national piloting activities in Malta were carried out through a collaborative effort involving educators affiliated with both the **University of Malta** and **Maria Regina College SPB Primary**. Participants reflected a balanced mix of pre-service teacher educators, teacher trainees, and practicing primary school teachers.

A total of **49 participants** affiliated with Malta completed the validation survey. These were identified either through their declared country of residence or their institutional affiliation with known Maltese education providers.

Table 7
Survey Results (Malta)

Survey Item	Malta Avg. Score (1–5)
The MOOC content was well-organized and easy to follow	4.13
The course objectives were clear and met my expectations	4.16
The learning platform (Moodle) was easy to navigate	3.71
I found the pacing of the course appropriate	4.13
The modules helped me better understand climate change	4.26

These scores reflect **good overall satisfaction**, with particularly strong appreciation for the climate science content and course organisation. The lower score on platform navigation (3.71) suggests some participants encountered mild usability issues with Moodle or with device compatibility.

Qualitative Feedback

Feedback from Maltese educators showed practical enthusiasm and clear intentions to integrate the materials into classroom and training contexts:

🇲🇹 *"I will definitely include the comics method in my environmental awareness lessons."* — Primary Teacher, Malta

🇲🇹 *"This MOOC provided a concrete, enjoyable method for explaining climate anxiety in a child-friendly way."*
— Teacher Educator, Malta

🇲🇹 *"Some parts of the platform were a bit confusing at first, but the materials were well thought out."*
— Teacher Trainee, Malta

Contextual Reflections

The Maltese piloting showcased the value of engaging both pre-service and in-service educators. The **University of Malta** played a key role in mobilising teacher trainees, while the **Maria Regina College** school partner offered practical classroom feedback. This blend of perspectives contributed to a **well-rounded understanding of both pedagogical value and technical challenges**.

Participants highlighted the **relevance of the content to the national curriculum**, particularly in the areas of science, citizenship, and digital education. The slightly lower scores on platform usability may reflect a need for additional guidance or onboarding, especially for users unfamiliar with Moodle.

The Maltese piloting contributed significantly to the overall success of the project by offering feedback that bridged theoretical training and practical classroom realities.

7.5 Portugal

In Portugal, the piloting of the MIRACLE MOOC was coordinated by the school partner **Agrupamento de Escolas Terras do Ave** (aeterrasave.net), which engaged its local network of primary school educators to test and evaluate the course. Participants represented a range of roles within the school system, including classroom teachers, ICT coordinators, and subject specialists.

A total of **20 participants** from Portugal completed the validation survey, contributing a strong and consistent data set reflecting both satisfaction and implementation potential.

Table 8
Survey Results (Portugal)

Survey Item	Portugal Avg. Score (1–5)
The MOOC content was well-organized and easy to follow	4.85
The course objectives were clear and met my expectations	4.85
The learning platform (Moodle) was easy to navigate	4.90
I found the pacing of the course appropriate	4.85
The modules helped me better understand climate change	4.90

These are among the **highest national scores** across the consortium. The results suggest that Portuguese participants found the course exceptionally well-structured, technically accessible, and relevant to their teaching practice.

Qualitative Feedback

Portuguese educators praised the interactivity of the content, its practical value, and the smooth experience on the platform:

🇵🇹 *"O curso está muito bem estruturado e os recursos são diretamente aplicáveis em sala de aula."*
"The course is very well structured and the resources are directly applicable in the classroom."
— Primary Teacher, Portugal

🇵🇹 *"Fiquei surpreendida com a facilidade de navegação e a clareza dos vídeos."*
"I was surprised by the ease of navigation and the clarity of the videos."
— Teacher, Portugal

🇵🇹 *"Excelente abordagem para falar de mudanças climáticas com crianças. Criatividade e ciência juntas."*
"Excellent approach to talk about climate change with children. Creativity and science combined."
— Educator, Portugal

Contextual Reflections

The success of the Portuguese piloting owes much to the active involvement of **Agrupamento de Escolas Terras do Ave**, which supported participants with onboarding and follow-up during the course. Teachers noted that the MOOC aligned well with existing national curricular goals, particularly in **environmental education and digital literacy**.

The high satisfaction scores—particularly regarding **usability** and **practical application**—highlight the readiness of Portuguese schools to adopt innovative digital resources when accompanied by strong institutional support.

7.6 Spain

In Spain, the piloting phase was coordinated by **JAITEK Tecnología y Formación** (jaitek.net), a key technical and pedagogical partner in the MIRACLE project. JAITEK led the national outreach to educators, primarily targeting teachers with an interest in ICT integration and climate literacy.

A total of **10 participants** from Spain completed the validation survey, providing focused and highly positive feedback across all categories.

Table 9
Survey Results (Spain)

Survey Item	Spain Avg. Score (1–5)
The MOOC content was well-organized and easy to follow	4.60
The course objectives were clear and met my expectations	4.70
The learning platform (Moodle) was easy to navigate	4.80
I found the pacing of the course appropriate	4.75
The modules helped me better understand climate change	4.80

These are among the most **consistently high scores** across the consortium, indicating that Spanish participants experienced the MOOC as well-structured, clearly articulated, and highly accessible.

Qualitative Feedback

Spanish teachers highlighted the clarity of the modules, the engaging nature of the AR-enhanced comics, and the relevance to their classrooms:

🇪🇸 *"Todo estaba bien organizado. Nunca me sentí perdida."*
"Everything was well organized. I never felt lost."
— Primary Teacher, Spain

🇪🇸 *"El módulo sobre la desinformación es justo lo que necesitábamos."*
"The module on misinformation is exactly what we needed."
— Spanish Educator

🇪🇸 *"Pude aplicar las ideas inmediatamente en mi aula de ciencias."*
"I was able to apply the ideas immediately in my science class."
— Teacher, Spain

Contextual Reflections

JAITEK's dual role as technical provider and pedagogical contributor enabled a smooth rollout of the piloting activities. Participants benefited from **clear instructions, timely support, and high-quality content delivery**. The high ratings for platform usability (4.80) and content clarity (4.70) reflect this coordinated effort.

Respondents noted that the **balance between creativity and science** made the MOOC both educational and engaging. The positive feedback further confirmed the value of digital innovation in Spanish classrooms, particularly when supported by structured training and localized support.

8. Conclusions

The validation of the MIRACLE MOOC under Work Package 3 confirmed that the course met and exceeded its intended objectives: delivering a high-quality, accessible, and pedagogically meaningful training experience for European educators aiming to teach climate change and sustainability through innovative methods.

A total of **151 educators** across **five piloting regions** (Greece, Croatia, Ireland/Malta, Portugal, and Spain) participated in the validation phase. They represented a broad spectrum of educational profiles—ranging from classroom teachers and ICT coordinators to headteachers and teacher educators—ensuring a rich and diverse evidence base. The average responses across all countries were **consistently high**, with many items scoring between **4.4 and 4.9 out of 5**, especially in areas such as improved climate literacy, confidence in addressing disinformation, and engagement with augmented comics as a teaching method.

The findings strongly validate the following:

- The **MOOC's content and structure** were clear, well-paced, and relevant to the daily practice of educators.
- The **digital platform** was generally accessible and functional, with only minor usability issues reported.
- The training **empowered teachers** with tools to tackle eco-anxiety, promote sustainability, and introduce media literacy in engaging, age-appropriate ways.
- The course was **successfully localised** and piloted in five languages, proving its transnational adaptability.

While minor challenges were identified (e.g. limited AR access in some rural schools or initial difficulties navigating Moodle), these did not hinder learning. On the contrary, participants demonstrated strong motivation to apply the methods in their own classrooms and expressed a desire for deeper engagement with the approach.

Importantly, the piloting process also revealed **contextual nuances**—for example, teacher trainees in Malta, university-based educators in Ireland, and school staff in rural Croatia—all contributed perspectives that underscore the **scalability and flexibility** of the MIRACLE MOOC.

In conclusion, the validation results confirm that the MOOC is **ready for final deployment and wide-scale use** as an open educational resource. It offers a timely, innovative, and impactful response to current educational challenges, aligning with both EU and national priorities in climate education, digital transformation, and inclusive teaching.

9. Recommendations

Based on the analysis of participant feedback, learning analytics, and country-level reflections, the following recommendations are proposed to strengthen the quality, usability, and long-term impact of the MIRACLE MOOC and its associated educational tools:

9.1 Improving Content, Structure, and Usability

- **Enhance user onboarding and navigation support**: Some participants—particularly those with limited digital experience—reported initial difficulties using the Moodle platform. A short introductory video or interactive walkthrough could improve early engagement and reduce cognitive load.
- **Provide optional pacing guidance**: While the self-paced format was appreciated, several educators suggested a suggested weekly timeline or "pathway view" to help plan their progress and better integrate MOOC content into school schedules.
- **Refine technical integration for AR tools**: Ensure clear, step-by-step instructions for using the MAC Toolkit and AR apps across different devices. Provide troubleshooting tips and low-tech alternatives where possible.
- **Expand classroom-ready resources**: Include downloadable lesson plans, editable templates, and student worksheets aligned with the MOOC modules to support immediate implementation.

9.2 Supporting Teachers and Trainers in Implementation

- **Offer a "train-the-trainer" version of the MOOC**: To facilitate local adaptation and peer-to-peer learning, a trainer guide or facilitator toolkit would support institutions and education authorities in scaling the course independently.
- **Encourage national/local discussion groups**: Teachers benefit from shared reflection. Embedding optional local discussion forums or virtual teacher lounges could enhance the MOOC's community dimension and long-term engagement.
- **Link with national curriculum frameworks**: Provide partners with brief, adaptable templates to map MOOC content onto national or regional curricular priorities, making it easier for teachers to justify its use in formal settings.

9.3 Enhancing Impact and Inclusiveness

- **Ensure accessibility across devices and connectivity levels**: Maintain mobile-friendly formatting, low-bandwidth access, and alternatives to AR features for schools with limited infrastructure.
- **Translate and adapt the MOOC for additional languages**: While the MOOC was piloted in five languages, further translations—including into minority or regional languages—can help ensure equitable access.
- **Promote uptake through institutional partnerships**: Work with ministries, teacher training institutes, and school networks to include the MIRACLE MOOC in CPD catalogues and national education portals.
- **Extend MOOC certification options**: Where feasible, explore recognition pathways such as micro-credentials or national CPD credits to boost teacher motivation and institutional support.

Annex I: Survey Monkey - Survey

Demographic Information

(*Mandatory*)

1. **Name**: _____

2. **Surname**: _____

3. **Email address**: _____

4. **Country**:

Greece
Croatia
Ireland
Malta
Spain
Portugal
Other country => Specify

5. **School/Organization name**: _____

6. **Type of school**:

○ Primary

○ Secondary

○ Other: _____

7. Gender:

- Female
- Male
- Non-binary / Third gender
- Prefer not to say

8. Role in the school/organization:

- Teacher
- Headteacher/Principal
- ICT Coordinator
- Support Staff (e.g., SEN specialist)
- Administrator
- Other (please specify): _____

9. Years of teaching experience:

○ 0–5 years

○ 6–10 years

○ 11–20 years

○ More than 20 years

10. Have you used Augmented Reality (AR) tools before?

○ Yes

○ No

11. Did you participate in the full MOOC?

○ Yes

○ Partially

○ No

12. Did you test the MIRACLE Augmented Classroom (MAC) activities?

○ Yes

○ Not yet

○ No

Section A: General Feedback

(Likert Scale: 1 = Strongly disagree to 5 = Strongly agree)

1. The MOOC content was well-organized and easy to follow.
2. The course objectives were clear and met my expectations.
3. The learning platform (Moodle) was easy to navigate.
4. I found the pacing of the course appropriate.

Section B: Content Relevance and Pedagogical Value

(Likert Scale: 1 = Strongly disagree to 5 = Strongly agree)

5. The modules helped me better understand climate change.
6. I found the integration of comics and digital tools engaging for classroom use.
7. The training increased my confidence in teaching about sustainability.
8. I can now better identify and address climate misinformation in the classroom.

Section C: Usability and Accessibility

(Likert Scale: 1 = Strongly disagree to 5 = Strongly agree, plus some Yes/No questions)

9. The videos and documents were accessible on all my devices.
10. I was able to complete activities without technical difficulties.
11. (Yes/No) I experienced technical problems.
    If Yes, please describe: _____
12. (Yes/No) The MOOC met accessibility standards for inclusive learners.
    If No, please suggest improvements: _____

Section D: Impact and Implementation
(Mixed: Multiple Choice + Open-ended)

13. Have you implemented (or do you plan to implement) elements of the MOOC in your school?
- Yes
- Not yet, but I plan to
- No (please explain why): _____

14. Would you recommend this MOOC to other teachers?
- Yes
- Maybe (please explain): _____
- No (please explain): _____

15. What was the most valuable module or activity for you? *(Open-ended)*
16. What improvements would you suggest? *(Open-ended)*
17. Please describe any noticeable impact on your teaching or classroom. *(Open-ended)*

Annex II: Sample Quotes by Country

The quotes presented here were selected from the national validation survey responses based on their relevance, clarity, and ability to provide meaningful insight into the user experience. One-word responses or non-substantive comments were excluded. Original language versions are followed by English translations, where applicable.

Greece

«Πολύ ενδιαφέρον πρόγραμμα που συνδυάζει τη δημιουργικότητα με το περιβαλλοντικό περιεχόμενο. Τα κόμικς ενθουσίασαν τα παιδιά.»
"A very interesting programme that combines creativity with environmental content. The comics thrilled the children."

«Μου άρεσε ιδιαίτερα η δυνατότητα να δημιουργήσουμε δικά μας σενάρια. Το εργαλείο ήταν εύκολο και πρακτικό.»
"I especially liked the possibility to create our own scenarios. The tool was easy and practical."

Croatia

"Pohvaljujem primjenu proširene stvarnosti u edukaciji. Učenici su pokazali veliki interes i bolje su razumjeli temu."
"I praise the use of augmented reality in education. The students showed great interest and understood the topic better."

"Ovo je prvi put da se osjećam spremno govoriti o klimatskim promjenama u učionici."
"This is the first time I feel ready to talk about climate change in the classroom."

Ireland / Malta

"This course was well thought out, timely, and inspiring. I've already shared it with my colleagues."

"The visual format was perfect for young learners. I especially liked the connection between real science and storytelling."

"As a trainee teacher, this helped me see how digital tools can engage even the quietest students."

🇵🇹 Portugal

"O curso despertou o meu interesse pela literacia climática. Pretendo usar os recursos já neste período."
"The course sparked my interest in climate literacy. I intend to use the resources this term."

"Os alunos ficaram motivados com a possibilidade de criar histórias visuais. É uma abordagem nova para nós."
"The students were motivated by the possibility of creating visual stories. It's a new approach for us."

🇪🇸 Spain

"Nunca había participado en un curso con tanto enfoque práctico. Me encantó la sección sobre desinformación."
"I had never taken a course with such a practical focus. I loved the section on disinformation."

"Fue una experiencia motivadora que me dio herramientas concretas para trabajar el cambio climático."
"It was a motivating experience that gave me concrete tools to work on climate change."

This annex offers a qualitative complement to the survey data presented in Section 6 and Section 7, reinforcing the MOOC's practical impact, emotional resonance, and classroom applicability across multiple European educational contexts.

Annex III – Full Likert-Scale Results by Country

Survey Item	Spain	Greece	Croatia	Ireland/Malta	Portugal
I can now better identify and address climate misinformation in the classroom.		4.75	4.86	4.21	4.8
I found the integration of comics and digital tools engaging for classroom use.		4.85	4.86	4.24	4.8
I found the pacing of the course appropriate.	4.75	4.45	4.86	4.13	4.85
I was able to complete activities without technical difficulties.		4.65	4.64	4.11	4.9
The MOOC content was well-organized and easy to follow.	4.6	4.55	4.91	4.13	4.85
The course objectives were clear and met my expectations.	4.7	4.65	4.91	4.16	4.85

The learning platform (Moodle) was easy to navigate.	4.8	4.5	4.68	3.71	4.9
The modules helped me better understand climate change.	4.8	4.9	4.95	4.26	4.9
The training increased my confidence in teaching about sustainability.		4.8	4.91	4.18	4.75
The videos and documents were accessible on all my devices.		4.85	4.82	4.37	4.95

Annex IV: MOOC Platform Screenshots

Screenshot 1: MOOC Landing Page

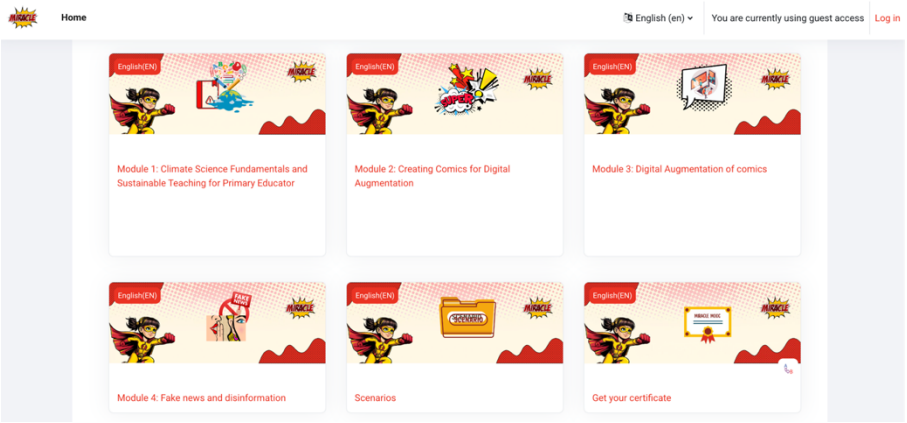


Figure 1 – MIRACLE MOOC landing page on the Moodle platform, showing course title, visual identity, and introductory navigation. This screen illustrates the clear structure and accessible design used throughout the course.

Screenshot 2: Inside a Module (Module 4 – Fake News and Disinformation)

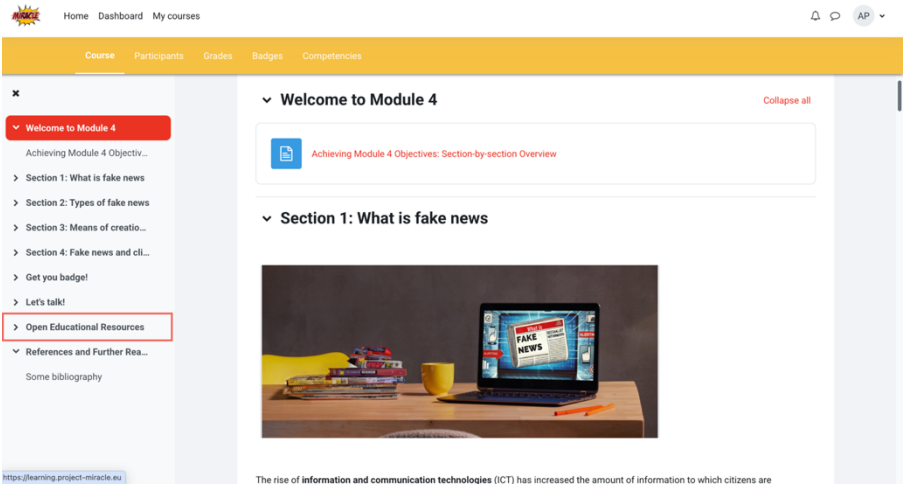


Figure 2 – Learning environment within Module 4, titled "Fake News and Disinformation." The screenshot displays the typical structure of a MOOC lesson: video instruction, core content, and digital learning tasks—all presented within a clear and user-friendly interface.

📷 Screenshot 4: Certificate Completion Page

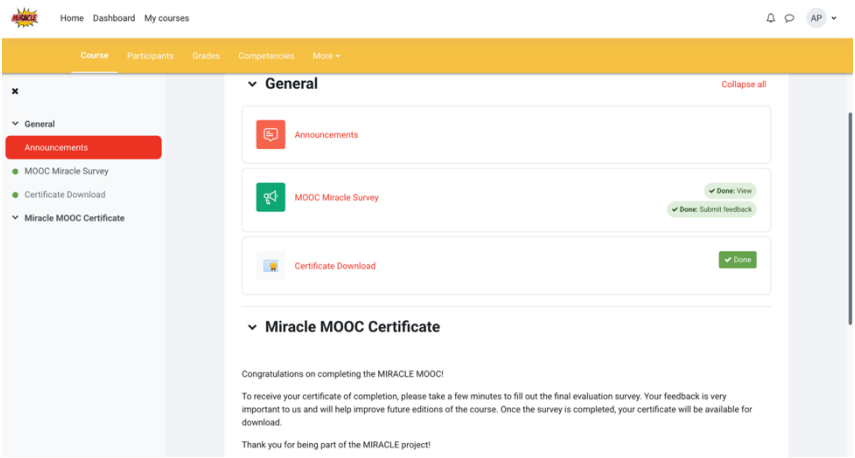
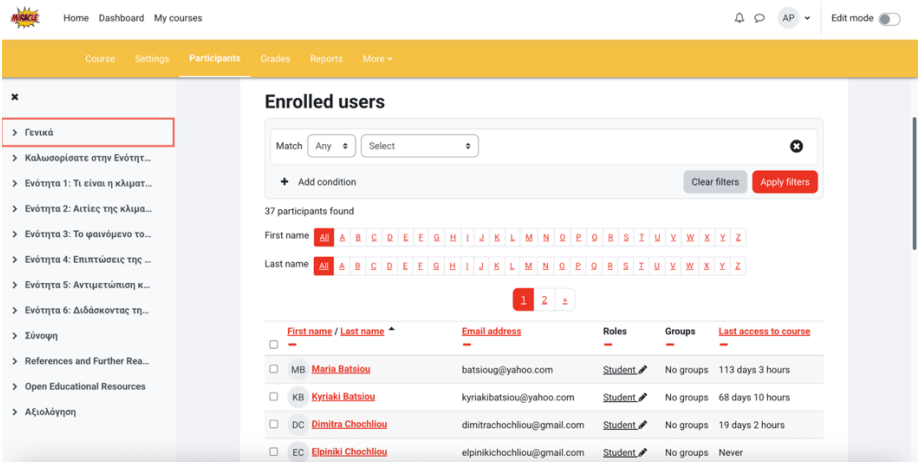


Figure 4 – "Get your Certificate" module page, enabling participants to track course progress and download their completion certificate. This feature supported learner motivation and recognition.

📷 Screenshot 5: Enrolled Users in the Greek-Language Course

Figure 5 – Screenshot from the Greek version of the MIRACLE MOOC, showing the course navigation menu and the list of enrolled users. A total of 37 Greek educators enrolled in the platform—significantly exceeding the initial benchmark of 20 users—demonstrating strong national engagement during the piloting phase.


Home Dashboard My courses
AP
Edit mode
Course Settings Participants Grades Reports More
Γενικά
Καλωσορίσατε στην Ενότητ...
Ενότητα 1: Τι είναι η κλιματ...
Ενότητα 2: Αιτίες της κλιμα...
Ενότητα 3: Το φαινόμενο το...
Ενότητα 4: Επιπτώσεις της ...
Ενότητα 5: Αντιμετώπιση κ...
Ενότητα 6: Διδάσκοντας τη...
Σύνοψη
References and Further Rea...
Open Educational Resources
Αξιολόγηση
Enrolled users
Match Any Select
Add condition
Clear filters
Apply filters
37 participants found
First name All A B C D E F G H I J K L M N O P Q R S T U V W X Y Z
Last name All A B C D E F G H I J K L M N O P Q R S T U V W X Y Z
1 2 »
First name / Last name
Email address
Roles
Groups
Last access to course
MB Maria Batsiou batsioug@yahoo.com Student No groups 113 days 3 hours
KB Kyriaki Batsiou kyriakibatsiou@yahoo.com Student No groups 68 days 10 hours
DC Dimitra Chochliou dimitrachochliou@gmail.com Student No groups 19 days 2 hours
EC Elpiniki Chochliou elpinikichochliou@gmail.com Student No groups Never

Screenshot 7: Sample Certificate of Completion

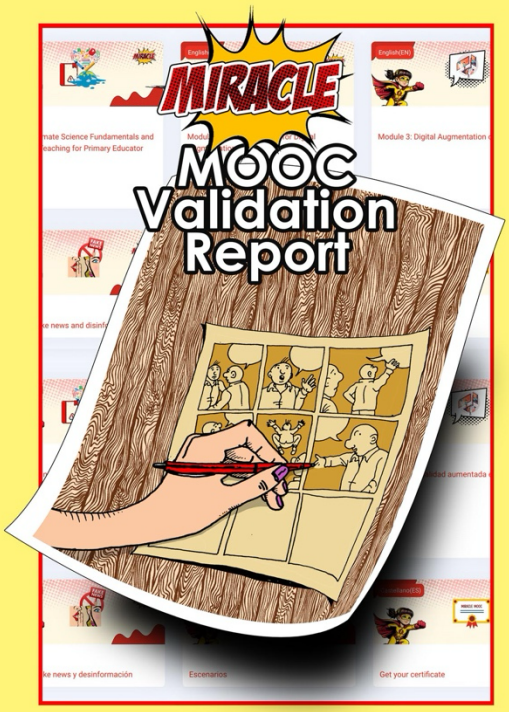
Figure 7 – Example of the MIRACLE MOOC Certificate of Completion awarded to participants who successfully completed all course modules. The certificate recognises professional development in climate education, digital storytelling, and media literacy.

Acknowledgements

The consortium would like to express its sincere gratitude to all the **pilot schools and educators** who participated in the MIRACLE MOOC validation phase. Their feedback, engagement, and classroom insights were instrumental in shaping and affirming the value of the course.

Special thanks are extended to the **national coordinators** in each partner country, whose efforts in recruitment, support, and monitoring ensured the success of the piloting process.

We also acknowledge the exceptional **technical support provided by JAITEK**, including the hosting and maintenance of the Moodle platform, which enabled smooth access to the course materials across five languages and multiple national contexts.



This report presents the findings of the validation phase for the MIRACLE MOOC ("coMics and IllustRations Augmented to tackle CLimate change in primary Education"), implemented under Work Package 3. The MOOC was developed to equip primary educators with innovative tools—including comics, augmented reality, and media literacy approaches—to address climate change, eco-anxiety, and misinformation in age-appropriate and creative ways.

The validation process involved a total of 151 educators across five countries: Greece, Croatia, Ireland/Malta, Portugal, and Spain. The MOOC was piloted in five languages, and participants included classroom teachers, headteachers, ICT coordinators, support staff, and teacher educators. The evaluation combined Moodle analytics, quantitative Likert-scale data, and qualitative survey feedback to assess usability, pedagogical value, and implementation potential.