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Project: 23043 – SkiComCu-LL

Lifelong Learning Course for skills & competences in the Copper sector

Project number:	23043
Project short title:	SkiComCu-LL
Project starting date:	2023-09-01
Project ending date:	2026-08-31
Project duration:	36 months

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Internal Identifier:	EITRM122080
Description:	<p>The task leaders will develop a report outlining the results of the pilot-testing of all project outcomes. This report will include the testing & validation methodology comprising a) the development of SMART indicators to measure development effectiveness, outcomes in terms of access, usage and stakeholders' satisfaction, b) the mobilisation & design of the means used to collect quantitative and qualitative inputs and results, c) the specific focus on competence profiles of pilot testing in each training centre (e.g. 100 trainees by centre) and d) the methods for the analysis and interpretation of assessment results. Finally, this report will conclude in specific suggestions for the improvement of the project outcomes. In addition, the pilot testing reports will feed the lessons-learned report (D1.5) with information about the course evaluation.</p>
Included in BP year:	2025

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Executive Summary

Deliverable 5.2 presents the process of verification and validation of training materials enhanced with XR tools, developed within the SkiComCu-LL educational project. These tools directly respond to the identified needs of European copper industry representatives regarding the competencies required for future sector employees, as well as the diagnosed gaps in both soft and technical, professional skills. These areas were investigated during the early stages of the project within WP2 activities. In following steps, educational materials were developed in selected areas chosen by the consortium partners to address part of the identified needs.

The Report describes the structured and methodologically designed process of validation and testing of the project outputs, as well as the feedback received from trained participants. The collected data were analysed and presented in detail in Section 3. The analysis showed overall satisfaction and a positive reception of the prepared outputs. Moreover, additional areas of improvements and further verification for potential changes were identified and described. Based on survey results, some opportunities for further development of the tools in terms of future enhancements and added engagement beyond the scope of the project were also identified.

This document concludes the pilot-testing activities carried out within the SkiComCu-LL project. It highlights the strengths of the verified project outcomes as well as potential areas for improvement. In the next steps, the training materials and other tools will be made available to a broader audience of users and stakeholders beyond the consortium partners.

Objectives, and EIT Impact Framework and KIC Impact

Objectives

Objective	Description	Status
Objective of this report is to present the testing & validation methodology comprising a) the development of SMART indicators	This report is to present the testing and validation methodology used in the project. Specifically, it focuses on the development of SMART indicators, which are designed to measure the effectiveness of the project outcomes in terms of access, usage, and stakeholder satisfaction. This objective emphasizes creating a structured, measurable approach to evaluate the project, ensuring that the results of pilot testing can be reliably assessed and used to inform improvements.	Achieved
To provide specific, evidence-based recommendations for the improvement and enhancement of project outcomes based on pilot-testing results, improving project outcomes and to feed key findings into the lessons-learned report (D1.5).	Report provides specific, evidence-based recommendations aimed at improving and enhancing the project outcomes. By analysing the data and feedback collected during pilot testing, the report seeks to identify strengths, weaknesses, and areas for refinement, ensuring that the project delivers more effective, relevant, and high-quality results.	Achieved

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EIT Impact Framework and KIC Impact

The SkiComCu-LL educational materials and XR tools support the main objectives outlined in the EIT RawMaterials Strategic Agenda 2021–2027 and contribute to the achievement of the planned KPIs. In particular, they directly address the identified needs of the sector, including:

- Ensuring a stable raw materials workforce by creating, maintaining, and re-skilling jobs within the sector, including the transition to new technologies.
- Improving gender balance in the raw materials sector by supporting women graduating from RM-related courses.
- Enhancing innovation capacity and talent development – The project strengthens the skills and competences of participants, equipping them with practical, technical, and digital capabilities necessary for the evolving raw materials sector.
- Creating more and better jobs – products of the project generates opportunities for current and future employees of the copper sector across Europe, measured by the number of participants completing online training programs.
- Fostering digital transformation and sustainability – By integrating XR/VR tools and digital learning platforms, the project promotes the adoption of advanced technologies and sustainable practices within training programs to the copper industry.
- Increased digital upskilling of European professionals – The project's outcomes facilitate access to modern technologies and innovative training approaches, enhancing the digital competences of professionals across Europe in the context of education and workforce development.
- Reducing skills mismatches and improving industry-academia cooperation – The curriculum and training tools are designed in close alignment with industry needs, bridging gaps between theoretical knowledge and practical applications while reinforcing collaboration between academic institutions and industry partners.

The educational materials and IT tools (XR/VR) developed and validated within the SkiComCu-LL project support specific KPIs established by EIT, including:

- EITHE08.1 – Participants in non-labelled education activities
- EITHE02.4 – Innovations launched on the market
- KICN01–11 – Improving gender balance in education and training

1. Introduction

Within the activities carried out under the SkiComCu-LL project, educational materials and training tools were developed as part of Work Packages WP3 and WP4. These outputs directly address the previously identified needs of skills and competences in copper sector in Europe.

In the early stages of the project, a competency needs and gaps assessment was conducted among selected employees from the following companies: Aurubis Bulgaria, Elval Halcor Greece, and KGHM Poland. Initially, survey research was carried out among selected employee groups in specific positions to identify the areas and scope of competencies required for their roles. The surveys targeted employees themselves, their supervisors, colleagues, and HR departments. The results of these surveys were subsequently verified, confirmed, and further detailed through focus group studies conducted with consortium partners. These findings were presented in deliverables D2.1 and D2.2.

In response to these findings, within WP3 and WP4, educational and training materials as well as IT tools supporting the learning process were developed. These materials were created based on the latest academic expert knowledge, complemented with real-life examples. Furthermore, state-of-the-art IT tools were developed to support the learning process, including CuExplorer and the Peirce-Smith Converter (described in detail in D4.2 SkiComCu XR Tools). In the next phase, a Health and Safety Procedures in Mining VR tool is being developed, which will be subjected to validation and verification in accordance with the established project assumptions. This report summarizes another stage of the long-term, ongoing collaborative work carried out by experts, specialists, and practitioners of SkiComCu-LL project who combined their knowledge, skills and experience to develop a coherent and comprehensive product: training materials and XR tools. All stages, underlying assumptions, collected feedback, as well as the summary, analysis, and recommendations are presented in this report.

2. Validation process-methodology

2.1. Objectives

The main objective of the testing and validation process for the training tools and educational materials developed within the SkiComCu-LL project is to ensure that all outputs meet the highest standards of quality and effectiveness. This process is divided into several stages, with all project partners and external experts involved at each step, ensuring the accuracy and reliability of the process through their expertise and experience. Within the individual stages, the focus was placed on several key aspects, including: Verify content accuracy (compliance with up-to-date knowledge, regulations, and standards).

- Assess usability and quality (clarity, ease of use, attractiveness).
- Ensure educational effectiveness (materials support the learning process).
- Validate technical and functional performance (IT systems and courses run smoothly without errors).

2.2. Validation Process Stages

The entire process of testing and validating the SkiComCu-LL materials was carried out in a structured and systematic manner to ensure the achievement of the intended objectives. The process was divided into several stages, each designed to properly execute the validation and to obtain the best possible results. At each stage, both consortium partners – including representatives from universities, research institutions, and industry participants involved in SkiComCu-LL – as well as external experts were actively engaged. This approach ensured that the project outcomes were assessed from both a substantive and expert perspective, as well as evaluated for their practical usability and potential application within copper sector companies.

1. Planning

The Planning phase is the foundational stage of the validation process, ensuring that the evaluation is well-structured, purposeful, and aligned with the SkiComCu-LL goals. It begins with defining the validation objectives and quality criteria, which clarify what aspects of the project outputs—such as training materials, courses, or tools—will be assessed. These objectives set measurable targets and establish the standards for success, ensuring that the evaluation is focused, consistent, and aligned with the intended outcomes of the project.

The next step involves selecting the target group, which includes a combination of experts, trainers, and members of the consortium partners (experts, employees but also students and lecturer). Experts bring professional knowledge and ensure compliance with standards, trainers provide practical insights from the teaching perspective, and the pilot group represents the end users, providing feedback on usability, clarity, and learning effectiveness. Moreover, the validation process can also involve external experts from the copper sector. These specialists provide sector-specific knowledge and practical insights, ensuring that the project outputs are aligned with industry standards and real-world professional requirements. All of this ensures that the results are comprehensive and reliable.

Finally, the planning phase includes preparing the evaluation tools. This involves designing checklists, surveys, and test protocols tailored to the project's outputs and objectives. These supports the collection process, ensure consistency across focus groups and allow for both qualitative and quantitative feedback. Well-prepared evaluation instruments are essential for capturing actionable insights, identifying strengths and weaknesses, and ultimately informing improvements in the project's materials, tools, and processes.

2. Initial Testing

The training and educational materials, as well as the XR tools, were developed as part of the activities carried out under WP3 and WP4. At every stage of their creation, project partners were actively involved, ensuring continuous collaboration and oversight. This approach allowed for preliminary validation of the outputs and enabled the project team to receive appropriate feedback, minimizing delays and facilitating early improvements.

The initial testing phase was carried out primarily by the project's development team- consortium partners of WP3 and WP4 and internal experts. These activities aimed to validate the tools in two main areas: first, the content accuracy of the educational materials, and second, their technical usability of IT tools.

Internal experts (who were previously assigned to this step) were focused on evaluating the content and educational aspects of the outputs, such as clarity, logical structure, and alignment with project objectives. Moreover, the training materials, including the Train the Trainers modules, were carefully verified to ensure they deliver up-to-date knowledge and comply with university-level requirements for lifelong learning. The content was checked in terms of complying with relevant regulations and best practices. This step ensures that the materials are reliable, functional, and ready for subsequent testing with external users or next pilot groups.

During this stage, all IT tools and Learning Platform were carefully assessed against predefined technical specifications and content requirements. Technical verification includes checking system performance, compatibility across devices, user interface functionality, and error-free operation.

The verification of the tools in both of these areas allows for comprehensive testing and provides appropriate feedback on any potential errors, thereby enabling their correction and elimination.

3. Pilot Testing / End-User Testing

During this phase, the tools and educational materials are released to a broader group of end users, including participants from the pilot group, trainers, and selected external experts- external users. This controlled release allows the project team to observe real-world usage and assess how effectively the materials support learning and engagement.

The next step was to collect feedback from these users through satisfaction surveys, face-to-face interviews, and other evaluation tools. Feedback focuses on usability, clarity, technical functionality, and overall satisfaction with the materials and platforms (the Satisfaction Survey is presented in next section.)

Both the initial testing, which involved a small group of specialists from the SkiComCu-LL project team, and the pilot testing conducted with a broader group of end users, mainly from consortium partners, aim to refine and optimize the training tools and materials. The goal of these phases is to prepare the outputs for the next stage of wider testing, involving a selected group of participants outside the consortium. This approach ensures that the tools and materials are thoroughly validated and ready for potential commercial application.

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4. Results Analysis & Validation

In this stage, all data collected during the testing phases—both initial testing by developers and internal experts, and pilot testing with end users—is systematically analysed and validated. Quantitative data, such as survey results, test scores, and platform usage metrics, is being processed statistically to identify trends, patterns, and deviations from expected outcomes. Qualitative feedback, including comments from platform users is examined for recurring potential areas of concern.

One of the key tools used in this stage is the set of SMART indicators (Specific, Measurable, Achievable, Relevant, Time-bound), which are applied to evaluate the effectiveness of the training materials, XR tools, and learning outcomes. These indicators help to measure not only whether the outputs meet the intended educational and technical objectives but also whether they are practical, usable, and aligned with stakeholder expectations.

5. Implementation of Corrections

Although this point was marked as a separate element, the process of implementing changes and improvements during the validation of the training tools was carried out systematically. Every identified error, as well as any content or functionality elements requiring clarification, was immediately addressed to the developers. This approach allowed for the instant improvement, updating, and re-validation of the tools by the focus group. All comments provided in questionnaires or any other way were reviewed by internal experts to assess their relevance and accuracy. At both stages: one and this stage, feedback regarding content accuracy as well as the usability and user-friendliness of the applications was taken into account. This ensured that the training tools were not only technically functional but also effective and accessible for end users.

This process of testing and implementing corrections will be repeated and continued until the final months of the project, due to the need for continuous verification of the tools before their release to a broader group of final users. Once the developers and internal users determine that the tools meet all expectations and achieve a high standard of quality, the process will be concluded, and the commercialization of the results will begin.

6. Final Approval and Sign-off

As indicated above, once the expected results are achieved, the training materials and XR tools will be approved for use by external users. The process of commercialization and potential sale to interested parties will also begin (the entire process is described in the Go-To-Market Strategy report).

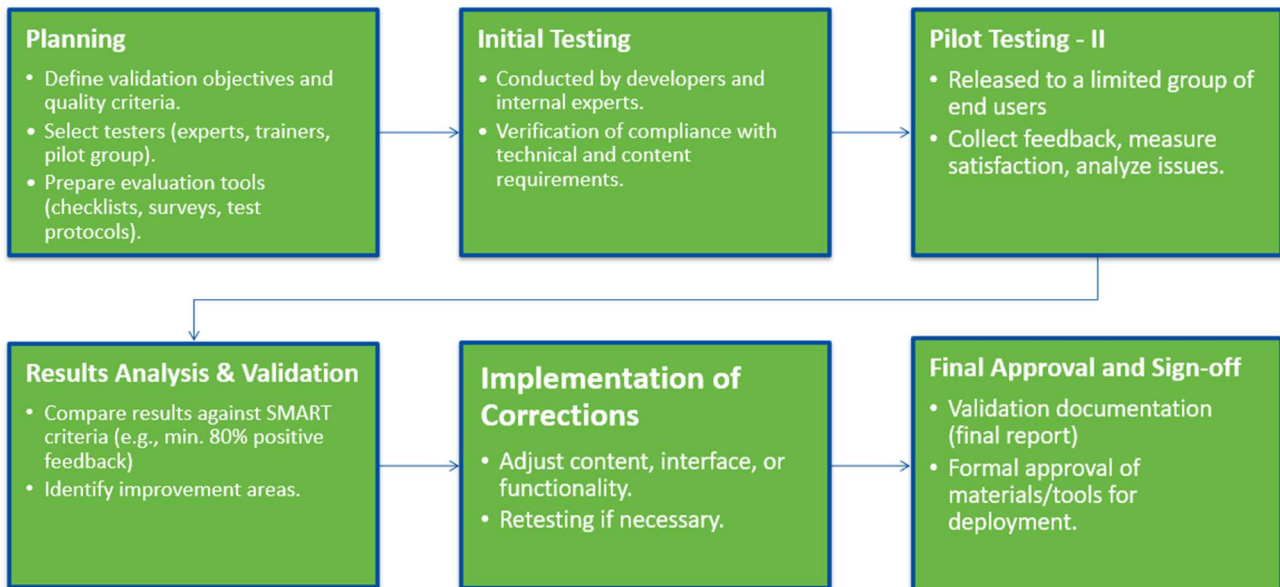
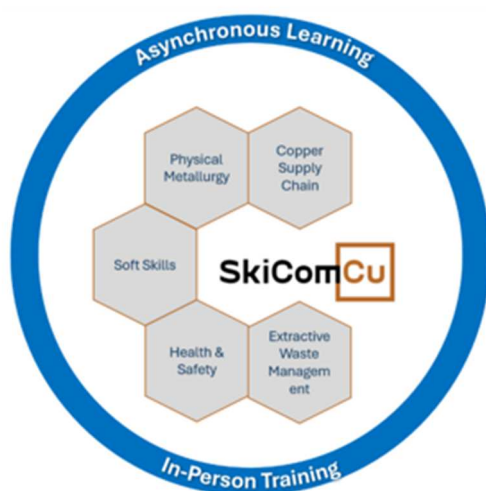


Figure 1. Validation process.

2.2 Validation areas

Two main areas of the project results were subjected to validation and verification. The first area was developed under Work Package WP3 by NTUA: Design and Development of Educational & Training Curriculum and Tools. Within this task, E-learning Courses were prepared in the following areas:

Fig. 2. SkiComCu Learning modules.

- Module 1: Supply Chain of Cu

This module offers an overview of the copper supply chain, covering primary and secondary resources, mineral beneficiation, metallurgical processing, by-products, market dynamics, and environmental considerations. It is designed for a wide range of learners—including engineers, geoscientists, managers, and policymakers—and aims to foster effective cross-disciplinary communication while supporting informed decision-making for the sustainable production and use of copper.

- Module 2: Extractive Waste Management

Extractive waste management is a critical aspect of sustainable resource extraction, focusing on the

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responsible handling and disposal of waste generated during mining and mineral processing activities. As demand for natural resources increases, effective management of extractive waste becomes essential to minimize environmental impact, protect public health, and ensure compliance with EU regulatory standards. This introductory module covers the core principles of waste characterization, classification, and rehabilitation, with emphasis on the copper industry. By understanding the complexities of extractive waste, participants gain insight into innovative solutions that balance economic growth with environmental stewardship.

- Module 3: Physical Metallurgy of Cu

Aimed at professionals across the copper value chain, this module deepens understanding of metallurgical principles and their application in process optimization and sustainable manufacturing. It connects fundamental science with practical performance analysis, supporting transition toward Industry 4.0 practices.

- Module 4: Health & Safety

This module introduces participants to the fundamental principles and practices of health and safety management in industrial environments, with emphasis on mining and metallurgical operations.

- Module 5: Soft Skills

This cross-cutting introductory module builds interpersonal and managerial skills essential for effective communication, leadership, teamwork, and inclusion in technical workplaces. It complements technical competence with professional behaviour aligned with lifelong-learning and diversity objectives.

In addition, train the trainers materials were developed covering topics such as Health and Safety and Physical Metallurgy. These scripts were uploaded to the educational platform as an online courses and made available to selected users upon login.

At this stage, the materials underwent review by internal subject-matter experts. Feedback was collected through surveys and focus group discussions to identify areas for improvement and to ensure the materials meet the intended learning objectives. The main validation criteria applied during this process included:

- Accuracy – correctness and reliability of the content.
- Clarity – ease of understanding and logical structure.
- Language – use of appropriate terminology, accessible to the target audience.
- Engaging Format – interactivity, visual appeal, and learner engagement.
- Compliance with Standards – alignment with academic, professional, and lifelong learning requirements.

The following images illustrate the interface of the application available to registered learners.



Figure 3. Module Physical Metallurgy on educational platform- screenshot

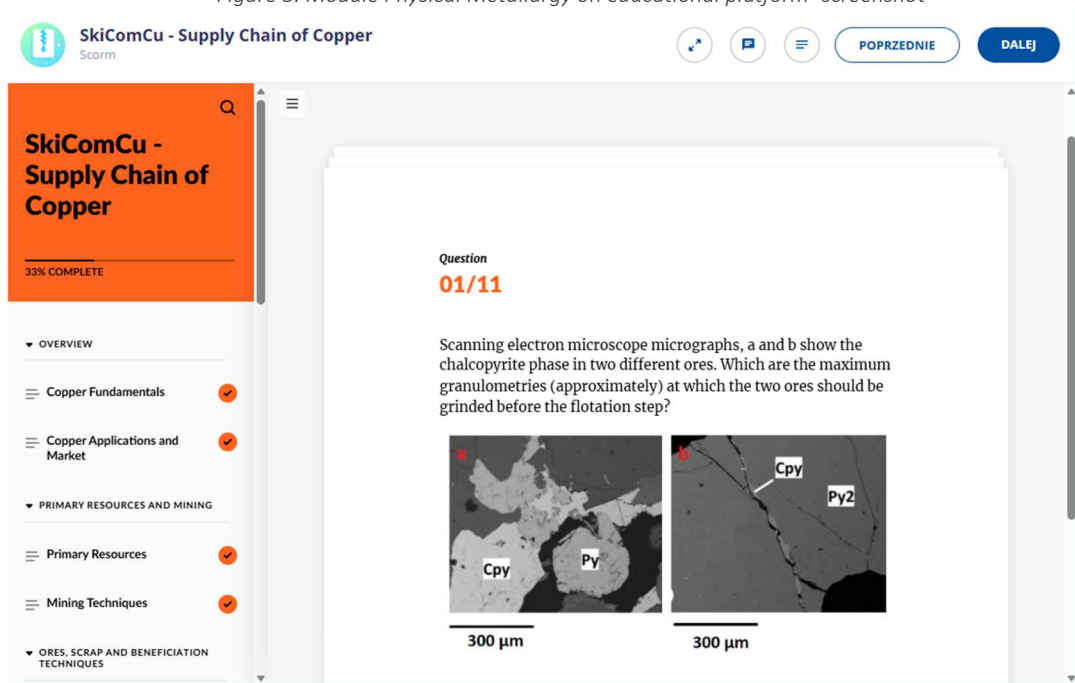


Figure 4. Module Supply Chain of Copper on educational platform- screenshot

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In addition, comprehensive training materials have been developed for trainers under a *train-the-trainers* framework. These materials target key areas previously identified as critical for industrial partners, including Copper Supply Chain and Soft Skills, Soft Skills, and Health & Safety and Soft Skills.

The training package offers a complete set of instructional resources designed to support trainers in delivering high-quality, impactful sessions. It includes ready-to-use presentations, detailed guidelines on best practices, real-life case studies, and practical examples that bring theoretical concepts to life.

In addition, the package features quizzes, tests, and interactive exercises that actively engage participants, encourage discussion, and reinforce learning. By combining theory with hands-on activities, these resources ensure that knowledge transfer is not only effective but also engaging, practical, and directly applicable to real-world industrial contexts.

The second area subjected to validation was developed by UPM in WP4: XR/VR tools. Within the project, the two following training tools have been presented. The last one: H&S is still under development:

- CuExplorer – an interactive tool designed to present Cu as a chemical element.

Provides an interactive visualization of crystal structures and material defects relevant to the Physical Metallurgy module. It is offered in two formats: an augmented reality version, which allows learners to project and explore three-dimensional crystal models in physical space using a mobile device, and a SCORM-compatible WebGL version, which delivers similar interactive experiences directly within the learning platform. CuExplorer enhances the understanding of fundamental metallurgical concepts by helping learners visualize structural features that are often difficult to grasp through static diagrams or text-based materials.

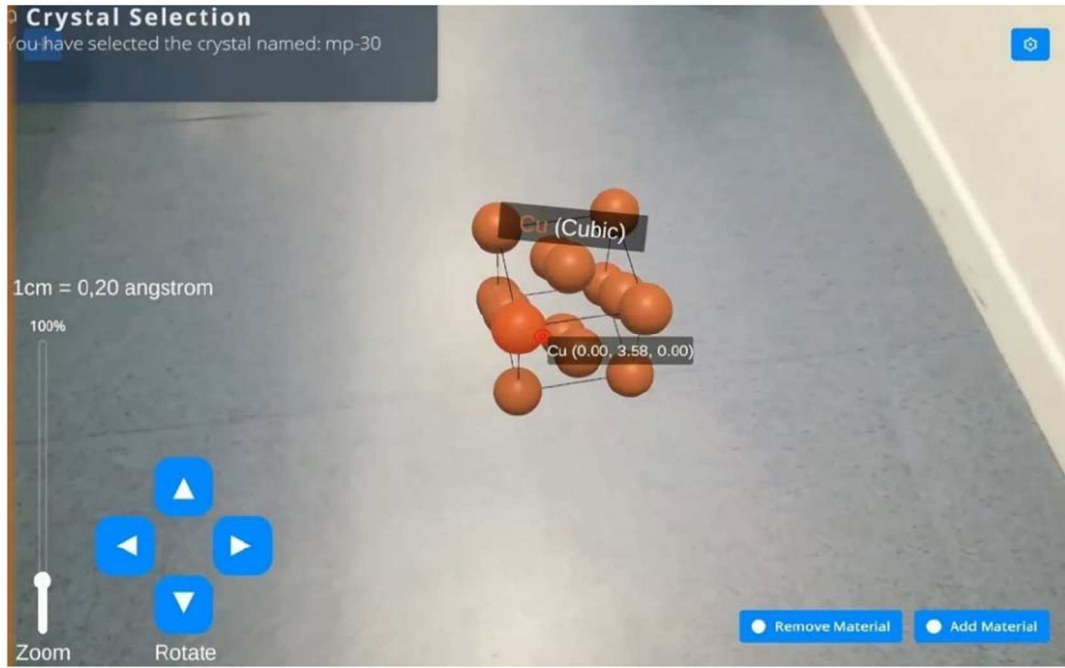


Figure 5. Cu- Explorer- application screenshot- Crystal insertion and material identification

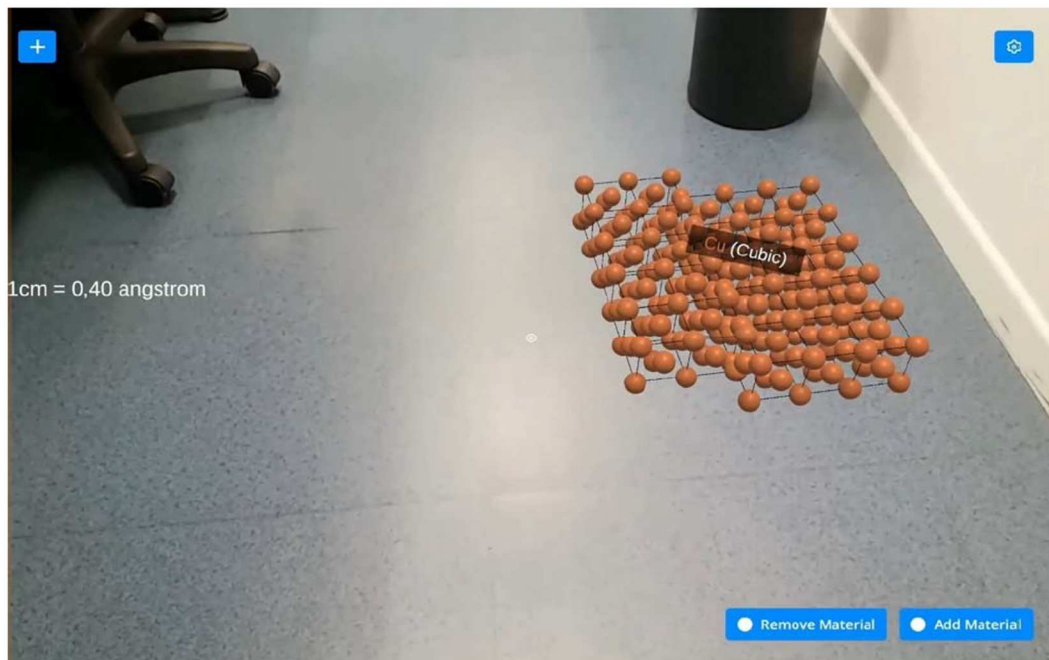


Figure 6. Cu- Explorer: Extended crystal with screw dislocation application

- Peirce-Smith Converter – a virtual training tool for the operation and management of the Peirce-Smith converter in metallurgy.

The second tool, the **Peirce-Smith Converter Inspector**, focuses on the copper supply chain and offers an interactive module illustrating the key components and operational stages of the converting process. By navigating annotated 3D models and observing process animations, learners can explore how copper matte is transformed into blister copper and gain a clear understanding of the equipment involved in this process. The tool is implemented as a WebGL application packaged in SCORM format, ensuring full compatibility with the SkiComCu-LL platform and seamless integration into the corresponding training units.

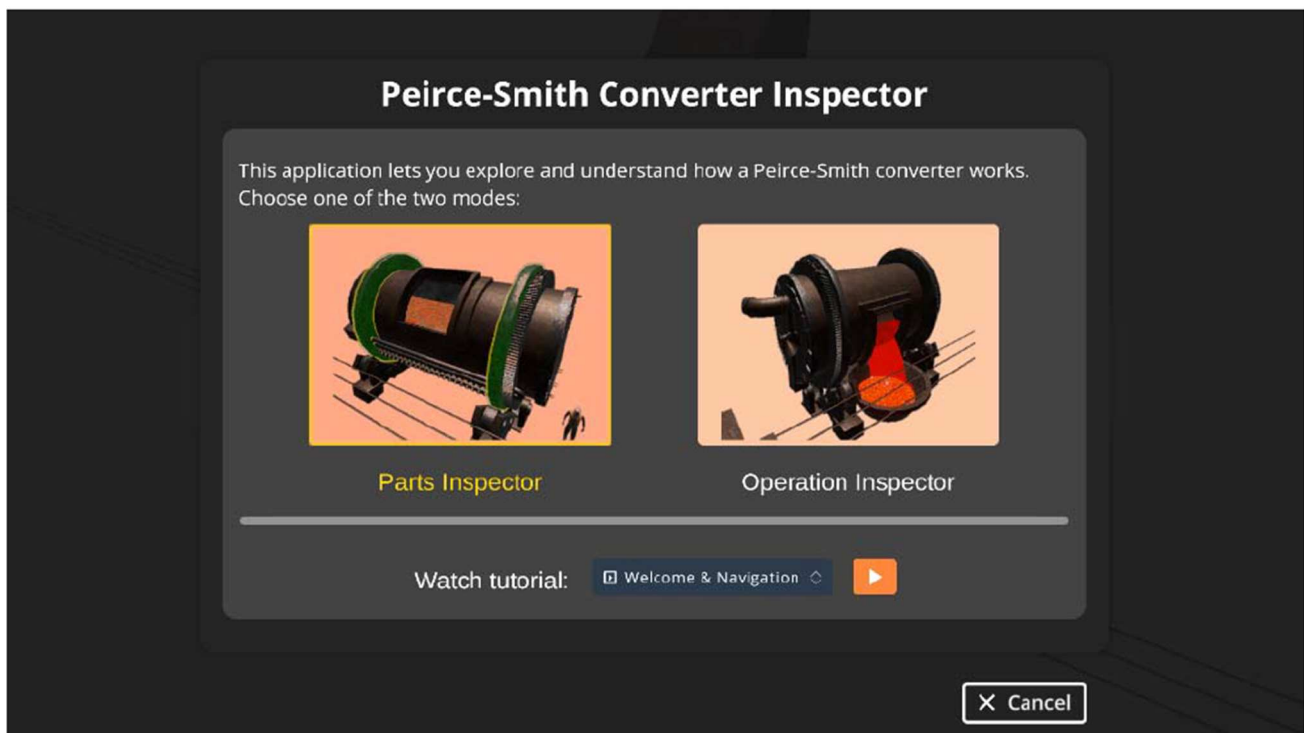


Figure 7. Peirce-Smith Converter

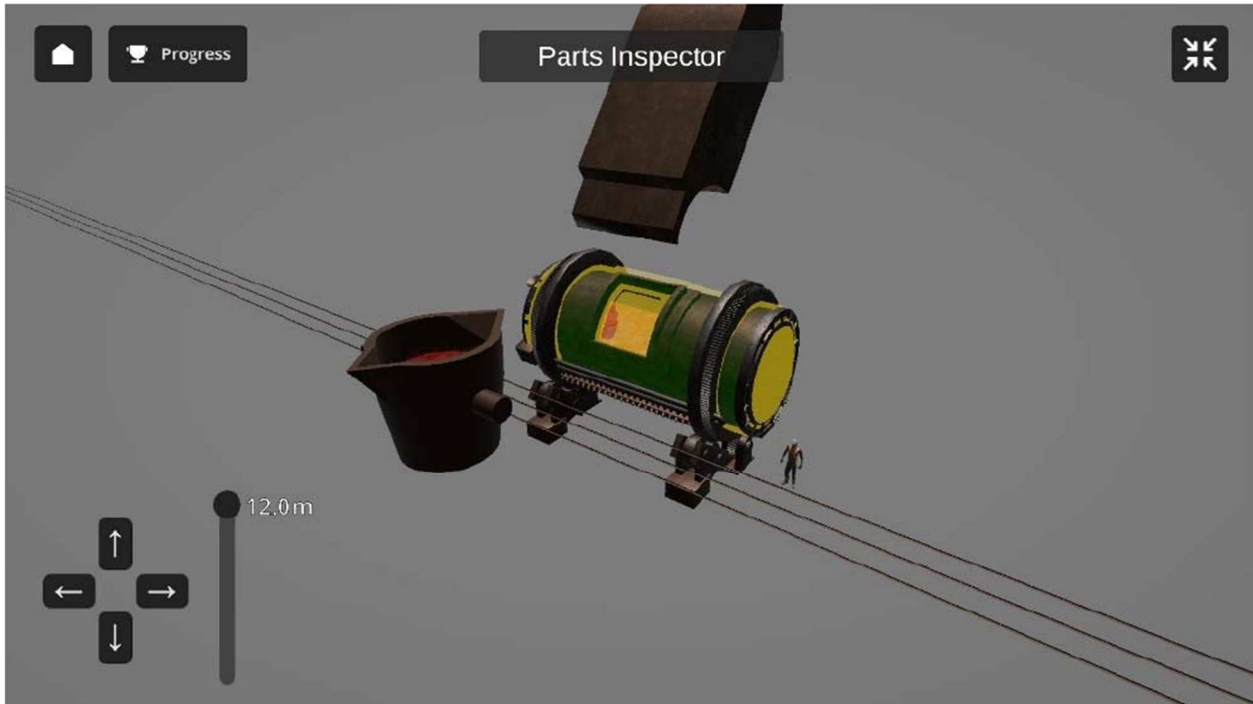


Figure 8. Peirce-Smith Converter- 3D Converter view in Part Inspector Mode

- Health and Safety Procedures in Mining – VR – a virtual reality simulation of mining environment.

Health & Safety Procedures in Mining, is a virtual reality application that simulates a mining environment for training in health and safety procedures. Designed for use with head-mounted displays, it allows trainees to navigate a realistic workspace, identify hazards, and follow correct operational protocols. The immersive VR experience provides a level of situational awareness and engagement that cannot be achieved with conventional training materials. While the underlying scenarios and interactions are still under development and are scheduled for completion by month 30, the current version lays the groundwork for a highly realistic and engaging safety training module.



Figure 10. Health and Safety XR tool- Changing room

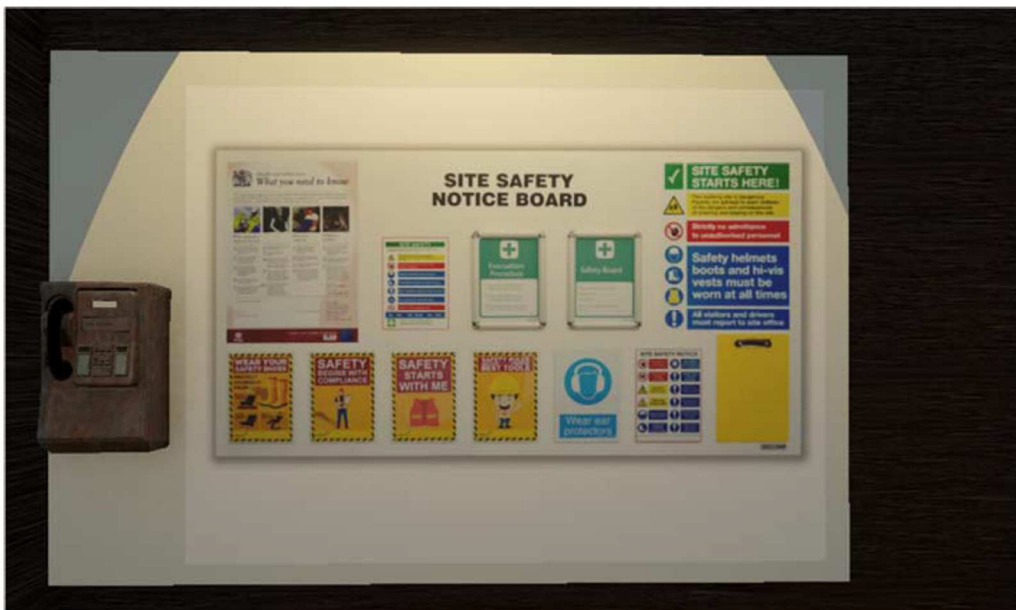


Figure 10. Health and Safety XR tool- safety notice board

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These XR/VR tools were (and still are) systematically reviewed and validated by experts and pilot users from project consortium partners. Main areas of validation are as follow:

- Technical Performance – The tools must operate smoothly without errors, crashes, or lag, and be compatible across supported devices and platforms. System responsiveness, load times, and stability are also carefully tested.
- Usability and User Experience – The interface should be intuitive, easy to navigate, and accessible to users with different levels of technical proficiency. Instructions and interactions must be clear, and the overall experience should be engaging and immersive.
- Immersion and Interactivity – XR tools should provide an immersive experience that enhances engagement, encourages active participation, and allows meaningful interaction with the simulated environment.

All these abovementioned tools, specifically Google VR, must also comply with health and safety requirements, following established safety guidelines to avoid scenarios that could cause discomfort, motion sickness, or other health issues. Regarding the educational content, they must ensure accuracy and relevance, reflecting up-to-date, scientifically and technically correct information applicable to the copper sector, metallurgical processes, or health and safety procedures. Finally, like all project-developed materials, they should support learning objectives, facilitate skill acquisition, and allow users to safely practice or visualize complex processes.

Together, these XR tools and educational materials available on Platform, create an integrated suite of interactive and immersive learning resources that enhance engagement, support diverse learning styles, and bridge theoretical knowledge with practical understanding. Once fully tested and officially approved, all these elements will actively support learners in acquiring essential skills and applying their knowledge in real-world contexts. Fully integrated into the SkiComCu-LL platform, they form a key component of the project's digital learning ecosystem.

2.3 Validation Methods

The Feedback on educational outcomes of the SkiComCu-LL project can be collected in various forms. Depending on the expected outcomes, the level of detail required, and the time available for this phase, a wide range of tools and methods can be used. The most important aspect is that the chosen methods are appropriate, feasible, and aligned with the project's objectives, and that the conclusions drawn from the collected feedback support the fundamental assumptions and goals of the validation process.

To carry out the verification process, it was decided that all tools would be reviewed by internal experts within the SkiComCu-LL consortium. The process involved developers presenting the content and making it accessible to specialists in selected fields. After careful analysis, feedback and comments were shared through email correspondence as well as during dedicated consultation sessions or project/package status meetings. These comments were evaluated for their relevance, and any necessary changes were implemented and updated accordingly.

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2.4 Process of verification of XR tools

Regarding XR tools, ongoing consultations, discussions, meetings, and correspondence were conducted during the development of each tool to ensure that scenarios fully addressed industry requirements. The first live demonstration took place during the meeting in Madrid, allowing participants to experience the application in action. Subsequent changes and updates were then verified through online review sessions. XR tools are available across mobile devices and as a desktop application for registered users (more information about development of the XR tools available in Deliverable 4.2).

2.5 Verification and Usability Analysis of Training Materials

Regarding the verification and usability analysis of the training materials, the NTUA experts conducted train-the-trainer activities. The NTUA team organized six sessions (both in-person and online) for ElvalHalcor (Copper Supply Chain and Soft Skills), Aurubis (Soft Skills), and KGHM/KGHM Cuprum (Health & Safety and Soft Skills). During these sessions, the tools were presented, and their usability as well as the relevance of the content were highlighted.

At the end of each session, a short feedback discussion was held to collect constructive input on various aspects of the prepared materials. Questions addressed, among other things, the content and its practical relevance for conducting training in specific thematic areas, the usability and intuitiveness of the tools themselves, and whether the training course was engaging and interesting for end users.

Regarding the verification and usability analysis of the training materials, the NTUA experts conducted train-the-trainer activities. The NTUA team organized six sessions (both in-person and online) for ElvalHalcor (Copper Supply Chain and Soft Skills), Aurubis (Soft Skills), and KGHM/KGHM Cuprum (Health & Safety and Soft Skills). During these sessions, the tools were presented, highlighting both their usability and the relevance of the content.

At the end of each session, a brief feedback discussion was conducted to gather constructive input on various aspects of the prepared materials. Questions addressed, among other things, the content and its practical relevance for conducting training in specific thematic areas, the usability and intuitiveness of the tools themselves, and whether the training course was engaging and interesting for end users.

Due to technical difficulties in launching the e-learning platform, as well as challenges in providing access to a broad number of applicants and the time required to collect feedback and make the materials available as quickly as possible, the SkiComCu-LL consortium decided to deliver the training through multiple formats. Some sessions were conducted face-to-face, during in-person meetings. Participants included students, industrial sector employees at various levels and areas (including senior and middle managers, line workers

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and HR personnel). These training sessions allowed for the presentation of materials and the training of participants in selected areas:

- Extractive Waste Management
- Soft Skills
- Health & Safety
- Copper Supply Chain

At the conclusion of each training session, participants were asked to complete a satisfaction survey.

The SkiComCu Course Evaluation Survey is designed to collect structured feedback from participants on the course's content, delivery, and impact. It consists of six sections: General Information, Course Structure and Content, Educational Design and Delivery, Learning Outcomes and Impact, Overall Satisfaction, and Future Recommendations. In the first five sections, participants answer closed-ended questions using a Likert scale ranging from 1 – Total Disagree to 5 – Total Agree to indicate their level of agreement with specific statements. The sixth section contains open-ended questions, allowing participants to provide detailed feedback, suggestions, and recommendations. This combination enables both quantitative and qualitative assessment of the training program. A template of this survey is presented below.

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SkiComCu Course Evaluation Survey

You participated in the SkiComCu course. We value your feedback and kindly invite you to complete a short survey, which will help us further develop and enhance our program. The survey should take no longer than 5 minutes to complete.

Thank you in advance for your time and contribution.

Objective: Assess the effectiveness, relevance, and educational quality of the SkiComCu training modules, while also identifying key areas for improvement to inform future iterations.

A. General Information

This section collects basic information about each participant, including their role (student, lecturer, professional, trainer, or other), focus area, course title, date of participation, and format (online, on-site, or hybrid). The purpose is to provide context for the responses and enable analysis of feedback according to participant profiles, course type, and delivery mode.

A. General Information
1. Role:
<input type="checkbox"/> Student <input type="checkbox"/> Lecturer <input type="checkbox"/> Professional <input type="checkbox"/> Trainer <input type="checkbox"/> Other
2. Focus Area:
4. Course title:
5. Date of participation:
<input type="checkbox"/> Online <input type="checkbox"/> On-site <input type="checkbox"/> Hybrid



B. Course Structure and Content					
7. Regarding the course, structure and content, please indicate your agreement or disagreement for each of the following statements:					
	1-Total Disagree	2	3	4	5-Totally Agree
i. The course objectives were clearly defined.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
ii. The course content was well organized and logically structured.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
iii. The materials provided (slides, readings, activities) supported my learning	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
iv. The examples and case studies were relevant to real-world applications.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
v. The course duration was adequate to cover the described learning outcomes	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

C. Educational Design and Delivery					
8. Regarding the educational design and delivery, please indicate your agreement or disagreement with each of the following statements:					
	1-Total Disagree	2	3	4	5-Totally Agree
i. The course used appropriate teaching and learning methods.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

ii. The balance between theory and practical examples was effective.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
iii. The platform used for the course was easy to navigate and user-friendly.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
iv. The course includes interactive elements (e.g., quizzes, discussions) for enhancing my engagement.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
v. The pace of the course supported understanding of key topics.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

D. Learning Outcomes and Impact					
9. Regarding the learning outcomes and impact Please indicate your agreement or disagreement with each of the following statements:					
	1-Total Disagree	2	3	4	5-Totally Agree
i. I have gained new knowledge or skills relevant to my professional or academic field.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
ii. I feel confident applying the knowledge gained in my work/studies.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
iii. The course helped me strengthen my competences.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
iv. The course improved my digital competences, including the understanding and use of digital tools for smart operations.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

B. Course Structure and Content

This section evaluates the organization and quality of the course content. It measures the clarity of course objectives, logical structure of materials, usefulness of supporting resources (slides, readings, activities), relevance of examples and case studies to real-world applications, and whether the course duration was sufficient to achieve the stated learning outcomes. The goal is to determine how effectively the course is designed to support learning.

C. Educational Design and Delivery

This section focuses on the teaching methods and delivery of the course. It assesses the appropriateness of instructional approaches, the balance between theory and practice, the usability of the course platform, the presence of interactive elements such as quizzes and discussions, and whether the course pace supports participant understanding. This feedback helps evaluate how effectively the course engages participants and facilitates learning.

D. Learning Outcomes and Impact

This section measures the actual learning and practical benefits participants gain from the course. It evaluates whether participants acquired new knowledge or skills, their confidence in applying what they learned, the strengthening of their competencies, and improvements in digital skills, including the use of digital tools for smart operations. The aim is to assess the tangible impact of the course on participants' professional or academic development.



E. Overall Satisfaction

10. Regarding your satisfaction, please indicate your agreement or disagreement with each of the following statements:

	1-Total Disagree	2	3	4	5-Totally Agree
i. Overall, I am satisfied with the quality of the course.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
ii. I would recommend this course to others.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

F. Future Recommendations

11. To what extent do you believe improvements are necessary in the course?

12. Which are the most critical areas for improvement for the course?

13. What topics would you like to include in future SkiComCu courses?

14. Please add any additional comments or suggestions you would like to share:

E. Overall Satisfaction

This section captures participants' overall impressions of the course. It measures general satisfaction with the quality of the training and the likelihood that participants would recommend the course to others. The results provide a high-level view of participant approval and help gauge the course's success in meeting expectations.

F. Future Recommendations

Finally, section F collects suggestions for course improvement and future development. It asks participants to identify areas where enhancements are needed, topics they would like to see included in future courses, and any additional comments or recommendations. The purpose is to gather actionable feedback to refine the course and better align it with participant needs in future iterations.

Figure SkiComCuLL- Course Evaluation Survey.

In the fourth quarter of 2025, the training platform at <https://learningpoint.eitrawmaterials.eu> was launched, enabling the start of online testing. In the first phase, members of the project teams within the SkiComCu-LL consortium were selected to participate. After preliminary verification, the platform was made available to selected employees and students affiliated with consortium members. The training was delivered online, allowing participants to access it at a convenient time. Learners had access to the full SkiComCu training program and could choose at least one area of particular interest to them.

As part of these activities, both online and on-site training sessions were conducted, with a total of 664 participants, including 316 men and 348 women. The results obtained and their analysis are presented in the following section.

3. Data analysis

3.1. Participants

A total number of 664 participant took part in the process of testing educational materials both online and in- person. There were 316 women and 348 men. All of them registered for five available courses. Detailed information on the number of participants and courses is presented in the table below.

Table 1. participants of SkiComCu Courses

SkiComCu course	total	Male	Female
Soft skills	198	27	171
Physical Metallurgy	138	107	31
Copper Supply Chain	248	155	93
Health & Safety	59	17	42
Extractive Waste Management	21	10	11
	664	316	348

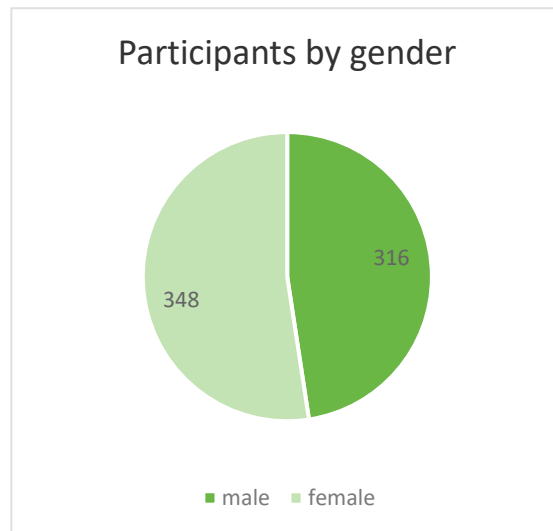


Figure 12. Participants by gender

At the end of the course, participants had the opportunity to complete a satisfaction survey. The survey was optional and did not determine successful course completion. Nevertheless, it made it possible to collect key information regarding the quality of the course, its usefulness, and the participants' overall satisfaction. As a result, a total of 212 surveys were collected: 83 from in-person training sessions and 129 from the e-learning platform.

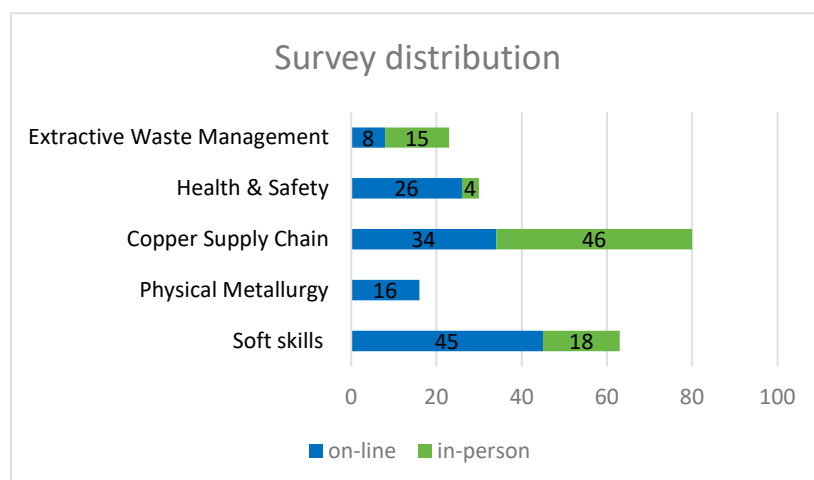


Figure 13. Survey distribution in terms of Course and number of feedback

3.2 In-Person Course Survey Results

The survey results obtained after conducting in-person training sessions are as follows and are presented in the table below. All responses from participants of each on-site training have been compiled here to provide an overall view of participants' perspectives on the SkiComCu-LL courses.

Table 2. Overall results of the in- person courses.

Section	Question	Answer				
		1	2	3	4	5
B. Course Structure and Content	The course objectives were clearly defined.	1%	0%	11%	43%	45%
	The course content was well organized and logically structured.	0%	1%	10%	31%	58%
	The materials provided (slides, readings, activities) supported my learning	0%	1%	13%	41%	45%
	The examples and case studies were relevant to real-world applications.	0%	6%	19%	26%	49%
	The course duration was adequate to cover the described learning outcomes	2%	1%	27%	41%	29%
C. Educational Design and Delivery	The course used appropriate teaching and learning methods.	0%	2%	22%	39%	37%
	The balance between theory and practical examples was effective.	1%	12%	29%	37%	21%
	The platform used for the course was easy to navigate and user-friendly.	2%	2%	15%	38%	43%
	The course includes interactive elements (e.g., quizzes, discussions) for enhancing my engagement.	4%	13%	37%	25%	20%
	The pace of the course supported understanding of key topics.	1%	7%	13%	29%	49%
D. Learning Outcomes and Impact	I have gained new knowledge or skills relevant to my professional or academic field.	0%	1%	18%	35%	46%
	I feel confident applying the knowledge gained in my work/studies.	1%	6%	25%	39%	29%
	The course helped me strengthen my competences.	1%	4%	25%	36%	34%
	The course improved my digital competences, including the understanding and use of digital tools for smart operations.	4%	23%	21%	33%	20%
E.	Overall, I am satisfied with the quality of the course.	1%	1%	16%	47%	35%
	I would recommend this course to others.	1%	2%	12%	40%	44%

Analysis of the survey results collected during the on-site sessions shows that the course was rated very positively in many areas, although there are also aspects that could be strengthened in the future. Most participants considered the course objectives to be clearly defined (45 % rated 5 and 43% rated 4) and the content well-organized and logically presented (58% rated 5 and 31% rated 4). The teaching materials supported the learning process (85% with the rate 4 and 5), and the examples and case studies were relevant to real-world applications (more than 75% responses 4/5). The course pace was positively evaluated by almost 80% of participants, as was the course platform with similar percentage of positive evaluation.

The most varied feedback was related to the interactive elements and the balance between theory and practice. Engaging activities, such as quizzes or discussions, received following scores—20% rated 5 and 25% rated 4, while 37% rated them average (3) and 17% rated them 1–2 indicated that the opinions were divided. Similarly, the balance between theory and practice received more moderate evaluations as 57% of answers were positive, suggesting a potential for better alignment of practical examples with theoretical content.

Despite these differences, the course was highly rated in terms of both substantive and practical value—most participants gained new skills and knowledge (46% rated 5 and 35% rated 4) and felt confident in applying them in work or study (29% rated 5 and 39% rated 4). Overall satisfaction was high (35% rated 5 and 47% rated 4), and the vast majority of participants would recommend the course to others (44% rated 5 and 40% rated 4). The findings indicate that the course is effective, academically valuable, and well-received, with room to enhance interactive elements and practical application of theory.

In the following sections, detailed survey results are presented, showing the responses given in the individual SkiComCu-LL courses.

3.2.1 Module 1: Supply Chain of Cu

Table 3. results of section B- Course structure and content of Module Supply Chain of Cu

Question	1	2	3	4	5
The course objectives were clearly defined.	2,17%	0,00%	15,22%	39,13%	43,48%
The course content was well organized and logically structured.	0,00%	0,00%	10,87%	39,13%	50,00%
The materials provided (slides, readings, activities) supported my learning	0,00%	0,00%	13,04%	34,78%	52,17%
The examples and case studies were relevant to real-world applications.	0,00%	0,00%	4,55%	31,82%	63,64%
The course duration was adequate to cover the described learning outcomes	2,17%	2,17%	30,43%	43,48%	21,74%

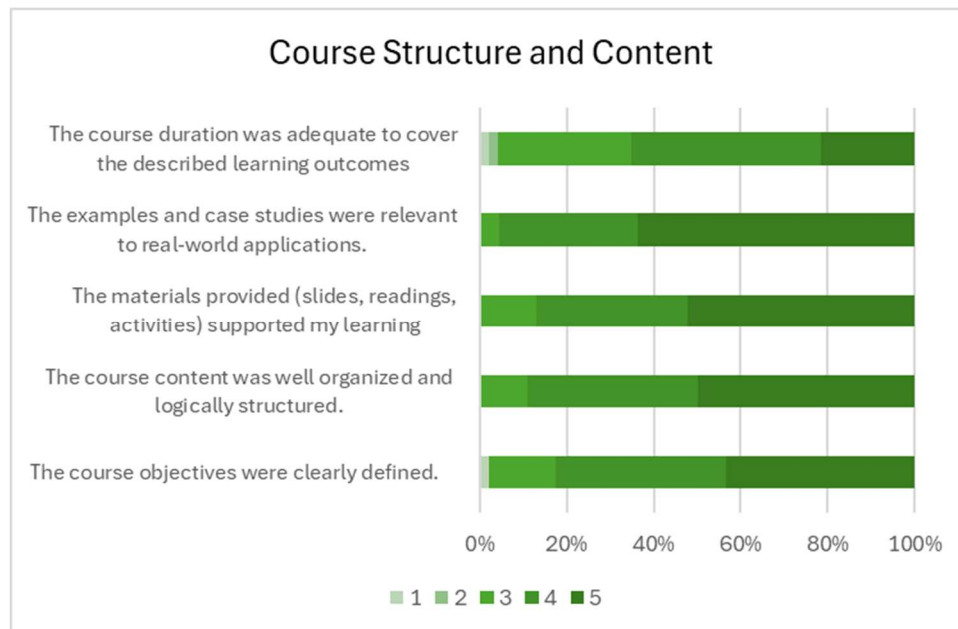


Figure. 14 Results of Section B of Module Supply Chain of Cu

Results show that participants were highly satisfied with the Supply Chain of Cu course in terms of structure and content. Most found the objectives to be clearly defined, with about 83% rating them very good or excellent (4 and 5). The content was well organized and logically structured, with roughly 89% giving positive ratings. The provided materials, including slides, readings, and activities, were reported as supportive of learning by about 87% of participants, and the examples and case studies were considered highly relevant to real-world applications by approximately 95%. Feedback on course duration was more varied: about 65% rated it positively (4 and 5), 30% gave a moderate rating (3), and about 4% rated it low (1 and 2), suggesting some room for adjustment.

Table 4. results of section C- Educational design and delivery of Module Supply Chain of Cu

Question	1	2	3	4	5
The course used appropriate teaching and learning methods.	0,00%	2,22%	22,22%	31,11%	44,44%
The balance between theory and practical examples was effective.	2,22%	4,44%	28,89%	40,00%	24,44%
The platform used for the course was easy to navigate and user-friendly.	0,00%	2,22%	17,78%	42,22%	37,78%
The course includes interactive elements (e.g., quizzes, discussions) for enhancing my engagement.	4,35%	10,87%	23,91%	32,61%	28,26%
The pace of the course supported understanding of key topics.	2,17%	4,35%	13,04%	32,61%	47,83%

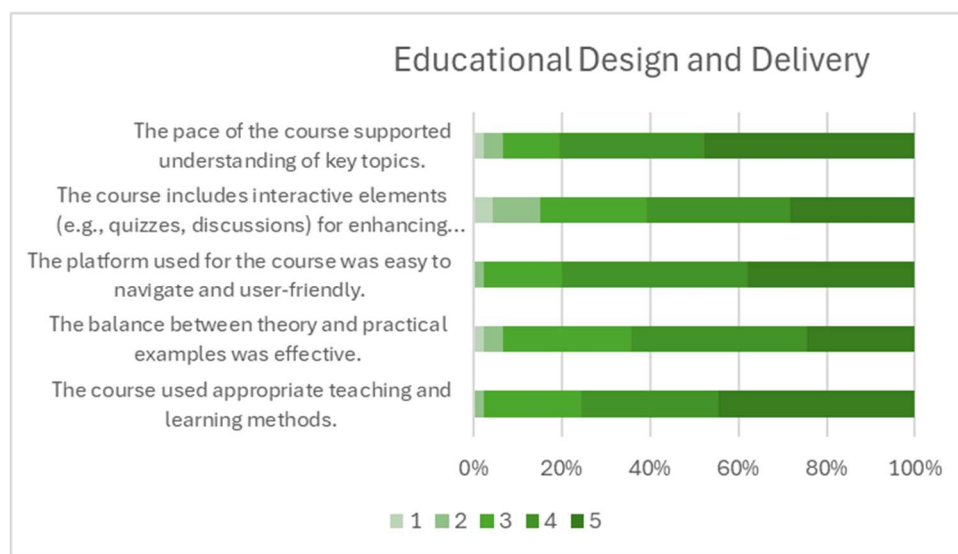


Figure 15. Results of Section C of Module Supply Chain of Cu

The survey results indicate that participants generally evaluated the teaching methods and course platform very positively, while opinions were more varied regarding interactive elements and the balance between theory and practice. Most participants found the teaching and learning methods appropriate, with about 75% rating them very good and excellent, and the course pace supported understanding of key topics, with more than 80% giving positive ratings. The platform was considered user-friendly and easy to navigate by roughly 80% of respondents. The balance between theory and practical examples received more moderate feedback, with about 64% rating it very good and excellent, and nearly 30% giving a neutral rating. Interactive elements, such as quizzes and discussions, showed the widest range of responses, with about 61% rating them very good and excellent, while less than 15% rated them low, indicating room for increased engagement.

Table 5. results of section D- Learning outcomes and impact of Module Supply Chain of Cu

Question	1	2	3	4	5
I have gained new knowledge or skills relevant to my professional or academic field.	0,00%	2,17%	17,39%	36,96%	43,48%
I feel confident applying the knowledge gained in my work/studies.	2,17%	10,87%	26,09%	23,91%	36,96%
The course helped me strengthen my competences.	2,17%	2,17%	26,09%	28,26%	41,30%
The course improved my digital competences, including the understanding and use of digital tools for smart operations.	4,35%	28,26%	28,26%	28,26%	10,87%

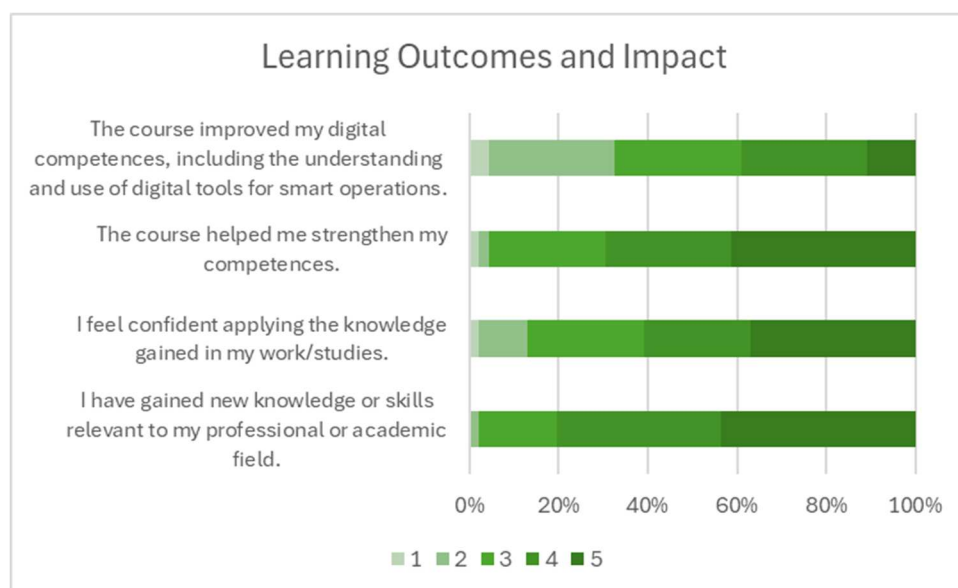


Figure 16. Results of section D- of Module Supply Chain of Cu

The Learning Objectives and Impact part was generally perceived as effective in enhancing knowledge, skills, and competences, although confidence in applying the knowledge and improvement in digital skills showed more variation. Most participants reported gaining new knowledge or skills relevant to their professional or academic field, with about 44% rating it excellent and 37% very good, and felt that the course helped strengthen their competences, with roughly 41% rating it excellent and 28% very good. Confidence in applying the knowledge gained was slightly lower, with about 37% rating it excellent and 24% very good, and nearly 26% giving a neutral rating, indicating that some participants may need additional support to fully translate

learning into practice. The course's impact on digital competences, including understanding and using digital tools for smart operations, received the most varied responses, with less than 11% rating it excellent and about 28% giving low ratings, suggesting that this area may benefit from additional focus or training.

Table 6. Results of section E-Overall Satisfaction of Module Supply Chain of Cu

Question	1	2	3	4	5
Overall, I am satisfied with the quality of the course.	2,27%	0,00%	15,91%	43,18%	38,64%
I would recommend this course to others.	2,27%	2,27%	9,09%	31,82%	54,55%



Figure 17. Results of section E- of Module Supply Chain of Cu

High overall satisfaction with the courses and strong support for recommending them to others were demonstrated by participants, indicating that the SkiComCu courses were well-received and valued. Overall satisfaction was rated very good and excellent by about 80% of participants, while less than 3% gave low ratings and roughly 16% provided a neutral answers.

3.2.2 Module 2: Extractive Waste Management

Table 7. Results of section B- Course structure and content of the Module Extractive Waste Management

Question	1	2	3	4	5
The course objectives were clearly defined.	0,00%	0,00%	0,00%	33,33%	66,67%
The course content was well organized and logically structured.	0,00%	0,00%	0,00%	20,00%	80,00%
The materials provided (slides, readings, activities) supported my learning	0,00%	0,00%	0,00%	33,33%	66,67%
The examples and case studies were relevant to real-world applications.	0,00%	0,00%	6,67%	20,00%	73,33%
The course duration was adequate to cover the described learning outcomes	0,00%	0,00%	26,67%	33,33%	40,00%

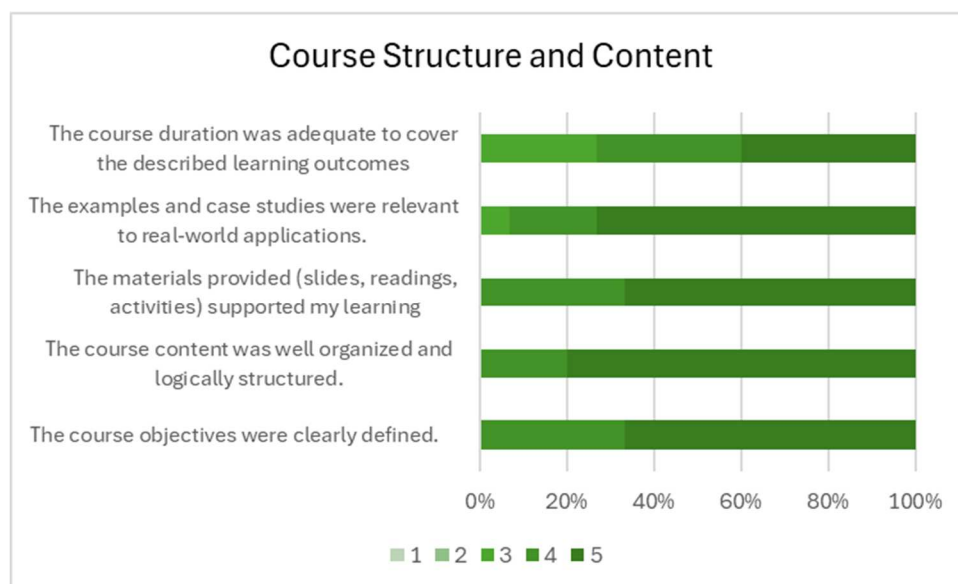


Figure 18. Results of section B- of the Module Extractive Waste Management

The First area of evaluation in module 2: Extractive Waste Management, was positively assessed by participants. The course objectives were considered clearly defined, with 66.67% rating 5 and 33.33% rating 4. The content was well organized and logically structured (80% rated 5, 20% rated 4), and the learning

materials, including slides, readings, and activities, effectively supported the learning process (66.67% rated 5, 33.33% rated 4). Examples and case studies were seen as highly relevant to real-world applications (73.33% rated 5, 20% rated 4), while feedback on course duration was slightly more varied, with 40% rating 5, 33.33% rating 4, and 26.67% rating 3, suggesting that for most participants the duration was adequate but could be fine-tuned in future sessions.

Table 8. Results of section C- Educational design and delivery of the Module Extractive Waste Management

Question	1	2	3	4	5
The course used appropriate teaching and learning methods.	0,00%	0,00%	0,00%	46,67%	53,33%
The balance between theory and practical examples was effective.	0,00%	13,33%	20,00%	26,67%	40,00%
The platform used for the course was easy to navigate and user-friendly.	0,00%	0,00%	13,33%	46,67%	40,00%
The course includes interactive elements (e.g., quizzes, discussions) for enhancing my engagement.	6,67%	6,67%	33,33%	33,33%	20,00%
The pace of the course supported understanding of key topics.	0,00%	0,00%	13,33%	40,00%	46,67%

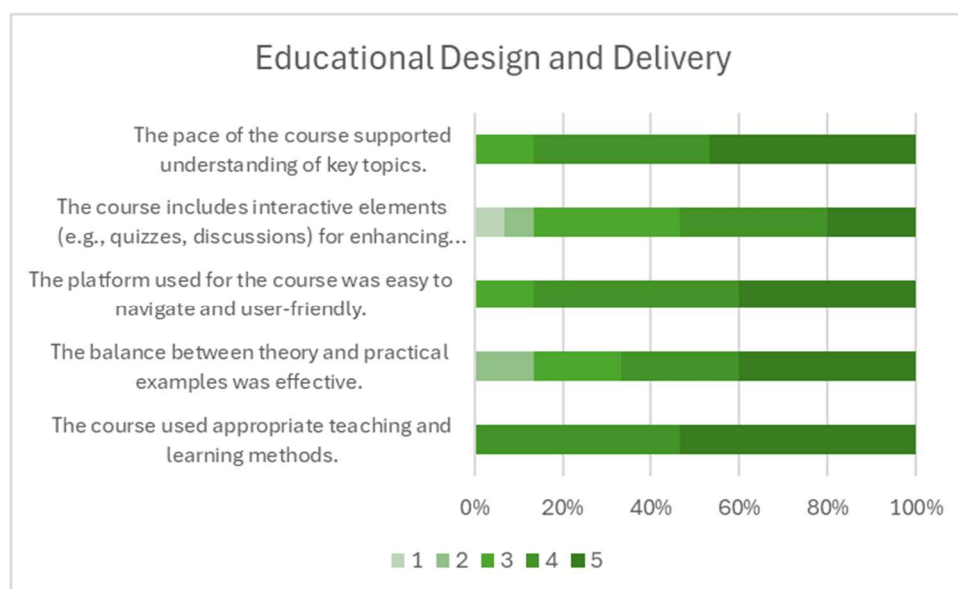


Figure 19. Results of section C- of the Module Extractive Waste Management

In section Education Design and Delivery the survey results show that participants generally evaluated the course very positively, particularly regarding teaching methods, course tempo, and platform usability. About 53% of participants rated the teaching and learning methods as excellent, and about 47% rated them very good. Similarly, about 47% rated the course tempo as excellent and about 40% as very good, while the platform was considered user-friendly by about 40% of participants and very good by about 47%. The balance between theory and practical examples received slightly more varied feedback, with about 40% rating it as excellent, 27% as very good, and about one-third giving moderate ratings. Interactive elements such as quizzes and discussions showed the widest range of responses, with about 20% rating them excellent, 33% very good, and roughly 13% giving lower ratings, indicating room to further enhance participant engagement.

Table 9. Results of section D- Learning outcomes and impact of the Module Extractive Waste Management

Question	1	2	3	4	5
I have gained new knowledge or skills relevant to my professional or academic field.	0,00%	0,00%	0,00%	26,67%	73,33%
I feel confident applying the knowledge gained in my work/studies.	0,00%	0,00%	46,67%	46,67%	6,67%
The course helped me strengthen my competences.	0,00%	6,67%	26,67%	46,67%	20,00%
The course improved my digital competences, including the understanding and use of digital tools for smart operations.	6,67%	20,00%	20,00%	20,00%	33,33%

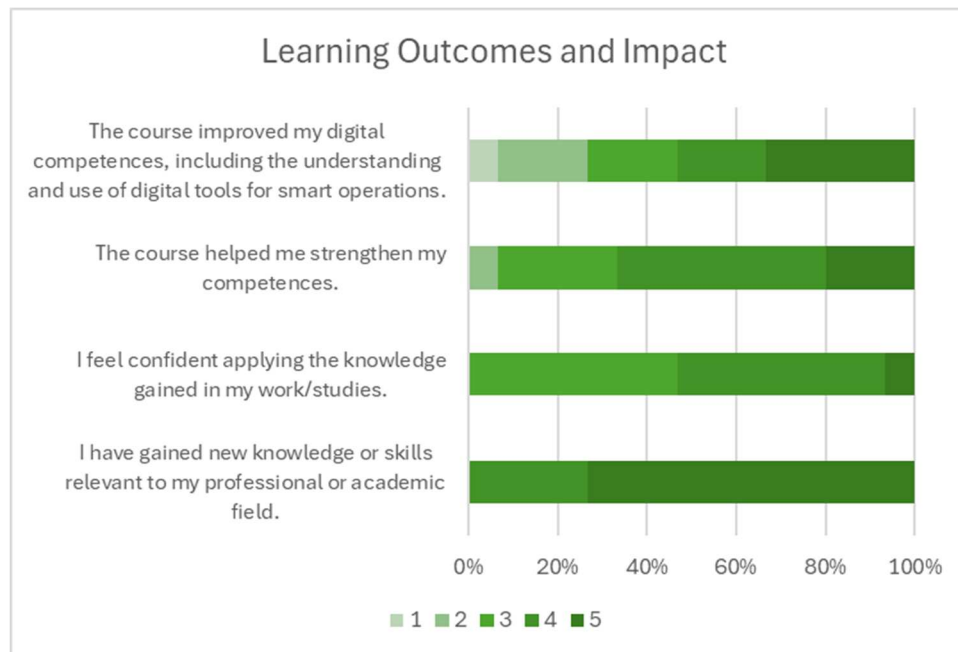


Figure 20. Results of section D- of the Module Extractive Waste Management

Presented above results show that participants rated the course very positively overall, particularly in teaching methods, course tempo, and platform usability. About 53% rated the teaching methods as excellent and 47% very good, while the course tempo and platform received similarly high ratings. The balance between theory and practice was slightly more varied, with about 40% rating it excellent and 27% very good. Interactive elements showed the widest range, with about 20% rating them excellent and 33% very good, suggesting some room to further increase engagement.

Table 10. Results of section E- Overall satisfaction of the Module Extractive Waste Management

Question	1	2	3	4	5
Overall, I am satisfied with the quality of the course.	0,00%	0,00%	6,67%	46,67%	46,67%
I would recommend this course to others.	0,00%	0,00%	26,67%	26,67%	46,67%



Figure 21. Results of section E- of the Module Extractive Waste Management

Overall, participants were highly satisfied with this module its quality and value. About 93% of participants rated their overall satisfaction as very good or excellent. More than 73% gave a positive recommendation to others.

In terms of additional recommendations, participants were asked to complete a section containing open-ended questions. This form of free expression indicates which elements, beyond those generally included in the earlier sections, should be taken into account when introducing additional changes or improvements. It also allows for the evaluation of aspects that were not covered by the closed-ended questions but were highlighted by the users. Below are several selected example excerpts from the questionnaires.

Table 11. Results of section F- Future Recommendations of the Module Extractive Waste Management

<p>11. To what extent do you believe improvements are necessary in the course?</p> <p>I think this course achieves its objectives to better understand extractive waste management, the main topics was well structured, started from introduction, next environmental characterization etc. The course maintains a balance between theoretical content in the form of text, graphics, and content to listen and watch. Real industrial project examples were very interesting and significantly enriched each of the course module.</p>
<p>12. Which are the most critical areas for improvement for the course?</p> <p>Perhaps this is due to the format of the course, but increasing interaction, discussion could be an added value to the course.</p>
<p>13. What topics would you like to include in future SkiComCu courses?</p> <p>In future SkiComCu courses I would like to include the subject of critical metals, their importance for the economy, recycling etc., as well as more detailed and comprehensive information about tailings management and thickening.</p>
<p>14. Please add any additional comments or suggestions you would like to share:</p> <p>In the quiz after the module ‘Environmental characterization of extractive waste’, there is a question with two correct answers. It is the only such question in the course. I am not sure if this was intentional or if it was a small mistake</p>

To sum up, the responses to questions 11–14 indicate that the participant has a very positive overall assessment of the course and believes that it largely achieves its educational objectives. In particular, the clear structure of the content, the balanced combination of theoretical material with visual and multimedia resources, and the use of real industrial project examples were highly appreciated, as they significantly enriched the individual course modules.

At the same time, the respondent pointed out that increased interaction could be an area for improvement, as more opportunities for discussion and exchange of ideas could add further value to the course. With regard to future editions, it was suggested to include topics related to critical metals, their economic importance and recycling, as well as more detailed and comprehensive coverage of tailings management and thickening. Additionally, a minor technical issue was noted concerning a quiz question with two correct answers, which may require verification to ensure consistency in the assessment process. The majority of the questionnaires did not include additional recommendations. Nevertheless, some respondents briefly mentioned the need to increase the number of practical examples, enhance interaction, extension of time, or more engagement through quizzes and tests, as well as greater interaction between the trainer and the trainees.

3.2.3 Module 4: Health and Safety

Table 12. Results of section B- Course structure and content of the Module Health & Safety

Question	1	2	3	4	5
The course objectives were clearly defined.	0,00%	0,00%	0,00%	75,00%	25,00%
The course content was well organized and logically structured.	0,00%	25,00%	25,00%	25,00%	25,00%
The materials provided (slides, readings, activities) supported my learning	0,00%	25,00%	25,00%	25,00%	25,00%
The examples and case studies were relevant to real-world applications.	0,00%	25,00%	25,00%	0,00%	50,00%
The course duration was adequate to cover the described learning outcomes	0,00%	0,00%	50,00%	50,00%	0,00%

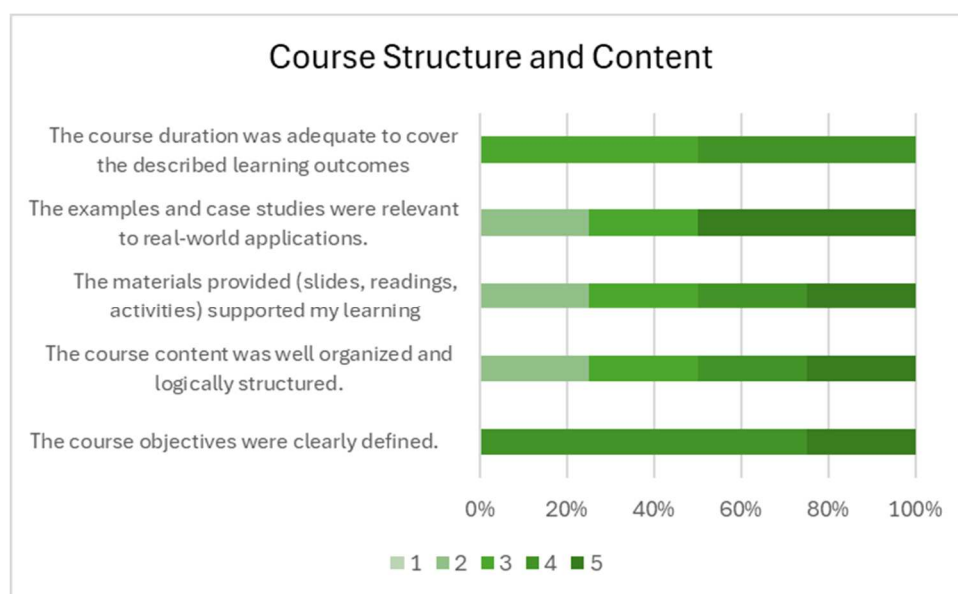


Figure 22. Results of section B- of the Module Health & Safety

Participants generally evaluated the course positively, particularly regarding clearly defined objectives, content organization, and learning materials. Combined “very good” and “excellent” ratings (4+5) show that about 100% of participants found the course objectives clear, while roughly 50% rated the content

organization and learning materials positively. Examples and case studies were considered relevant to real-world applications by about half of the participants. Feedback on course duration was more mixed, with about 50% giving moderate ratings, suggesting that the length of the course could be adjusted in the future.

Table 13. Results of section C - Educational design and delivery of the Module Health & Safety

Question	1	2	3	4	5
The course used appropriate teaching and learning methods.	0%	25%	50%	0%	25%
The balance between theory and practical examples was effective.	0%	50%	0%	50%	0%
The platform used for the course was easy to navigate and user-friendly.	50%	25%	0%	0%	25%
The course includes interactive elements (e.g., quizzes, discussions) for enhancing my engagement.	0%	0%	75%	0%	25%
The pace of the course supported understanding of key topics.	0%	0%	25%	50%	25%

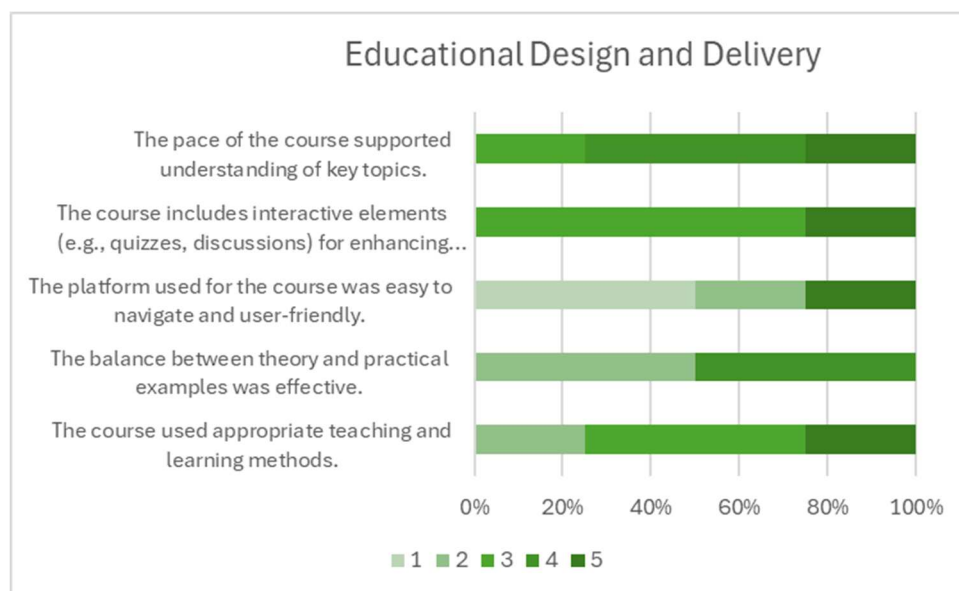


Figure 23. Results of section C- of the Module Health & Safety

Participants' evaluations in terms of design and delivery were mixed. About 25% rated teaching methods and interactive elements as excellent, while most gave moderate ratings. The balance between theory and practice

was rated very good by about 50%. Platform usability and course pace received varied but generally positive feedback, indicating room to improve engagement and interactivity.

Table 14. Results of section D - Learning outcomes and impact of the Module Health & Safety

Question	1	2	3	4	5
I have gained new knowledge or skills relevant to my professional or academic field.	0%	0%	75%	25%	0%
I feel confident applying the knowledge gained in my work/studies.	0%	0%	25%	75%	0%
The course helped me strengthen my competences.	0%	25%	0%	75%	0%
The course improved my digital competences, including the understanding and use of digital tools for smart operations.	0%	75%	0%	25%	0%

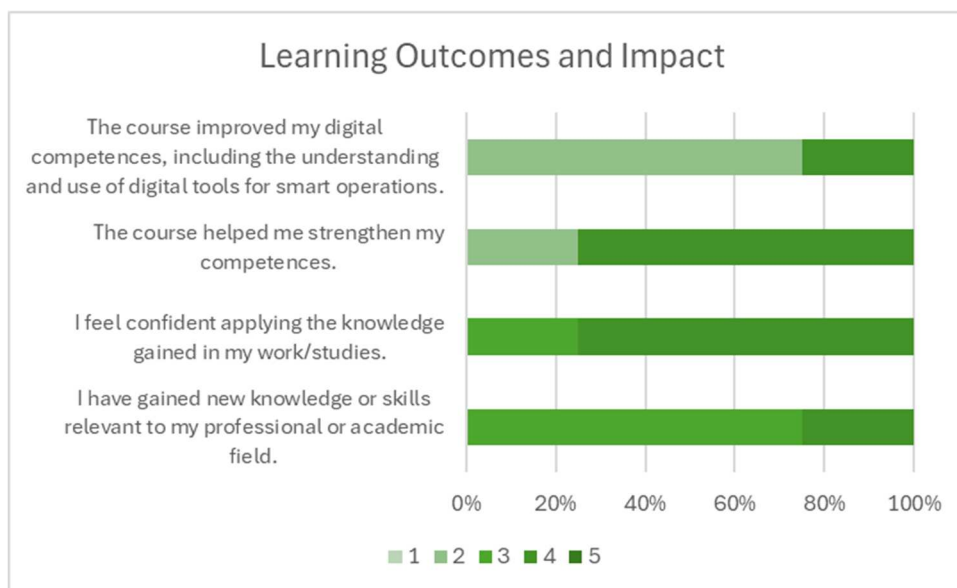


Figure 24. Results of section D- of the Module Health & Safety

Participants reported moderate improvements in knowledge and skills. About 25% felt very confident applying what they learned, and 75% rated their gains in knowledge or competence as moderate to very good. Most participants (75%) felt the course helped strengthen their competences, while digital competences showed

the most variation, with 75% giving lower ratings and only 25% rating them positively, suggesting a need for more focus on digital skills development.

Table 15. Results of section E - Overall satisfaction of the Module Health & Safety

Question	1	2	3	4	5
Overall, I am satisfied with the quality of the course.	0,00%	25,00%	50,00%	25,00%	0,00%
I would recommend this course to others.	0,00%	25,00%	25,00%	50,00%	0,00%



Figure 25. Results of section E- of the Module Health & Safety

Overall satisfaction and willingness to recommend the course were moderate. About 25% of participants rated their satisfaction and recommendation as very good, 25–50% gave moderate ratings, and none rated the course as excellent. This indicates that course met participants’ expectations, there is room to increase overall satisfaction and encourage stronger recommendations.

For Section F, which contains open-ended questions, the following section provides examples of participants’ responses. Unfortunately, the number of received answers was insufficient, nonetheless all of the answers will be taken for consideration as part of future improvement.

Table 16. Results of section F - Future Recommendations of the Module Health & Safety

<p>11. To what extent do you believe improvements are necessary in the course?</p> <p>Deeper exploration of the issues <u>covered</u>, greater interactivity, testing of knowledge and its use</p>
<p>12. Which are the most critical areas for improvement for the course?</p> <p>Broader scope - deeper content of the teaching materials</p>
<p>13. What topics would you like to include in future <u>SkiComCu</u> courses?</p> <p>Mining operations and processing of the copper ores</p>
<p>14. Please add any additional comments or suggestions you would like to share:</p> <p>The final test is missing</p>

<p>11. To what extent do you believe improvements are necessary in the course?</p> <p>The scope of training could be deeper</p>
<p>12. Which are the most critical areas for improvement for the course?</p> <p>I. We suggest including also the procedure used in KGHM for <u>the emergency</u> light communication, where the light signals transmitted by a miner's lamp are as follows: 1. circular motion – stop 2. vertical swing - go from me 3. horizontal swing - come to me</p> <p>II. one matching task is the mistake - The predictive maintenance <u>analitics</u> does not improve "who might be harmed and how", <u>its is connected with</u> the sensors and AI as well. in our opinion, this simplification is misleading.</p> <p>III. editorial mistake - "thermal and noise hazards" should be in Bold</p>
<p>13. What topics would you like to include in future <u>SkiComCu</u> courses?</p> <p>Mining operations and processing of the copper ores</p>
<p>14. Please add any additional comments or suggestions you would like to share:</p> <hr/>

11. To what extent do you believe improvements are necessary in the course?

Improvements are needed to a moderate to high extent. The current course format does not sufficiently support effective learning and should be enriched with practical, application-oriented content and elements that promote active learning, rather than focusing mainly on normative and regulatory information.

12. Which are the most critical areas for improvement for the course?

- The course structure and overall logic should be simplified to make navigation more intuitive and accessible for all user groups.
- System instructions and user guidance should be clearer and should lead learners step by step through the learning process.
- The course should be more strongly connected to real working conditions by introducing situational examples, scenarios, and exercises reflecting professional practice, including underground work environments and non-verbal communication methods.

13. What topics would you like to include in future SkiComCu EE4M courses?

-

14. Please add any additional comments or suggestions you would like to share:

- The course lacks clarity and does not fulfil its core educational purpose.
- Content is largely limited to fragmented excerpts from directives and legal acts, without didactic explanation or practical interpretation.
- The course explains *what* the regulations state, but not *how* or *why* they should be applied in real work situations.
- There is a clear lack of practical examples, case studies, and realistic scenarios (e.g. underground behaviour, non-verbal communication using gestures or light signals).
- The learning platform is not intuitive; navigation is unclear even for technologically experienced users.
- Insufficient system communication (UX writing) causes confusion, e.g. regarding correction of answers or progression through tasks.
- Overall, the course provides limited added educational value and requires a practice-oriented redesign.

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D5.1 - Pilot testing reports

Project: 23043 – SkiComCu-LL

To sum up, participants consistently indicated that improvements are required to a moderate to high extent. Key points include the need for deeper exploration of the topics, greater interactivity, and opportunities to test and apply knowledge. The current course format is seen as insufficient for effective learning, focusing too heavily on normative and regulatory content, with limited explanation of practical application.

It was also highlighted main areas of improvement:

- simplify the overall logic and structure to make navigation more intuitive and accessible for all users,
- provide clearer system instructions and step-by-step guidance throughout the learning process,
- connect the course more strongly to real working conditions by introducing situational examples, realistic scenarios, and exercises reflecting professional practice,
- correct inaccuracies, such as a matching task linking predictive maintenance analytics to “who might be harmed and how,” which is misleading. Emphasize key terms like “thermal and noise hazards” for clarity,
- expand the content to provide a broader and deeper understanding of the topics, including mining operations and copper ore processing,
- include a final test to evaluate overall learning outcomes,
- improve system communication and platform usability. Navigation is unclear even for tech-savvy users, and insufficient UX writing causes confusion regarding tasks, answer correction, and progression.

Suggested areas include also underground work environments, non-verbal communication using gestures or light signals, and emergency light communication procedures dedicated to specific mining company (e.g., KGHM lamp signals: circular motion – stop; vertical swing – go from me; horizontal swing – come to me).

3.2.4 Module 5: Soft Skills

Table 17. Results of section B- Course structure and content of the Module Soft Skills

Question	1	2	3	4	5
The course objectives were clearly defined.	0,00%	0,00%	11,11%	55,56%	33,33%
The course content was well organized and logically structured.	0,00%	0,00%	5,56%	27,78%	66,67%
The materials provided (slides, readings, activities) supported my learning	0,00%	0,00%	22,22%	66,67%	11,11%
The examples and case studies were relevant to real-world applications.	0,00%	22,22%	55,56%	22,22%	0,00%
The course duration was adequate to cover the described learning outcomes	5,56%	0,00%	11,11%	38,89%	44,44%

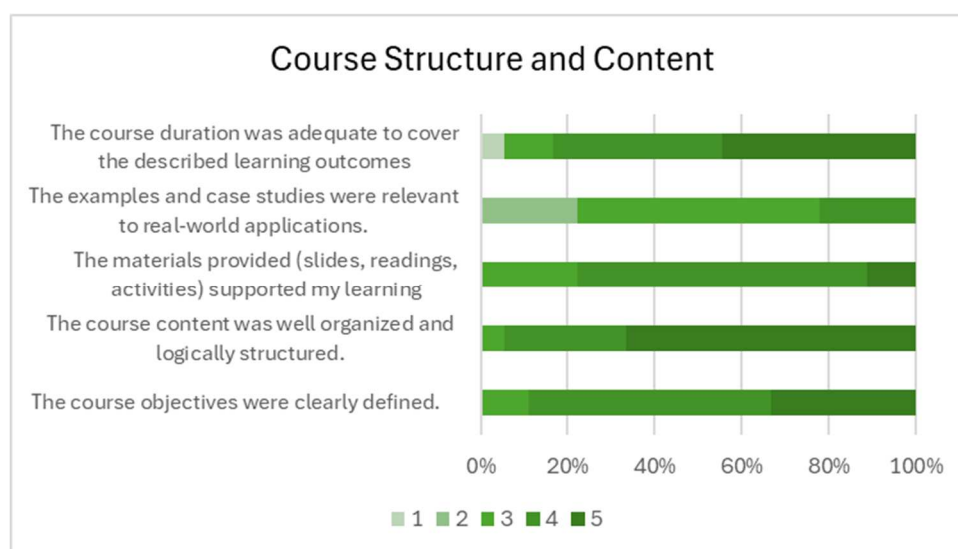


Figure 26. Results of section B- of the Module Soft Skills

Participants generally evaluated the course positively, particularly regarding objectives, content organization, and course duration. About 89% rated the course objectives as very good or excellent, and roughly 94% rated the content organization positively. Learning materials were considered helpful by about 78% of participants, while examples and case studies received more varied feedback, with about 22% rating them very good and

55% giving moderate ratings. The course duration was well received, with about 83% rating it very good or excellent, suggesting that the length generally met participants' expectations.

Table 18. Results of section C - Educational design and delivery of the Module Soft Skills

Question	1	2	3	4	5
The course used appropriate teaching and learning methods.	0,00%	0,00%	33,33%	61,11%	5,56%
The balance between theory and practical examples was effective.	0,00%	22,22%	44,44%	33,33%	0,00%
The platform used for the course was easy to navigate and user-friendly.	0,00%	0,00%	11,11%	27,78%	61,11%
The course includes interactive elements (e.g., quizzes, discussions) for enhancing my engagement.	0,00%	27,78%	66,67%	5,56%	0,00%
The pace of the course supported understanding of key topics.	0,00%	22,22%	11,11%	5,56%	61,11%

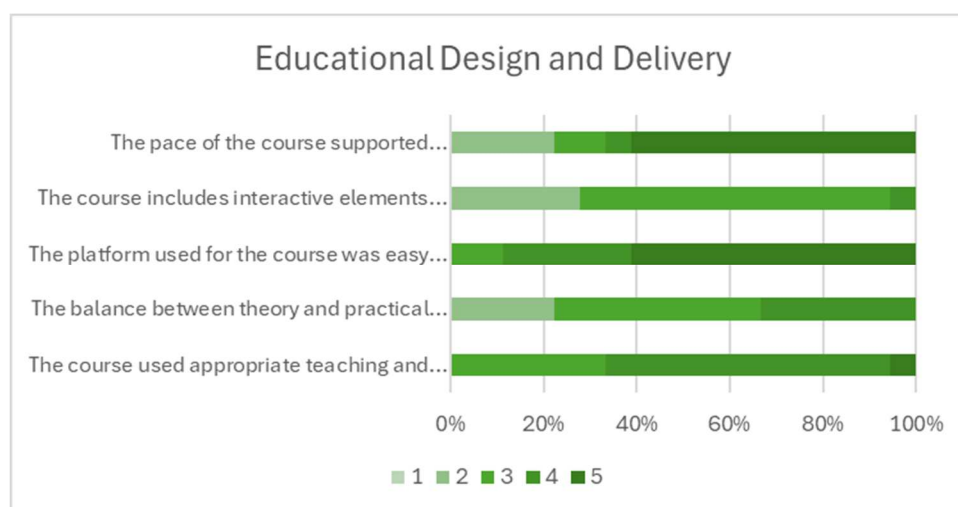


Figure 26. Results of section B- of the Module Soft Skills Figure 27. Results of section C- of the Module Soft Skills

The course was generally rated positively by participants, particularly in terms of teaching methods, platform usability, and pace, with about 67% of responses being very good or excellent. The balance between theory and practice was assessed more variably, and interactive elements were rated least positively, indicating that participant engagement could be further improved.

Table 19. Results of section D - Learning outcomes and impact of the Module Soft Skills

Question	1	2	3	4	5
I have gained new knowledge or skills relevant to my professional or academic field.	0,00%	0,00%	22,22%	38,89%	38,89%
I feel confident applying the knowledge gained in my work/studies.	0,00%	0,00%	5,56%	61,11%	33,33%
The course helped me strengthen my competences.	0,00%	0,00%	27,78%	38,89%	33,33%
The course improved my digital competences, including the understanding and use of digital tools for smart operations.	0,00%	0,00%	5,88%	58,82%	35,29%

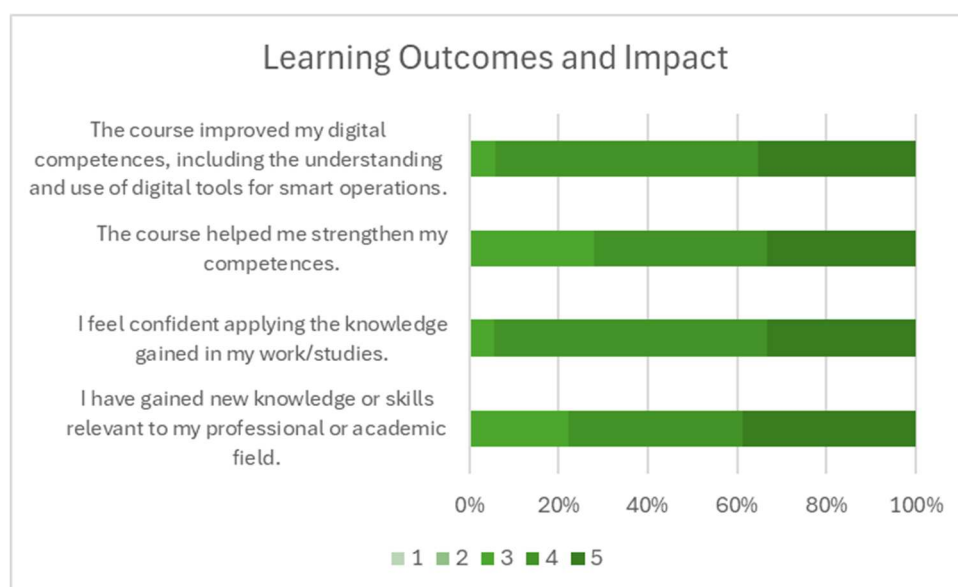


Figure 28. Results of section D- of the Module Soft Skills

New knowledge and skills relevant to participants' professional or academic fields were reported by most respondents, with about 78% rating this as very good or excellent. Confidence in applying the knowledge gained was also rated positively, with about 94% giving very good or excellent ratings. Roughly 72% of participant rated that competences might be strengthened, while digital competences, including understanding and use of digital tools for smart operations, were improved according to about 94% of responses, indicating that the course effectively supported both of them.

Table 20. Results of section E - Overall satisfaction of the Module Soft Skills

Question	1	2	3	4	5
Overall, I am satisfied with the quality of the course.	0,00%	0,00%	16,67%	61,11%	22,22%
I would recommend this course to others.	0,00%	0,00%	5,56%	66,67%	27,78%



Figure 29. Results of section E- of the Module Soft Skills

Overall satisfaction with the course was rated positively by most participants, with about 83% giving very good or excellent ratings. The course was reported as likely to be recommended to others by approximately 94% of respondents.

Overall, the reception of the “Soft Skills” module was positive, although several participants highlighted areas that should be addressed in the context of potential changes and improvements.

Table 21. Results of section F - Future Recommendations of the Module Soft Skills

Survey 1

<p>11. To what extent do you believe improvements are necessary in the course?</p> <p>I believe the course was informative and well-structured overall, but there is still some room for improvement. In particular, adding more practical case studies and real-world examples _____</p>
<p>12. Which are the most critical areas for improvement for the course?</p> <p>Ensuring that statistics, trends, and market information are as up-to-date as possible would strengthen the course's relevance. Enhance visual materials _____</p>
<p>13. What topics would you like to include in future SkiComCu courses?</p> <p>Exploring the growing role of scrap, recovery technologies, and closed-loop systems. _____</p>
<p>14. Please add any additional comments or suggestions you would like to share:</p> <p>More emphasis on emissions reduction, circular economy strategies, and responsible sourcing practices. _____</p>

Survey 2

<p>11. To what extent do you believe improvements are necessary in the course?</p> <p>Adding more practical exercises and interactive elements would help reinforce the concepts. _____</p>
<p>12. Which are the most critical areas for improvement for the course?</p> <p>Summaries, frameworks, or step-by-step guidance would help reinforce the main learning points. _____</p>
<p>13. What topics would you like to include in future SkiComCu courses?</p> <p>Methods for supporting employee development and guiding performance growth. _____</p>

14. Please add any additional comments or suggestions you would like to share:

Overall, I found the course meaningful and well-presented. I appreciate the effort put into creating a supportive and engaging learning environment.

—

Survey 3

11. To what extent do you believe improvements are necessary in the course?

More exercises / practical examples

12. Which are the most critical areas for improvement for the course?

The are no significant shortcomings

13. What topics would you like to include in future SkiComCu courses?

Topis are well selected

14. Please add any additional comments or suggestions you would like to share:

Survey 4

11. To what extent do you believe improvements are necessary in the course?

More practical exercises

12. Which are the most critical areas for improvement for the course?

13. What topics would you like to include in future SkiComCu courses?

14. Please add any additional comments or suggestions you would like to share:

Visually attractive course

Survey 5

11. To what extent do you believe improvements are necessary in the course?

Maybe not necessary, but always there is space for improvement

12. Which are the most critical areas for improvement for the course?

Strengthening the link between theory and real situations at work

13. What topics would you like to include in future SkiComCu courses?

14. Please add any additional comments or suggestions you would like to share:

e.g enriching the course content with short videos showing situational scenes as examples of appropriate and inappropriate behaviour

Participants generally found the course informative, well-structured, and visually appealing, but some of them noted that there is room for improvement, particularly through the addition of practical exercises, interactive elements, and real-world case studies. While some participants felt improvements were not strictly necessary, some answers indicated the need of reinforcing concepts with applied examples would enhance learning outcomes.

Areas for improvement:

- strengthen the link between theoretical content and real workplace situations. Include situational examples, case studies, and short illustrative videos demonstrating appropriate and inappropriate behavior,
- ensure that statistics, trends, and market information are up-to-date to maintain the course's relevance,
- introduce summaries, frameworks, or step-by-step guidance to reinforce key learning points,
- enhance visual materials and include interactive exercises to support knowledge retention and engagement.

Participants also suggested including following topics as part of "Soft Skills Module":

- Methods for supporting employee development and performance growth.
- The growing role of scrap, recovery technologies, and closed-loop systems.
- Further emphasis on emissions reduction, circular economy strategies, and responsible sourcing practices

3.2.5 Summary

The survey shows that the course was very well-received, with most participants finding the objectives clear, content well-organized, and learning materials effective. Practical examples and case studies were relevant, while interactive elements and the balance between theory and practice showed room for improvement. Both of these aspects were also highlighted in Section F of the evaluation survey, where respondents emphasized the need for more practical examples. Attention was also drawn to the time required to complete the course, which may warrant further review. In terms of the application, potential improvements were noted to facilitate navigation and address system errors.

Overall, participants indicated they gained new skills, felt confident applying them and would recommend the course to others.

3.3 On- line Course Survey Results

As it was described above in this report, in the fourth quarter of 2025, SkiComCu Course was launched on EIT KIC RawMaterials platform. All five modules of the course were released and available for wider group of users. Based on the collected data, it was found that 129 participants completed the online course and submitted their feedback survey. The numbers of participants for each module were as follow:

- Module 1: Supply Chain of Cu- 34
- Module 2: Extractive Waste Management- 8
- Module 3: Physical Metallurgy- 16
- Module 4: Health & Safety- 26
- Module 5: Soft Skills- 45

Questionnaire was slightly different from the one presented in section 2.5 as it was extended by additional questions regarding the usage of XR tool already available on Platform. Overall satisfaction in following areas was investigated.

1. Course Structure and Content

- The course objectives were clearly defined.
- The course content was well organized and logically structured.
- The materials provided (slides, readings, activities) supported my learning.
- The examples and case studies were relevant to real-world applications.
- The course duration was adequate to cover the described learning outcomes
- The content of the interactive 3D application aligns properly with the course content.

- Ease of use of the interactive 3D application.

2. Educational Design and Delivery

- The course used appropriate teaching and learning methods.
- The balance between theory and practical examples was effective.
- The platform used for the course was easy to navigate and user-friendly.
- The course includes interactive elements (e.g., quizzes, discussions) for enhancing my engagement.
- The pace of the course supported understanding of key topics.
- The use of the interactive 3D application is intuitive and the concepts are easy to understand.

3. Learning Outcomes and Impact

- I have gained new knowledge or skills relevant to my professional or academic field.
- I feel confident applying the knowledge gained in my work/studies.
- The course helped me strengthen my competences.
- The course improved my digital competences, including the understanding and use of digital tools for smart operations.
- Using the interactive 3D application helped me better understand the content of the course they are associated with.

4. Overall Satisfaction

- Overall, I am satisfied with the quality of the course.
- I would recommend this course to others.
- I would recommend to others the use of the interactive 3D application to complement the course content.

3.3.1 Module 1: Supply Chain of Copper

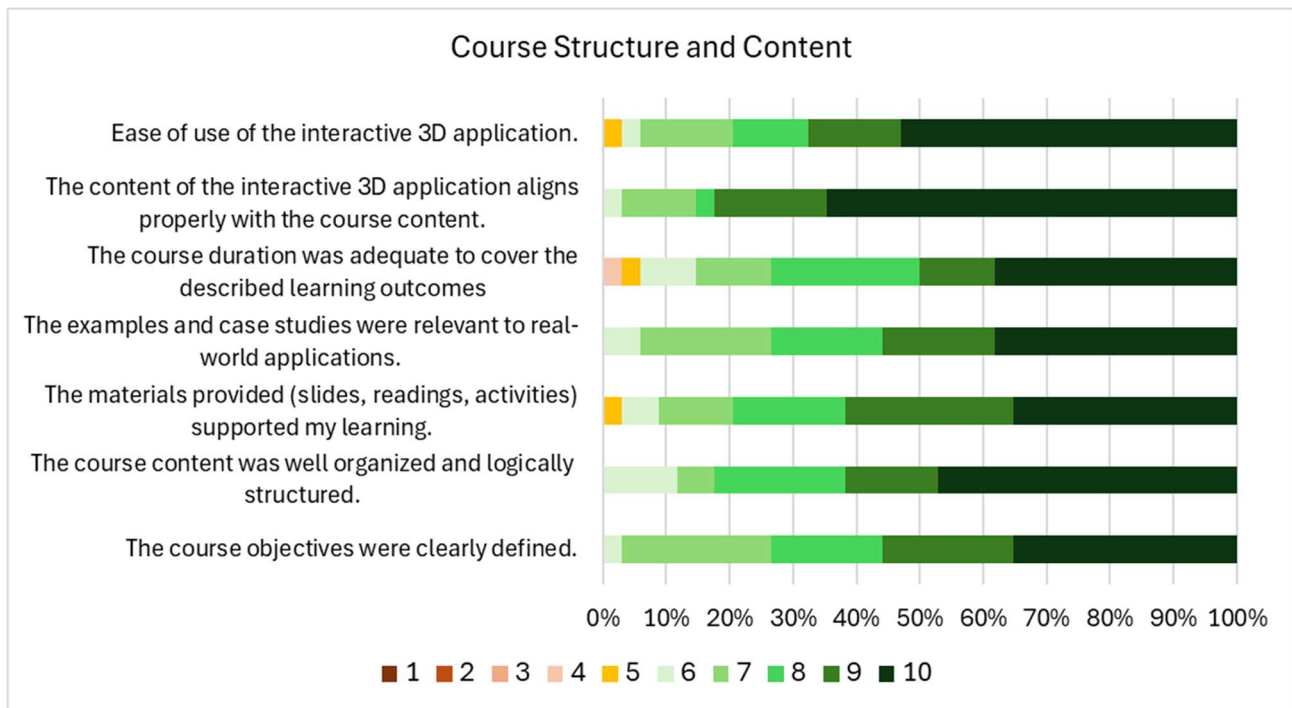


Figure. 30 Results of Section B of Module Supply Chain of Cu

Participants generally rated the Module's structure and content very positively. A total of 56% of respondents agreed or strongly agreed that the course objectives were clear. The content was well organized and logically structured, with 67.7% top responses. Learning materials such as slides, readings, and activities supported learning for 62% of the participants. Examples and case studies were relevant to real-world applications, with 55.8% positive responses. Most users (61.7%) felt the course duration was adequate. The interactive 3D application was highly aligned with the course content (82.3% agreement) and easy to use (67.6% agreement). Overall, the course was well-structured, effectively supported learning, and included interactive elements that participants found highly valuable.

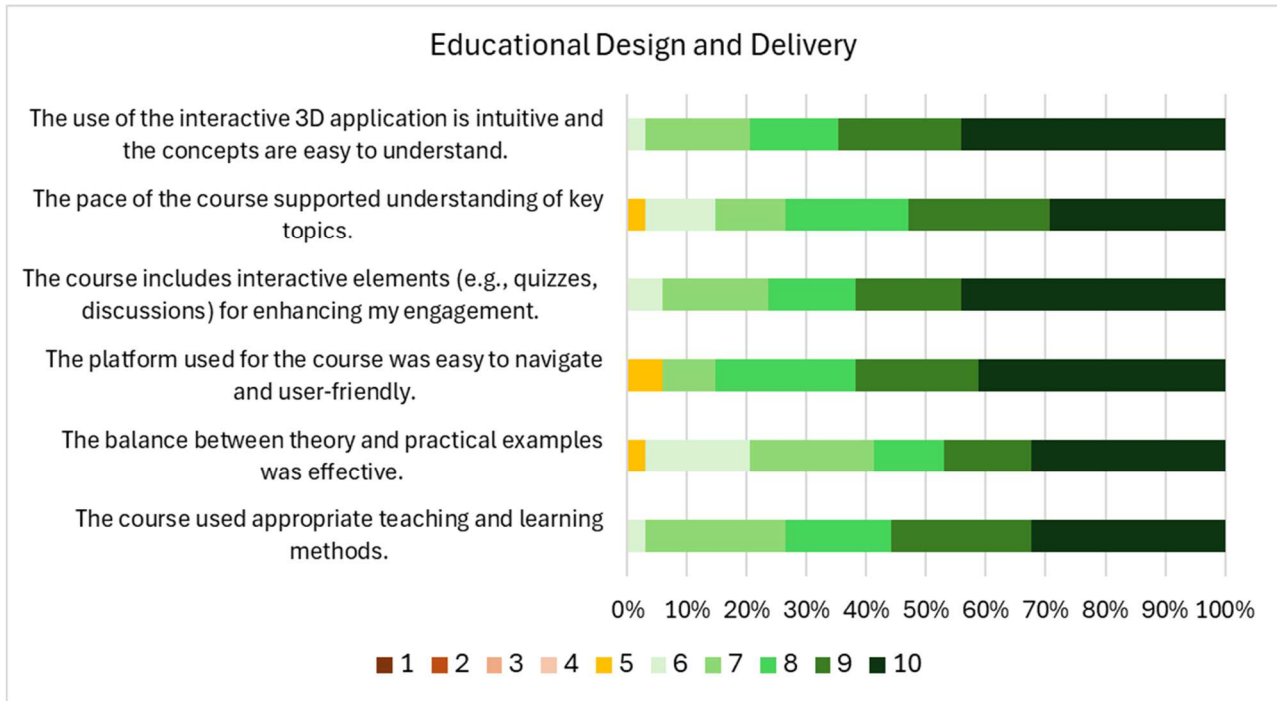


Figure 31. Results of section C- of Module Supply Chain of Cu

Participants rated the educational design and delivery of the course very positively. A total of 96.2% agreed or strongly agreed that the course used appropriate teaching and learning methods. Effective balance between theory and practical examples was reported by 79.1% of participants. The course platform was user-friendly and easy to navigate for 88.1% of respondents. Interactive elements such as quizzes and discussions enhanced engagement for 76.5% of participants. The pace of the course supported understanding of key topics for 85.9%, while the interactive 3D application was considered intuitive and easy to understand by 87.0% of participants. Overall, the course design successfully combined effective teaching methods, practical examples, user-friendly technology, and engaging interactive elements.

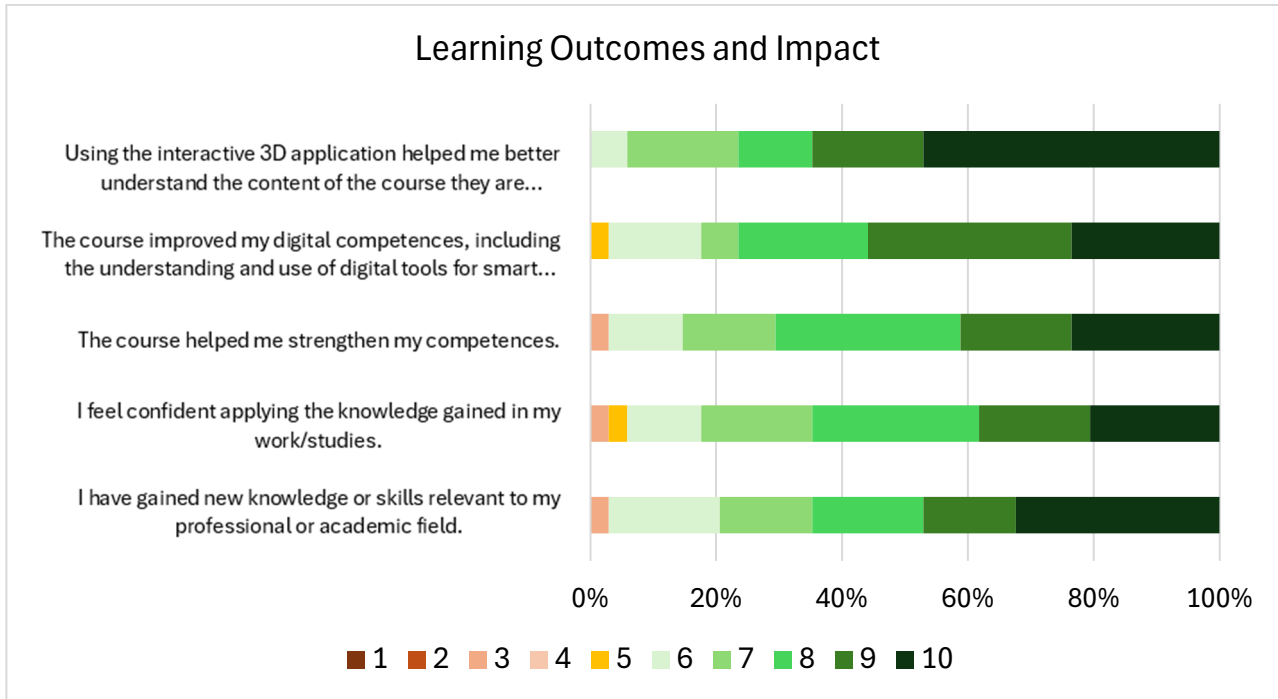


Figure 32. Results of section D- of Module Supply Chain of Cu

The next section of the Survey regards “Learning Outcomes and Impact” supported strong and positive feedback from participants. A total of 82.4% agreed or strongly agreed that they gained new knowledge or skills relevant to their professional or academic field. Confidence in applying this knowledge was reported by 82.3% of participants. The course helped strengthen competences for 85.9% of respondents. Digital competences, including understanding and use of digital tools, improved for 82.4%, while the interactive 3D application enhanced understanding of the course content for 94.1% of participants. Overall, the course was effective in developing knowledge, practical skills, competences, and digital literacy, with interactive tools playing a key role in supporting learning.

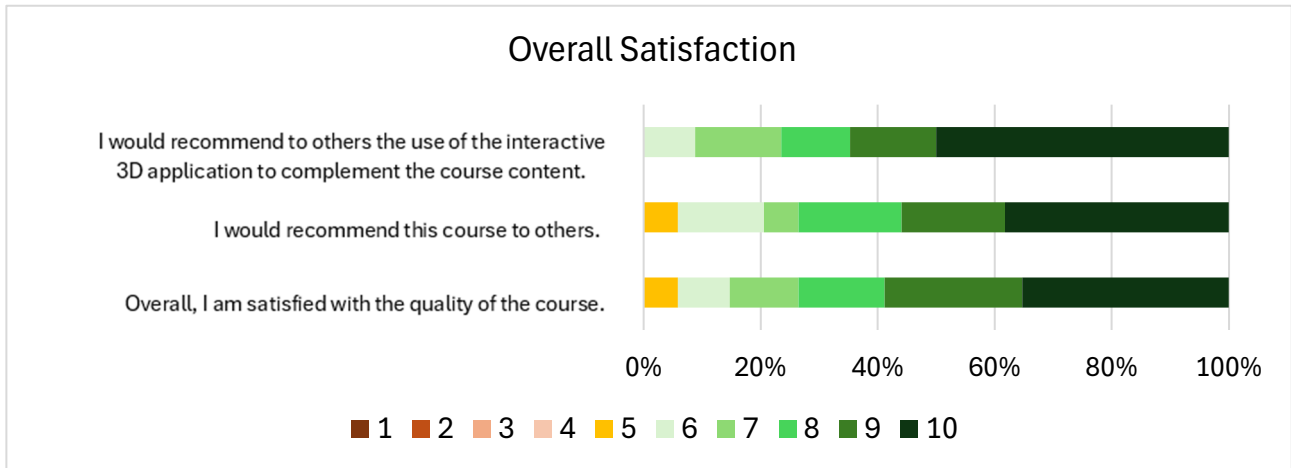


Figure 33. Results of section E- of Module Supply Chain of Cu

Participants were highly satisfied with the course. Overall, 80.0% agreed or strongly agreed that they were satisfied with the quality of the course. A similar proportion (79.4%) would recommend the course to others. The interactive 3D application received particularly strong endorsement, with 77.9% agreeing or strongly agreeing that they would recommend its use to complement the course content.

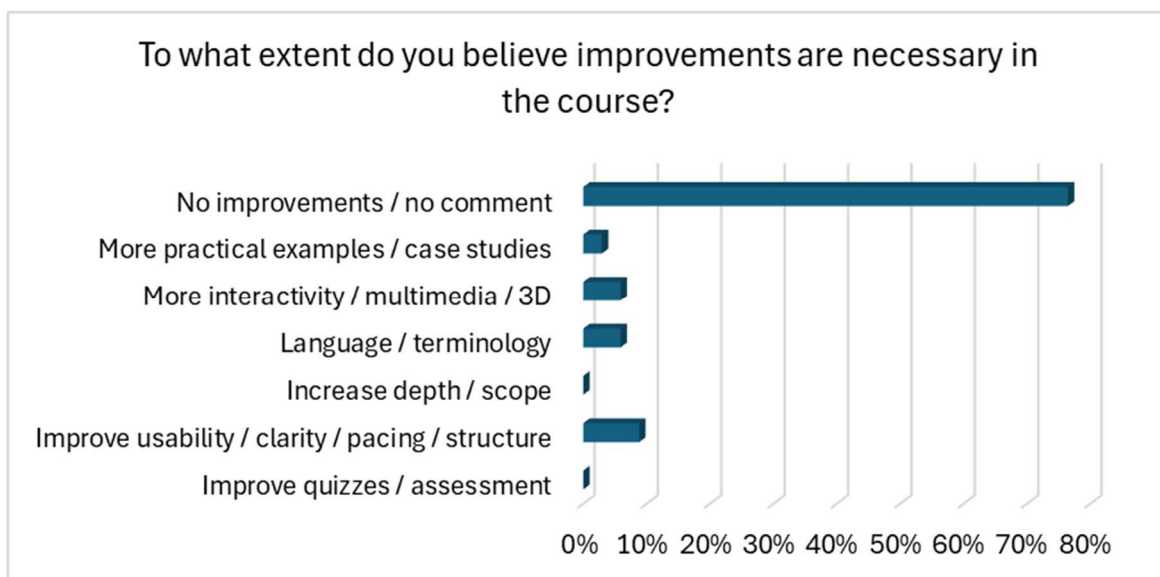


Figure 34. Results of the Section F- Future Recommendations of the Module Module Supply Chain of Cu

Most participants (~75%) indicated no improvements were needed or did not comment, showing general satisfaction with the course. A smaller group suggested adding practical examples, interactive content, or improving usability and structure, highlighting potential areas for targeted enhancements.

3.3.2 Module 2: Extractive Waste Management

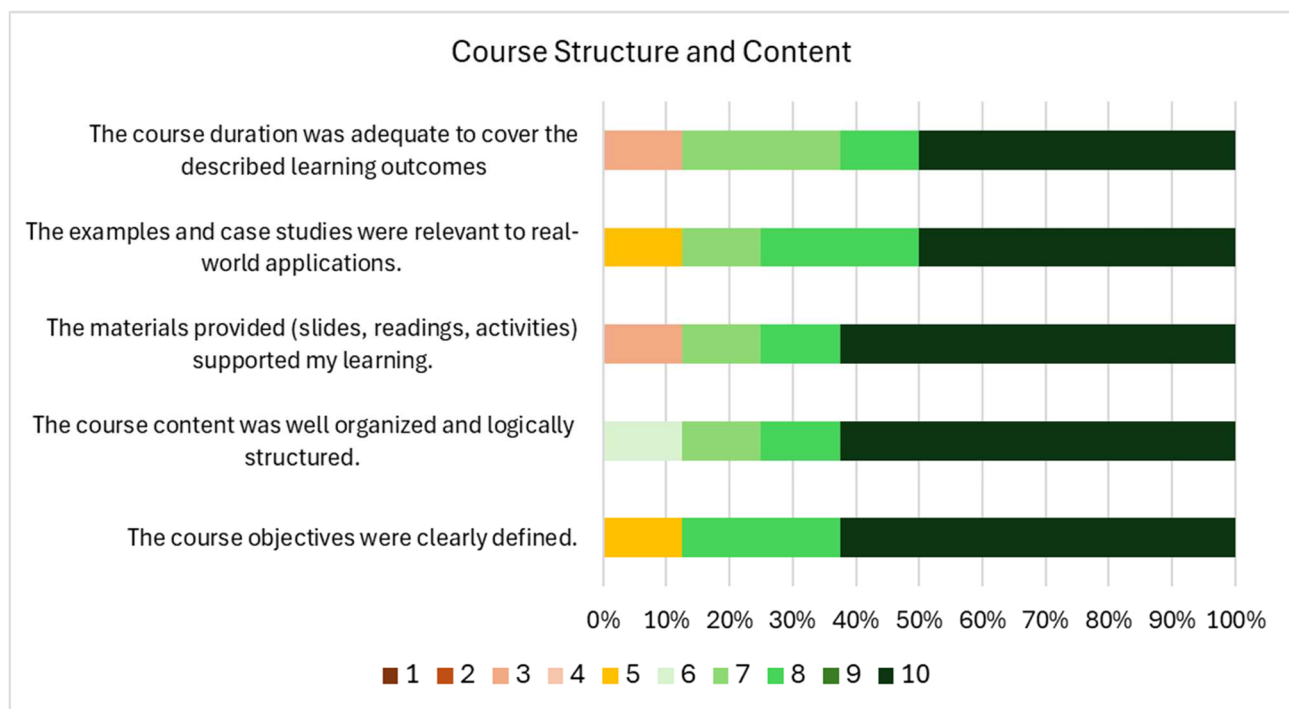


Figure 35. Results of section B- of the Module Extractive Waste Management

Participants rated the course structure and content very positively. A strong majority found the course objectives clearly defined (87.5% rated 8–10) and the content well organized and logically structured (75% rated 8–10). Learning materials such as slides, readings, and activities were considered supportive by 75% of respondents, while examples and case studies were relevant to real-world applications for 75% of participants when combining the top ratings. Most participants also agreed that the course duration was adequate to cover

the learning outcomes (62.5% rated 8–10). Overall, the course was seen as well-structured, with clear objectives, supportive materials, practical examples, and sufficient duration to achieve its goals.

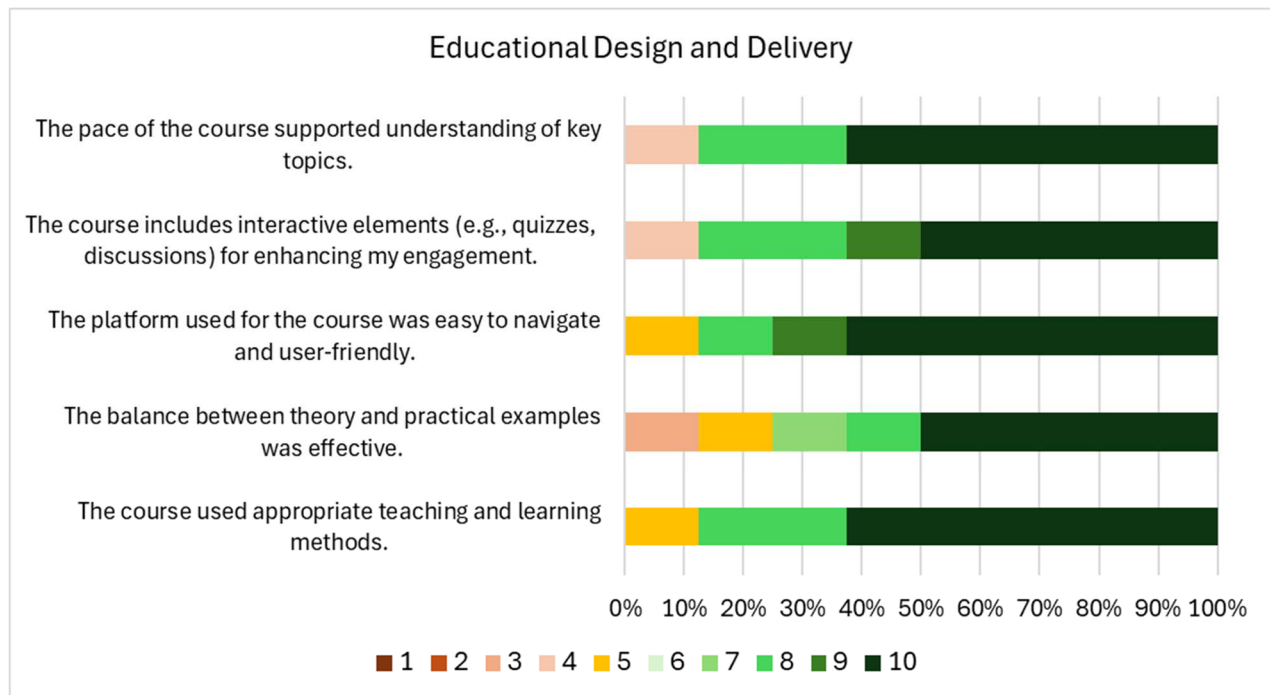


Figure 36. Results of section C- of the Module Extractive Waste Management

Participants rated the educational design and delivery of the course very positively. Most agreed that the course used appropriate teaching and learning methods (87.5% rated 8 and more) and that the balance between theory and practical examples was effective (62.5% answers between 8–10). The course platform was user-friendly and easy to navigate for 75% of respondents. Interactive elements such as quizzes and discussions enhanced engagement for 63%, and the pace of the course supported understanding of key topics for 87.5% of participants. Overall, the course was considered well-designed, effectively combining clear methods, practical examples, interactive tools, and an appropriate pace to support learning.

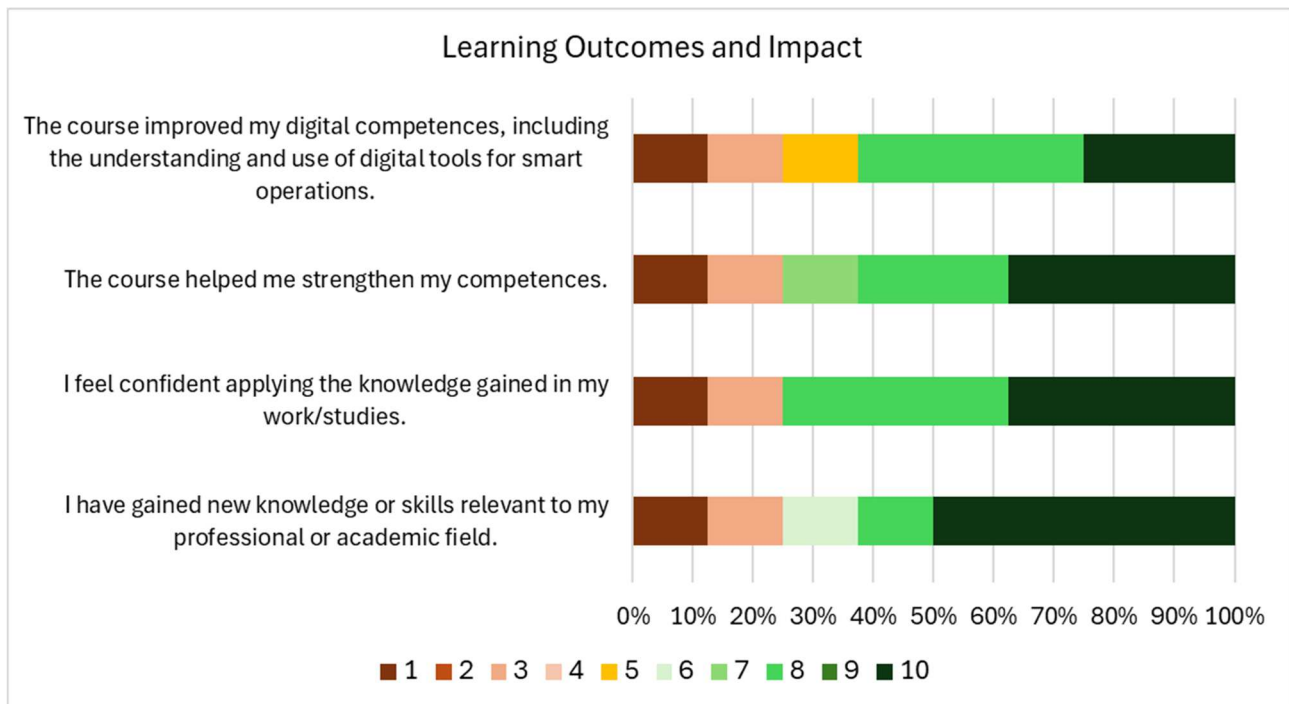


Figure 37. Results of section D- of the Module Extractive Waste Management

Participants reported positive outcomes from the course. A total of 62.5% agreed or strongly agreed that they gained new knowledge or skills relevant to their professional or academic field. Confidence in applying this knowledge was similarly high, with 75% agreement. The course helped strengthen competences for 62.5% of participants, while digital competences, including the understanding and use of digital tools, improved for 62.5%. Overall, the course was effective in enhancing knowledge, practical skills, competences, and digital literacy, though a smaller portion of participants indicated more moderate outcomes, suggesting some variability in experience.

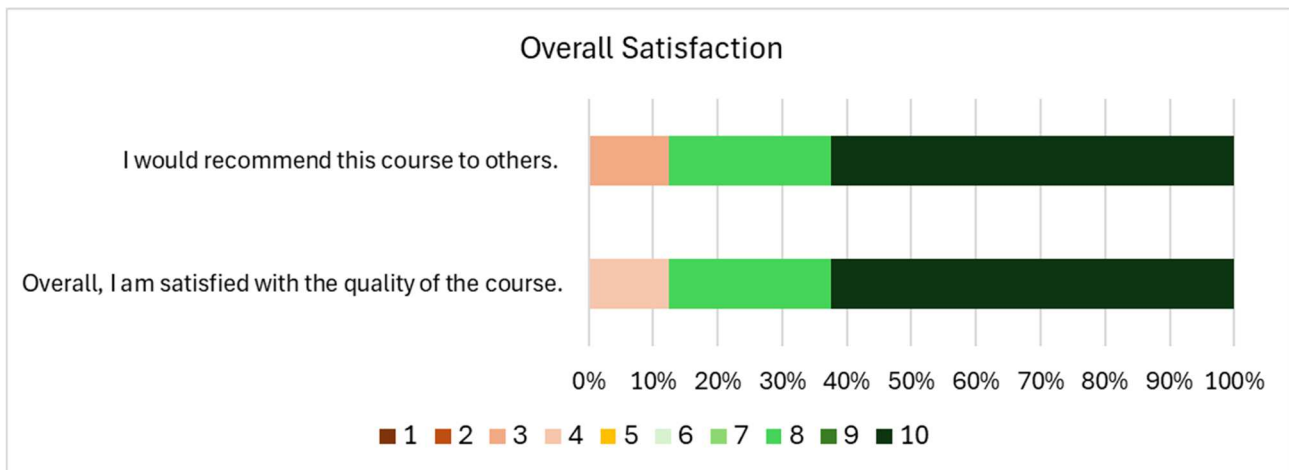


Figure 38. Results of section E- of the Module Extractive Waste Management

Participants were highly satisfied with the course. A total of 87.5% agreed or strongly agreed that they were satisfied with the quality of the course, and an equal 87.5% would recommend it to others. These results indicate strong overall satisfaction and endorsement from participants.

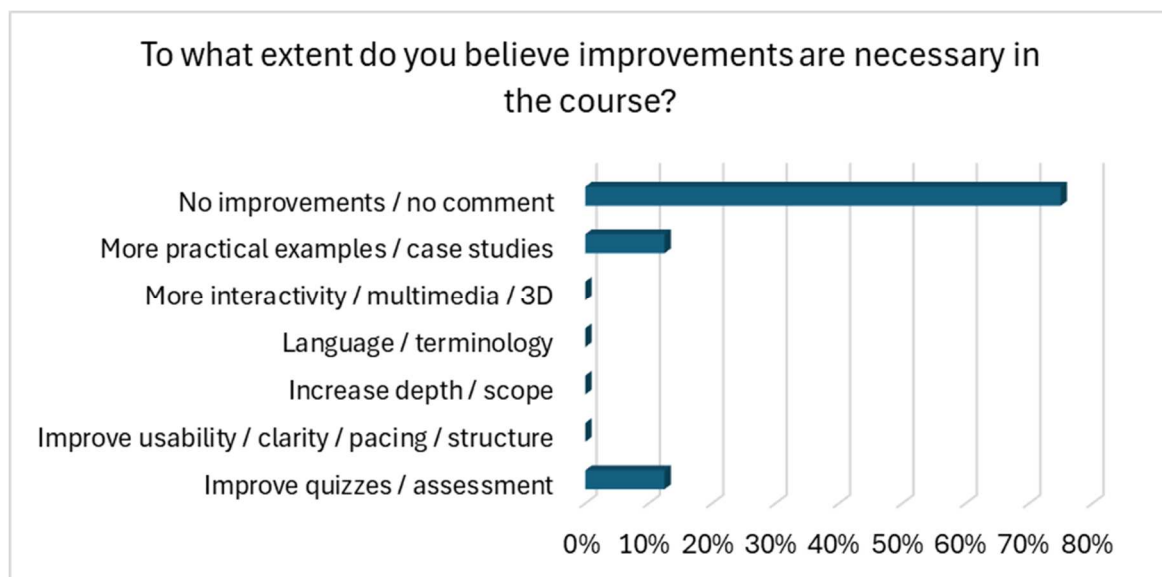


Figure 39. Results of the Section F- Future Recommendations of the Module Extractive Waste Management

The vast majority are satisfied with the course as it is. Nonetheless, small minorities would value more practical examples, case studies, or improved assessments. Other changes (interactivity, terminology, scope, structure) are nearly negligible in demand.

3.3.3 Module 3: Physical Metallurgy of Cu

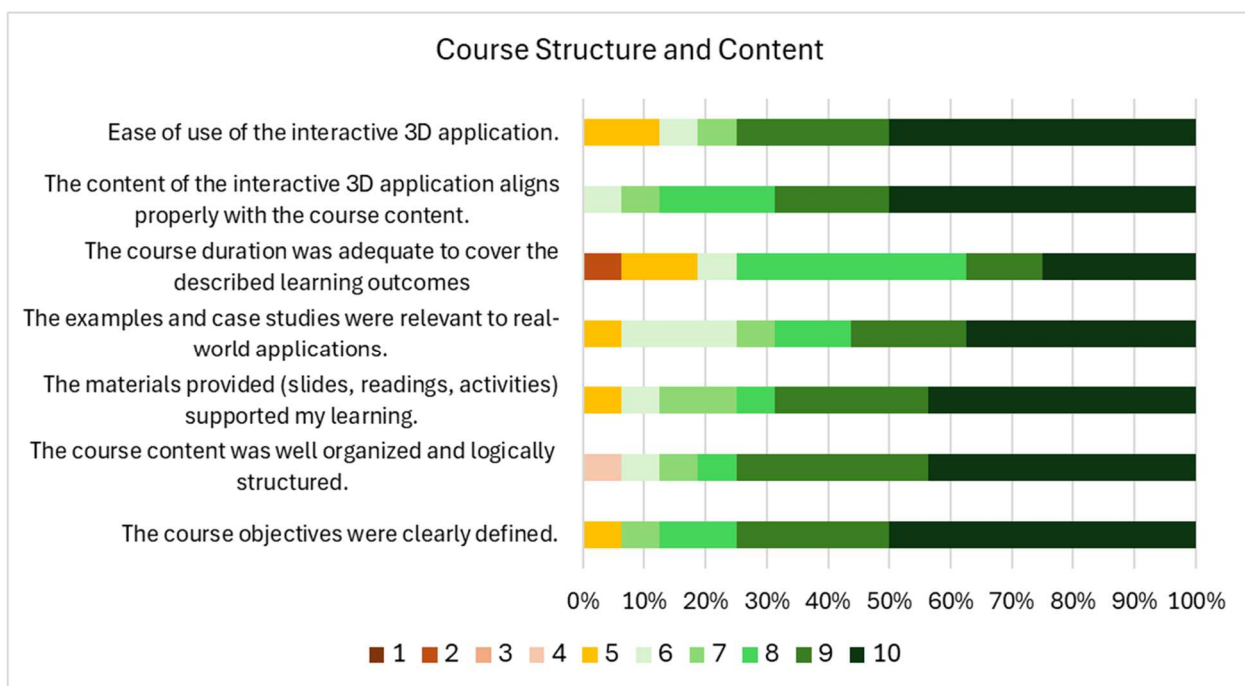


Figure 40. Results of section B- of the Module Physical Metallurgy of Cu

Participants rated the course structure and content very positively. A total of 87.5% agreed or strongly agreed that the course objectives were clearly defined. The content was well organized and logically structured, with 75.1% agreement, and the provided materials (slides, readings, activities) supported learning for 75% of respondents. Examples and case studies were relevant to real-world applications for 68.8%, while most participants found the course duration adequate to cover the learning outcomes (75%). The interactive 3D application was considered highly aligned with the course content (87.6%) and easy to use (75%). Overall, the course was well-structured, with clear objectives, supportive materials, practical examples, and effective interactive tools.

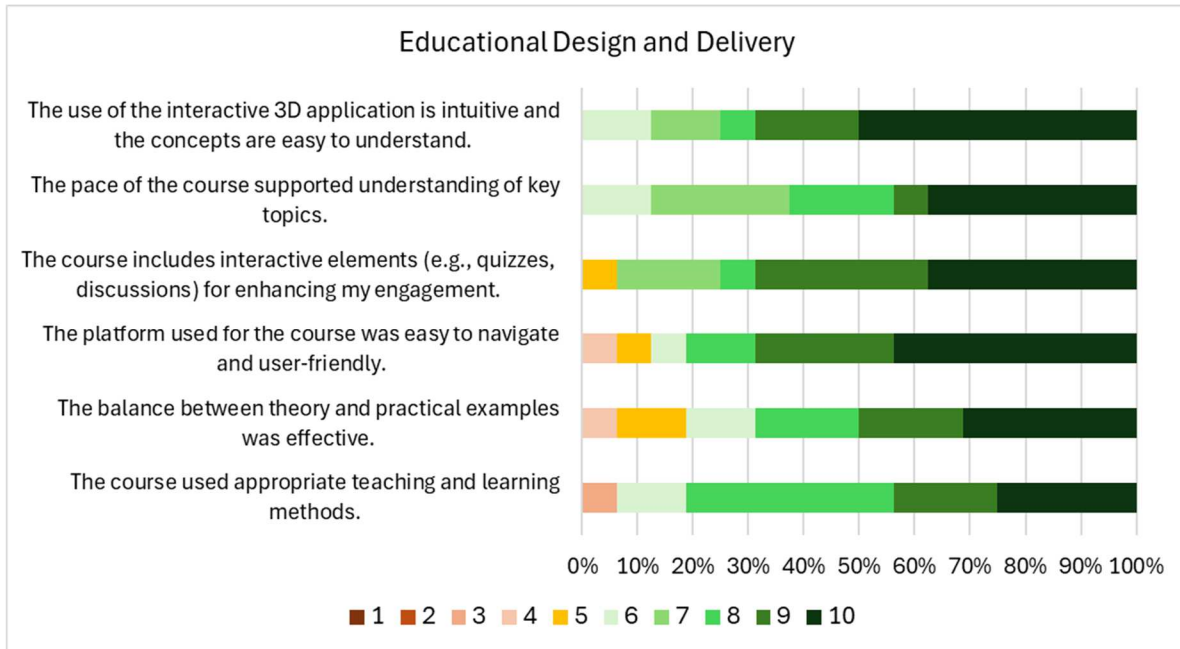


Figure 41. Results of section C- of the Module Physical Metallurgy of Cu

Participants rated the educational design and delivery of the course very positively. A total of 81.6% agreed or strongly agreed that the course used appropriate teaching and learning methods, while 68.1% felt that the balance between theory and practical examples was effective. The course platform was considered easy to navigate and user-friendly by 81.3% of respondents. Interactive elements such as quizzes and discussions enhanced engagement for 75.1%, and the course pace supported understanding of key topics for 62.6%. The interactive 3D application was intuitive and helped clarify concepts for 75.1% of participants. Overall, the course effectively combined clear methods, practical examples, interactive tools, and an appropriate pace to support learning.

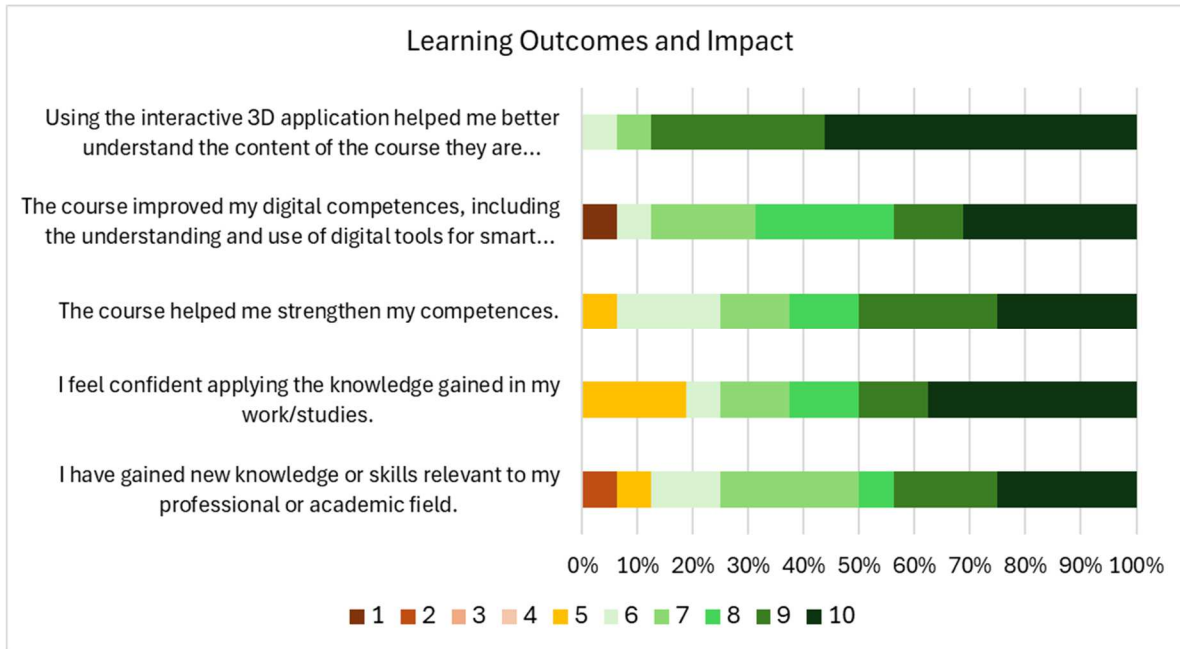


Figure 42. Results of section D- of the Module Physical Metallurgy of Cu

Participants reported positive learning outcomes from the course. A total of 50% agreed or strongly agreed that they gained new knowledge or skills relevant to their professional or academic field. Confidence in applying the knowledge was high, with 63% agreement. The course helped strengthen competences for 63% of participants, and digital competences improved for 69%. Using the interactive 3D application enhanced understanding of the course content for 88% of respondents. Overall, the course effectively supported knowledge acquisition, skill development, and digital literacy, with the interactive 3D tools playing a key role in enhancing understanding.

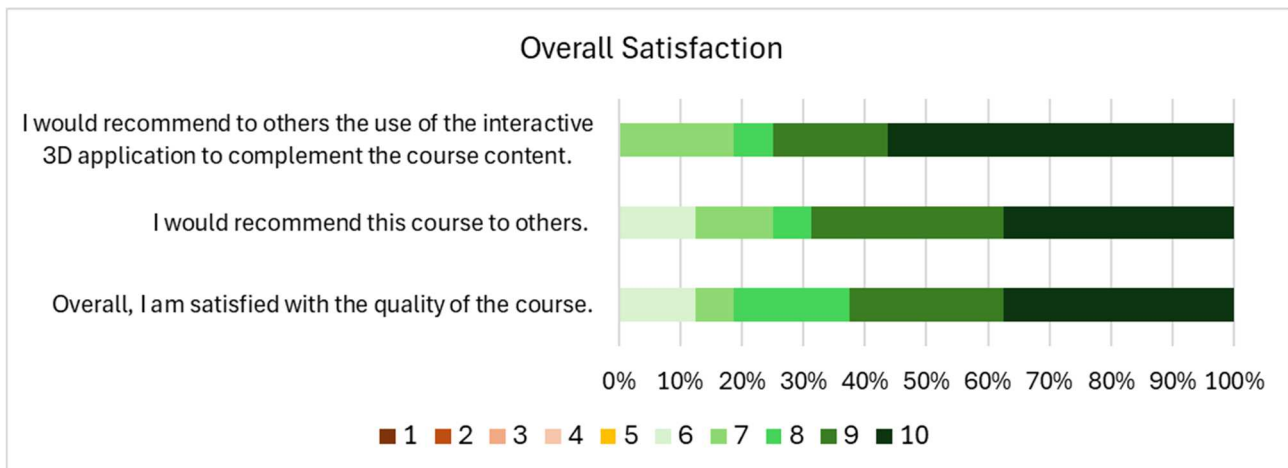


Figure 43. Results of section E- of the Module Physical Metallurgy of Cu

Participants were highly satisfied with the course. A total of 81% agreed or strongly agreed that they were satisfied with the overall quality of the course, and an equal 75% would recommend it to others. The interactive 3D application was particularly well-received, with 81% agreeing or strongly agreeing that they would recommend its use to complement the course content (100% of the scoring were 7 and more). Overall, participants expressed strong satisfaction with both the course and its interactive elements.

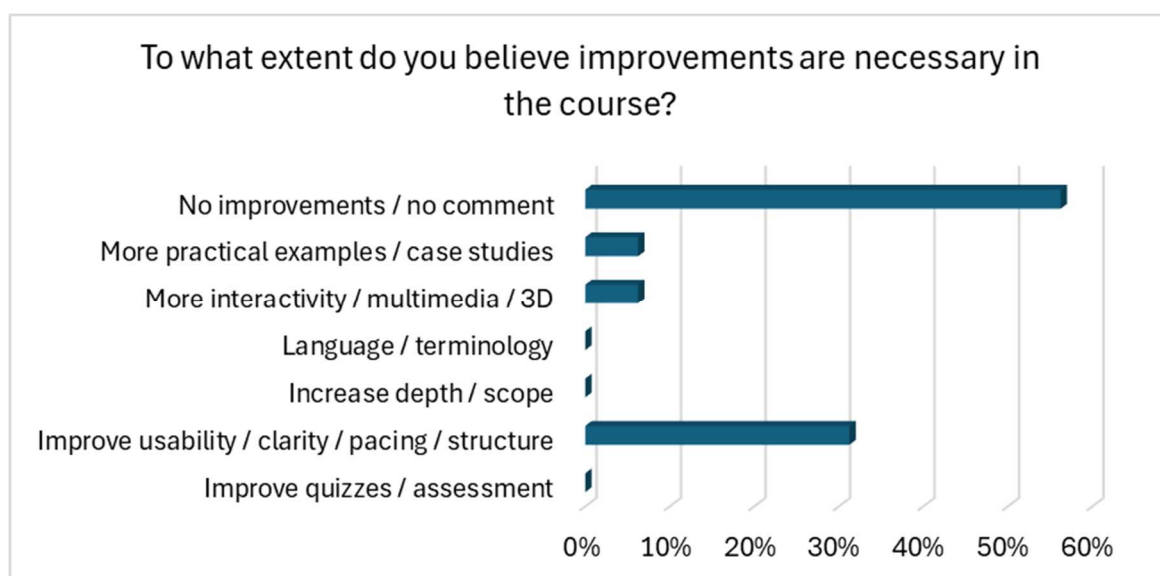


Figure 44. Results of the Section F- of the Module Physical Metallurgy of Cu

Overall, most respondents indicated that no further development or changes were necessary. A small portion suggested that adding more practical examples and case studies could positively enhance the learning experience in Module 3 – *Physical Metallurgy of Cu*. Additionally, around 30% of participants highlighted the importance of focusing on the course’s usability, clarity, and structure. Finally, pacing was also noted as an area with potential for improvement.

3.3.4 Module 4: Health and Safety

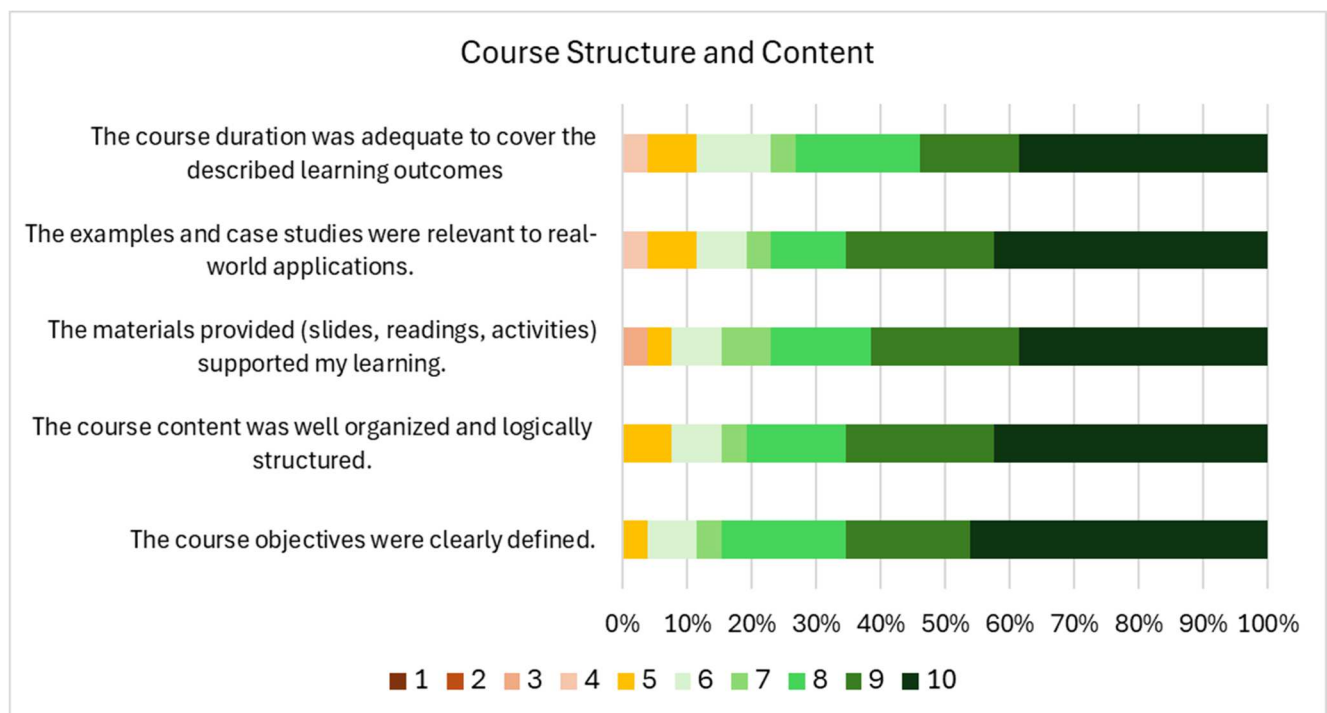


Figure 45. Results of section B- of the Module Health & Safety

Course objectives were clearly defined, with about 85% of positive responses (7 and more), the lowest score was 5- 3.8%. Course content was well-organized and logical for more than 65.4% (rated 9 or 10). Responders described learning materials as supportive in terms of learning effectively 61.6% rated 9 or 10. Examples and case studies were relevant to real-world applications (65.4% rated 9 or 10, minor lower ratings 3.8%–7.7% for 4–7). Course duration was generally assumed as adequate (53.9% rated 9 or 10, 3.8%–11.5% rated 4–7), reflecting strong overall satisfaction across all aspects.

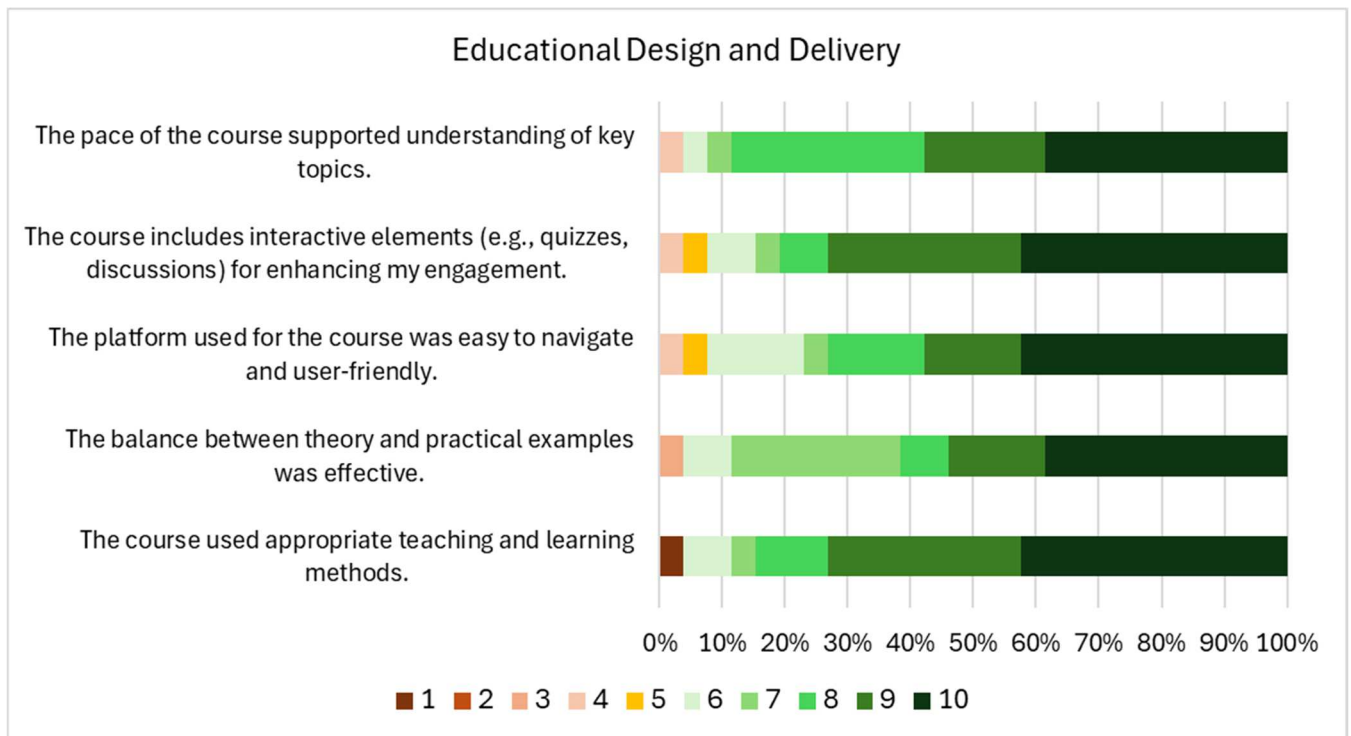


Figure 46. Results of section C- of the Module Health & Safety

The evaluation of the module's educational design and delivery was very positive. Teaching and learning methods were highly rated, with 73.1% scoring 9 or 10, and only a few lower ratings. The balance between theory and practice was adequate (53.9% rated 9–10), and the platform was generally described as user-friendly and easy to navigate (more than 90% of the participants find it positive- 5 or more on the scale). Interactive elements such as quizzes and discussions were well-received (73.1% rated 9–10), and the module pace supported understanding (57.7% rated 9–10).

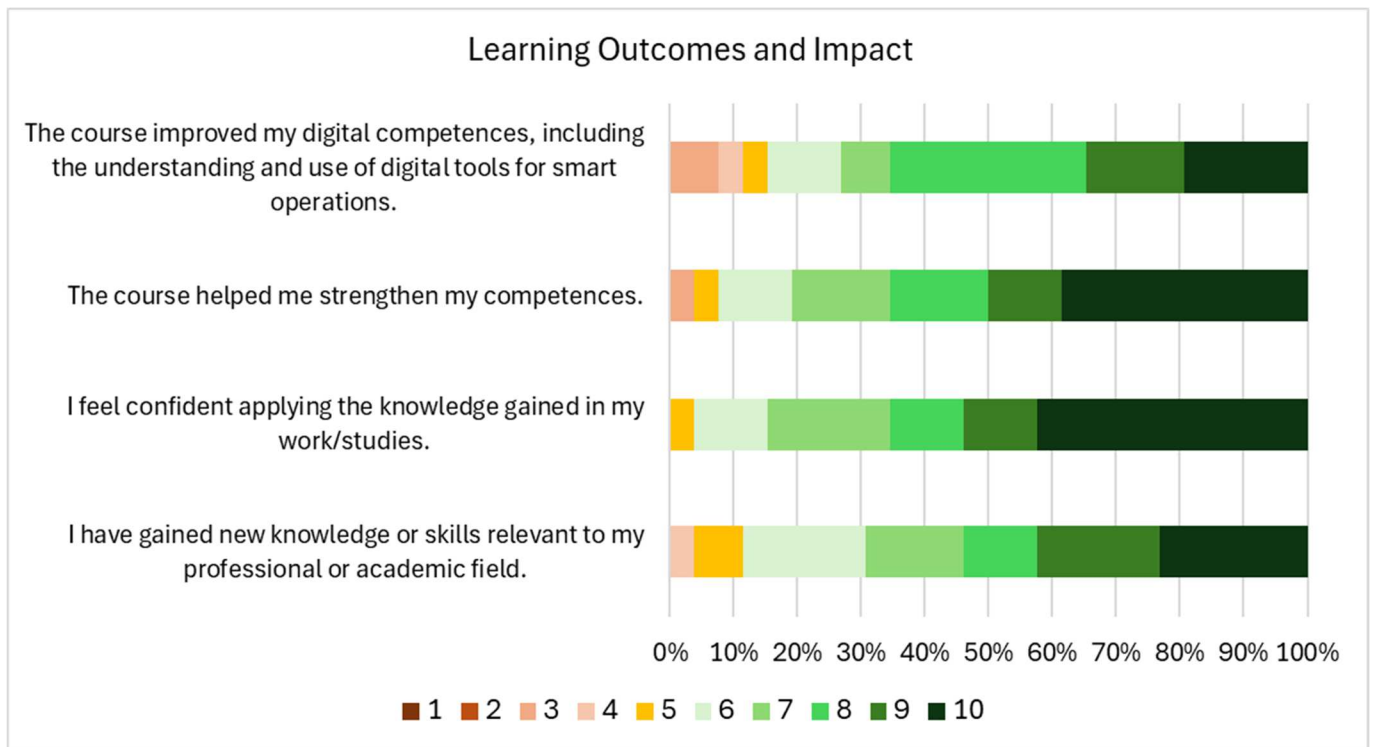


Figure 47. Results of section D- of the Module Health & Safety

A significant number of responders reported gaining new knowledge or skills relevant to their field (42.3% rated 9 or 10) and feeling confident in applying this knowledge (53.8% rated 9 or 10). Participants also noted improvements in their competencies (50% rated 9 or 10) and digital skills, including understanding and using digital tools for smart operations (34.6% rated 9 or 10). Notably, no participant gave the lowest ratings (1 or 2) for any element, and the remainder of responses were moderate. Overall, the module effectively supported skill development, competence enhancement, and practical application of knowledge.

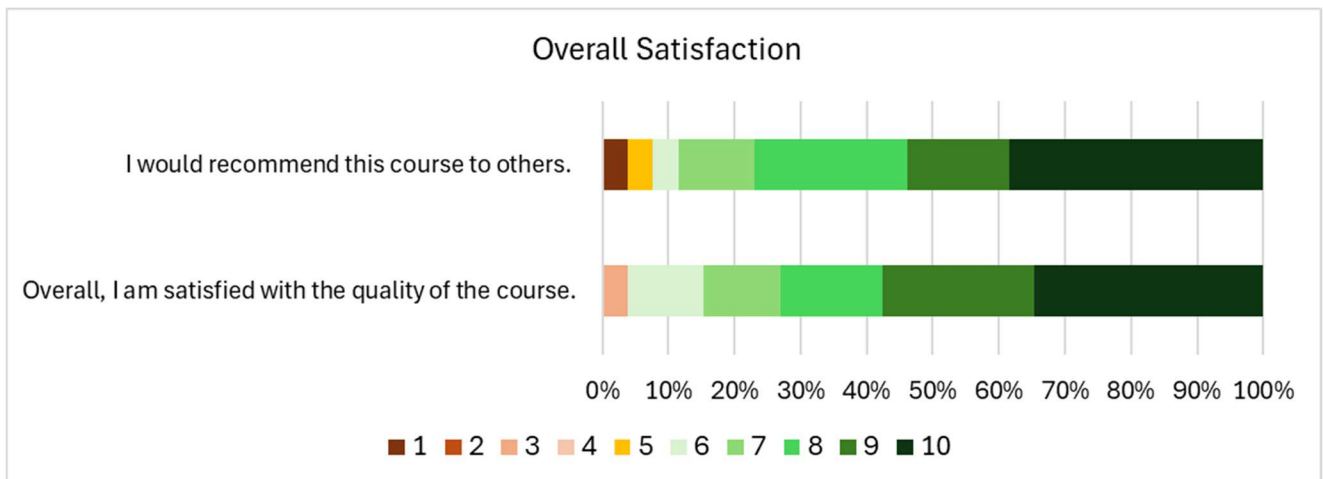


Figure 48. Results of section E- of the Module Health & Safety

Participants reported strong overall satisfaction with the module. 58% rated the quality 9 or 10, and 53.9% indicated they would recommend the module to others. Very few low ratings were recorded: for both questions 3,8% of responses were 3 or less. Overall, the results reflect a high level of satisfaction and a strong likelihood of participants endorsing the module.

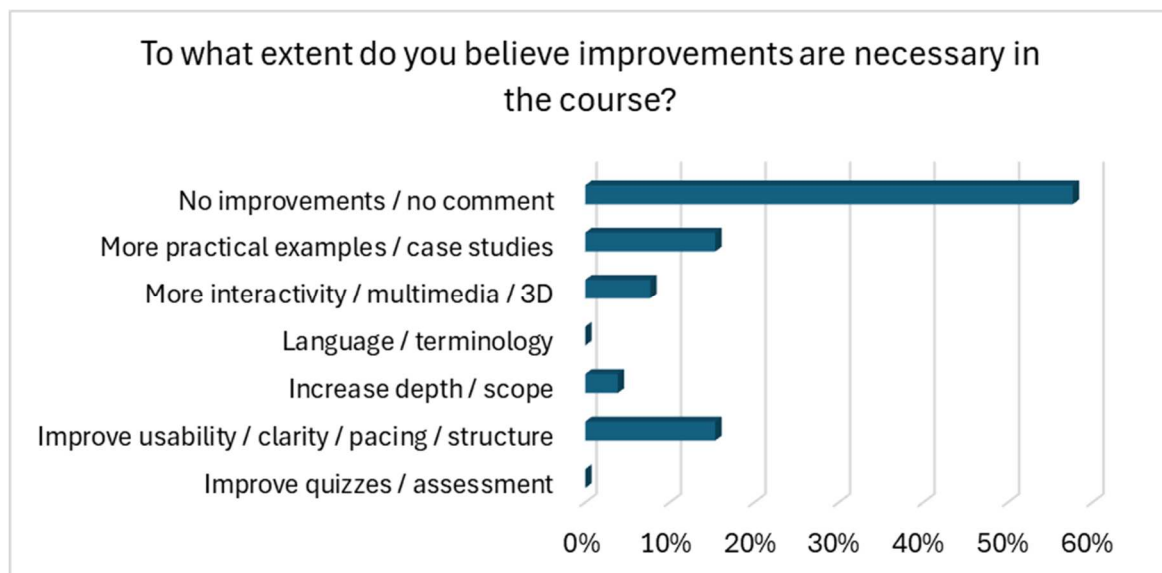


Figure 49. Results of the Section F- of the Module Health & Safety

Similar to previous responses, this module received comparable feedback. Over 50% of respondents did not see a need for further changes to the training or did not feel the need to comment on the course. Additional areas suggested for improvement included expanding the scope of the module or providing more detailed coverage of the topics it contains. Around 15% of participants highlighted aspects such as “usability, clarity, pacing, and structure”, as well as the need for more “interactivity, multimedia, and 3D elements”, as areas for further development.

3.3.5 Module 5: Soft Skills

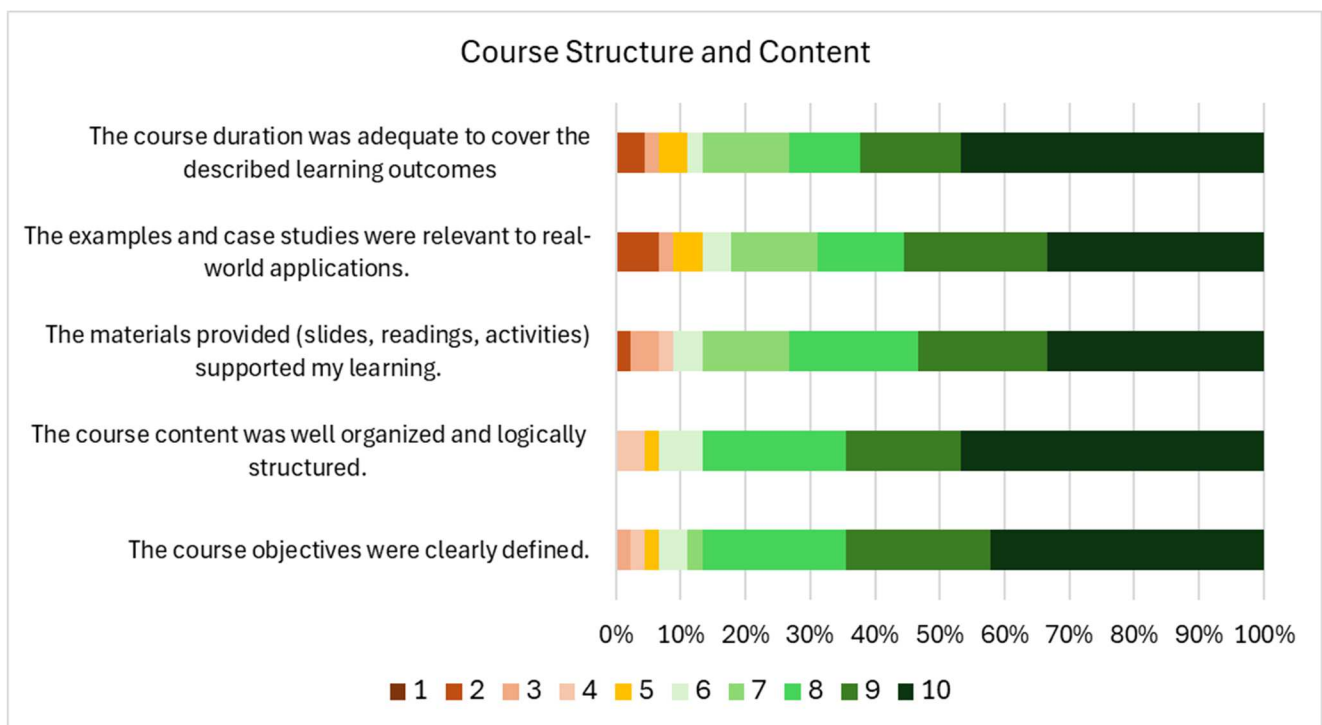


Figure 50. Results of section B- of the Module Soft Skills

The first area of Module Soft Skills was generally positively rated. Course objectives were considered clear, with 42.2% rating 10 and 22.2% rating 9, while only a few gave lower scores (2.2%–4.4%). The course content was seen as well-organized and logical (46.7% rated 10, 17.8% rated 9), and learning materials such as slides, readings, and activities effectively supported learning (33.3% rated 10, 20% rated 9). Examples and case studies were relevant to real-world applications (33.3% rated 10, 22.2% rated 9), and the course duration was generally adequate to cover the learning outcomes (46.7% rated 10, 15.6% rated 9). Overall, most participants gave high ratings, indicating strong satisfaction with the course structure, content, and practical applicability.

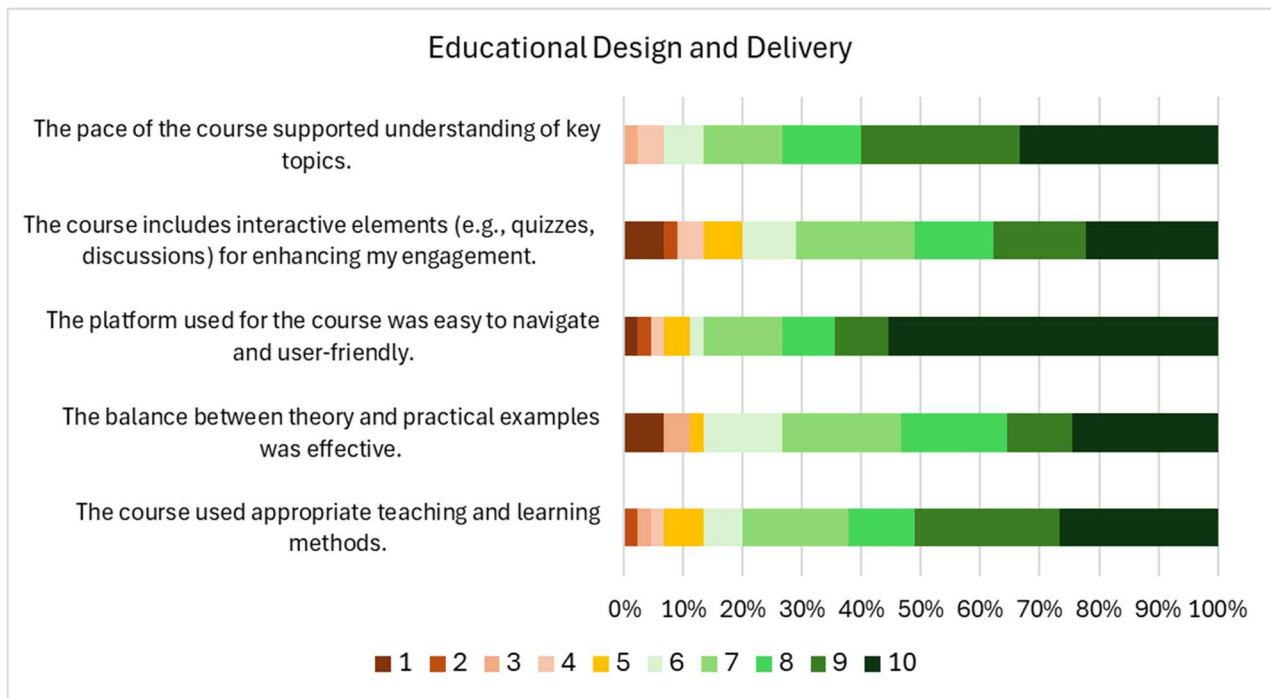


Figure 51. Results of section C- of the Module Soft Skills

Participants responded very positively to the module’s educational design and delivery. Teaching and learning methods were rated highly, with 26.7% giving a score of 10 and 24.4% giving a score of 9. The balance between theory and practical examples was effective, with 24.4% rating 10 and 11.1% rating 9. Interactive elements such as quizzes and discussions were valued, with 22.2% rating 10 and 15.6% rating 9. The platform was easy to use, with 55.6% rating 10 and 8.9% rating 9, and the module pace supported understanding, with 33.3% rating 10 and 26.7% rating 9. Overall, the results demonstrate strong satisfaction with the module’s design, delivery, and engagement features.

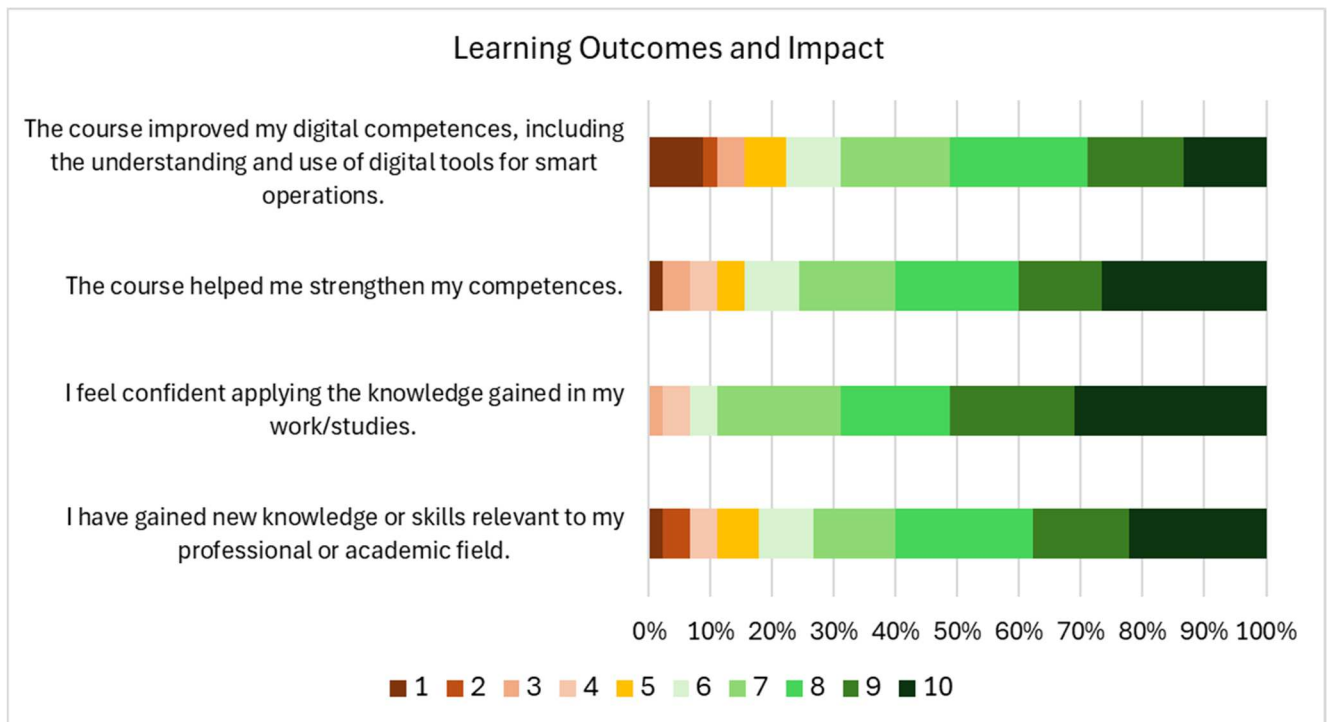


Figure 52. Results of section D- of the Module Soft Skills

Positive learning outcomes and impact were reported by participants for the module. New knowledge and skills relevant to professional or academic fields were gained, with 22.2% of participants rating 10 and 15.6% rating 9, while lower ratings ranged from 2.2% to 13.3%. Confidence in applying the knowledge acquired was expressed by 31.1% rating 10 and 20% rating 9. Competences were strengthened, with 26.7% rating 10 and 13.3% rating 9. Digital competences, including the use of digital tools for smart operations, were improved, with 13.3% rating 10 and 15.6% rating 9, and lower ratings remained limited. Overall, meaningful learning gains and enhanced skills were demonstrated across multiple areas.

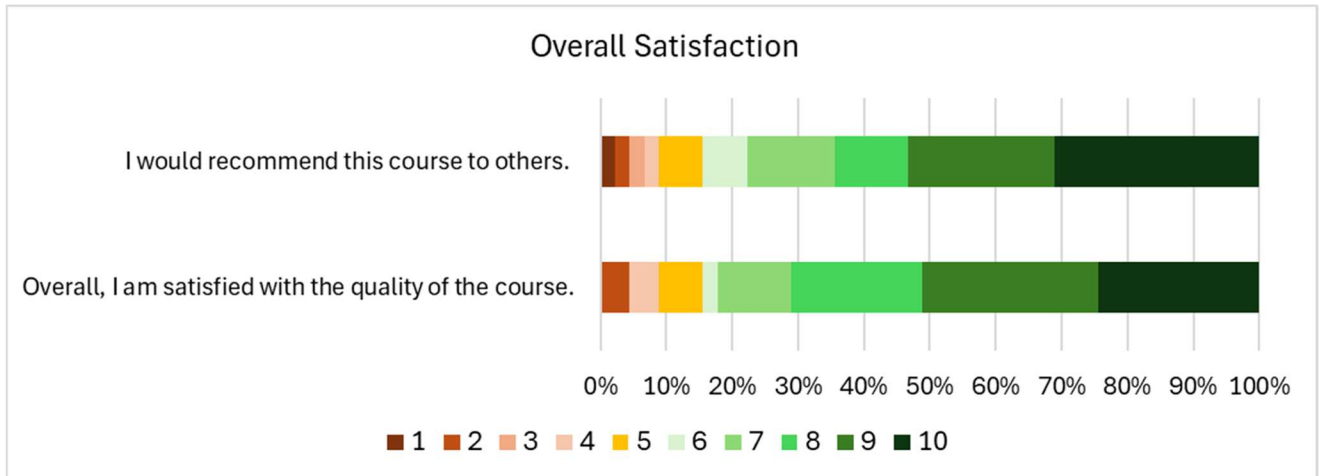


Figure 53. Results of section E- of the Module Soft Skills

High overall satisfaction with the module was reported. Satisfaction with the quality of the module was reflected in 24.4% of participants assigning a score of 10 and 26.7% assigning a score of 9, while moderate ratings were given by smaller shares, including 20.0% rating 8 and 11.1% rating 7. Willingness to recommend the module to others was also strong, with 31.1% rating 10 and 22.2% rating 9, supported by 11.1% rating 8. Lower ratings were limited and did not indicate widespread dissatisfaction.

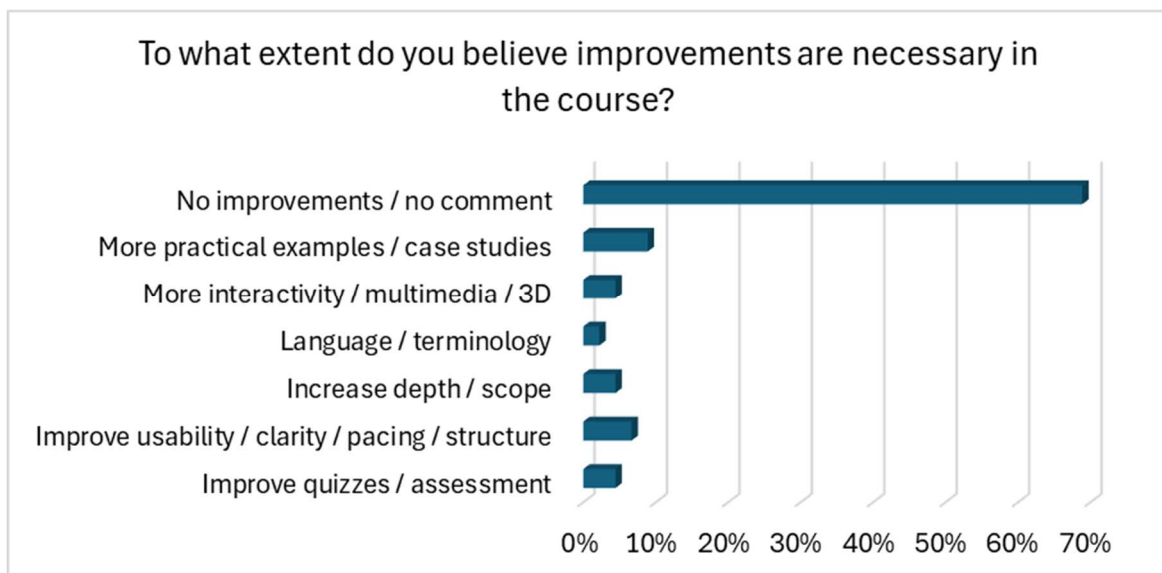


Figure 54. Results of the Section F- of the Module Soft Skills

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Most participants (69%) saw no need for improvements or did not comment. For each of the rest of the questions there was small number of suggested changes: 9% of the participants recommended more practical examples and case studies, 7% highlighted usability, clarity, pacing, and structure, 4% proposed improving quizzes and assessments, 4% suggested increasing depth or scope, 4% recommended more interactivity, multimedia, or 3D elements, and 2% mentioned refining language or terminology. Overall, the majority were satisfied with the current course

3.4 Summary

In general, the results of the online surveys indicate that the Course of SkiComCu was very positively received by participants. High ratings were recorded across all evaluated areas, including course structure and content, educational design and delivery, learning outcomes and impact, and overall satisfaction. Participants particularly appreciated the clear objectives, well-organized content, user-friendly platform, effective teaching methods, and relevant practical examples. The learning courses were found to support the development of professional, technical, and digital competences, while also increasing confidence in applying the acquired knowledge in practice. Several areas for potential improvement were identified, such as adding more practical examples or increasing the level of detail in courses and training (specific results are presented in the section above). These areas will be re-evaluated, and after analysing the feasibility and relevance of implementing any changes, the training will be adjusted accordingly.

Overall, the survey results confirm the high quality of the module and its strong educational value.

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4. Conclusions

This report provides a description of the process of validation and verification educational materials and XR tools developed within the SkiComCu-LL project. The primary aim of these activities was to present the methodology used for testing and validating the project outputs. Consortium partners actively participated in all of the activities, evaluating the effectiveness and identifying areas where improvements or enhancements could be introduced. These efforts were focused not only on ensuring the technical functionality of the tools but also on assessing their attractiveness, relevance, and competitiveness in the broader market of online courses and training programs. The materials were designed to meet industry needs, address identified skills gaps, and prepare the copper sector workforce for future demands and evolving competencies.

Key strengths were identified, including the clarity of course objectives, logical organization of content, and practical relevance of examples and case studies. At the same time, specific areas for improvement were highlighted to guide future development. These include occasional system errors, limited practical examples, and the duration of certain sessions within the Modules. Participants also suggested potential enhancements, such as incorporating additional multimedia materials, scenario-based exercises, or other interactive elements to increase engagement and interactivity.

Overall, feedback from both in-person and online training sessions was highly positive, demonstrating satisfaction with both the content and the technological platform. Most participants reported gaining new skills and knowledge, and expressed confidence in applying what they learned in their professional or academic contexts. While the majority of feedback was favourable, the identified areas for improvement provide clear guidance for further refinement. Importantly, some suggestions—such as the addition of supplementary multimedia or scenario-based content—were not part of the original project scope but indicate promising directions for the future development of these training programs.

In conclusion, the validation and verification process confirms that the SkiComCu-LL training materials are effective, relevant, and well-received, while also highlighting opportunities to further enhance interactivity, practical application, and overall user experience. These insights will help ensure that the project delivers high-quality, industry-relevant training solutions that remain competitive and impactful in a rapidly evolving sector.