The FuturENG Experience Report

Learn. Experience. Transform. – Empowering the Next Generation of Engineers

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Executive Summary

This report shares the experience and key findings from the implementation and validation of two core FuturENG results: the "Tech Essentials for Engineering Students" MOOC (Result 1) and the Challenge-Based Learning (CBL) Toolbox (Result 2). These activities took place across three partner universities and included local pilot testing, a digital hackathon, and a Learning, Teaching and Training Activity (LTTA) hosted by ISQ in Portugal.

During the pilot phase, the MOOC and the CBL Toolbox were tested with students from different engineering and STEM fields, supported by university facilitators. The feedback gathered through structured questionnaires showed that both tools were highly valued for their clarity, usability, and pedagogical relevance, while also suggesting areas for improvement and contextual adaptation.

The **digital hackathon** provided an opportunity to test the CBL approach in practice, highlighting how **interdisciplinary, challenge-based learning** can inspire creativity and teamwork in engineering education. Similarly, the **LTTA in Portugal** offered students an immersive international learning experience—combining hands-on activities in ISQ's technical laboratories with reflective teamwork and intercultural exchange.

These activities helped students strengthen essential skills such as **collaboration, problem-solving, and communication**, while also generating valuable feedback for the project team through a **co-creation workshop** held during the third project meeting in Portugal.

Beyond testing and validation, the FuturENG implementation created a **rich, engaging learning journey**—blending online learning, teamwork across borders, and real-world applications. For many students, it was a **unique opportunity to explore innovation environments** and apply their knowledge in authentic, high-impact contexts.

The outcomes of this phase confirm the **relevance and practical value** of the WP2 results, while also identifying next steps—such as providing stronger support for educators, adapting materials to different learner profiles, and expanding opportunities for hands-on application. The insights gained from this stage will guide the upcoming project activities and contribute to the **broader Erasmus+ goals of innovation and excellence in higher education**.

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Introduction

This document provides a comprehensive overview of the FuturENG implementation experience with a focus on Work Package 2 (WP2) – the development and piloting of innovative learning resources for higher education engineering students. It draws upon the activities carried out across partner institutions, capturing the perspectives of both students and staff involved in testing the MOOC and Challenge-Based Learning (CBL) Toolbox.

Particular attention is given to the implementation process, including the pilot phases, the digital hackathon, and the Learning, Teaching and Training Activity (LTTA) hosted by ISQ. During the LTTA week, participants also took part in a workshop conducted as part of TPM3, contributing to the need analysis and refinement of WP2 outputs.

This report is intended to inform internal and external stakeholders, including the European Commission and the Erasmus+ National Agency, providing both qualitative and contextual insights into the deployment of the WP2 resources and their validation in real learning environments.

1. Methodology

1.1 Purpose and Scope

The methodological approach adopted for this report was designed to document and analyse the implementation process of the FuturENG learning resources developed under WP2. The aim was to gather meaningful evidence on how the resources were received and used by higher education students, to identify strengths and areas for improvement, and to inform the ongoing development and refinement of project outputs.

The scope of the data collection was limited to student-facing activities, namely the pilot testing of the MOOC and CBL Toolbox, the digital hackathon, and the Learning, Teaching and Training Activity (LTTA). Data collection efforts focused on user feedback, participation quality, and learning experiences, rather than technical performance or long-term outcomes.

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1.2 Data Collection Methods

The data presented in this report was collected through a combination of structured and semi-structured methods applied across the main implementation stages of WP2.

During the piloting phase of the FuturENG learning resources, the MOOC and the Challenge-Based Learning (CBL) Toolbox were tested by students using the project's dedicated Moodle platform. Upon completion, participants were invited to provide feedback via a questionnaire combining closed-ended and open-ended questions. This instrument was designed to assess usability, relevance, clarity of content, and perceived learning outcomes.

The digital hackathon, held online via Zoom, served primarily as a platform for student teams to present their CBL project results. No formal feedback collection from students took place in this phase. However, qualitative performance data was gathered through the use of structured evaluation grids completed by jury members in real time. The judging process took place across two parallel Teams sessions, with each partner organisation delegating at least one evaluator per room. Each team was scored against a predefined set of criteria on a scale from 1 to 5, producing a final ranking that identified the winning teams.

Finally, during the Learning, Teaching and Training Activity (LTTA) hosted by ISQ, participating students were asked to complete a feedback questionnaire at the end of the training week. This instrument captured their reflections on the overall experience, including the training sessions, interactions with international peers, and perceived impact of the activities on their learning and professional development.

1.3 Validation and Triangulation

In order to ensure the credibility of the findings, multiple sources of data were used across different phases of implementation. Quantitative data from student questionnaires (pilot and LTTA) were analysed alongside qualitative feedback from open-ended responses and facilitator observations. In addition, performance assessments during the hackathon were based on a standardised evaluation grid filled in by multiple evaluators from different partner institutions.

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This triangulation of data sources—combining direct user feedback, structured scoring rubrics, and facilitator input—helped to provide a balanced and comprehensive understanding of the implementation experience. It also ensured that the report reflects not only students' individual perceptions but also partner institutions' shared observations.

2. Key Activities

2.1. Pilot Implementations in Universities

As foreseen in the project proposal, the pilot phase of the FuturENG learning resources was carried out by the three partner universities: The George Emil Palade University of Medicine, Pharmacy, Science, and Technology of Târgu Mureș (Romania), Kaunas University of Technology (Lithuania), and FH Joanneum University if Applied Science (Austria). Each institution was responsible for testing the two core WP2 resources—the Tech Essentials MOOC and the Challenge-Based Learning (CBL) Toolbox—using the project's Moodle platform as the delivery environment.

In March – May, 2025 a total of 114 students from a variety of academic backgrounds participated in the pilot activities, including those enrolled in engineering programmes, business and management studies, and fields closely related to emerging technologies such as artificial intelligence. While the participant profiles varied, the objective was consistent across all institutions: to evaluate the usability, relevance, and pedagogical value of the resources in real higher education learning settings.

The implementation was supported by faculty members and institutional project team representatives, who provided technical and pedagogical guidance throughout the process. Feedback was gathered from students at the end of the pilot through a structured questionnaire that included both closed and open-ended questions. The main feedback points and insights, which supported the validation and consolidation of the WP2 resources were very positive and are presented below.

When students were asked about the most positive aspects of the pilot testing of the FuturENG Tech Essentials MOOC and CBL Toolbox, they provided the following comments.

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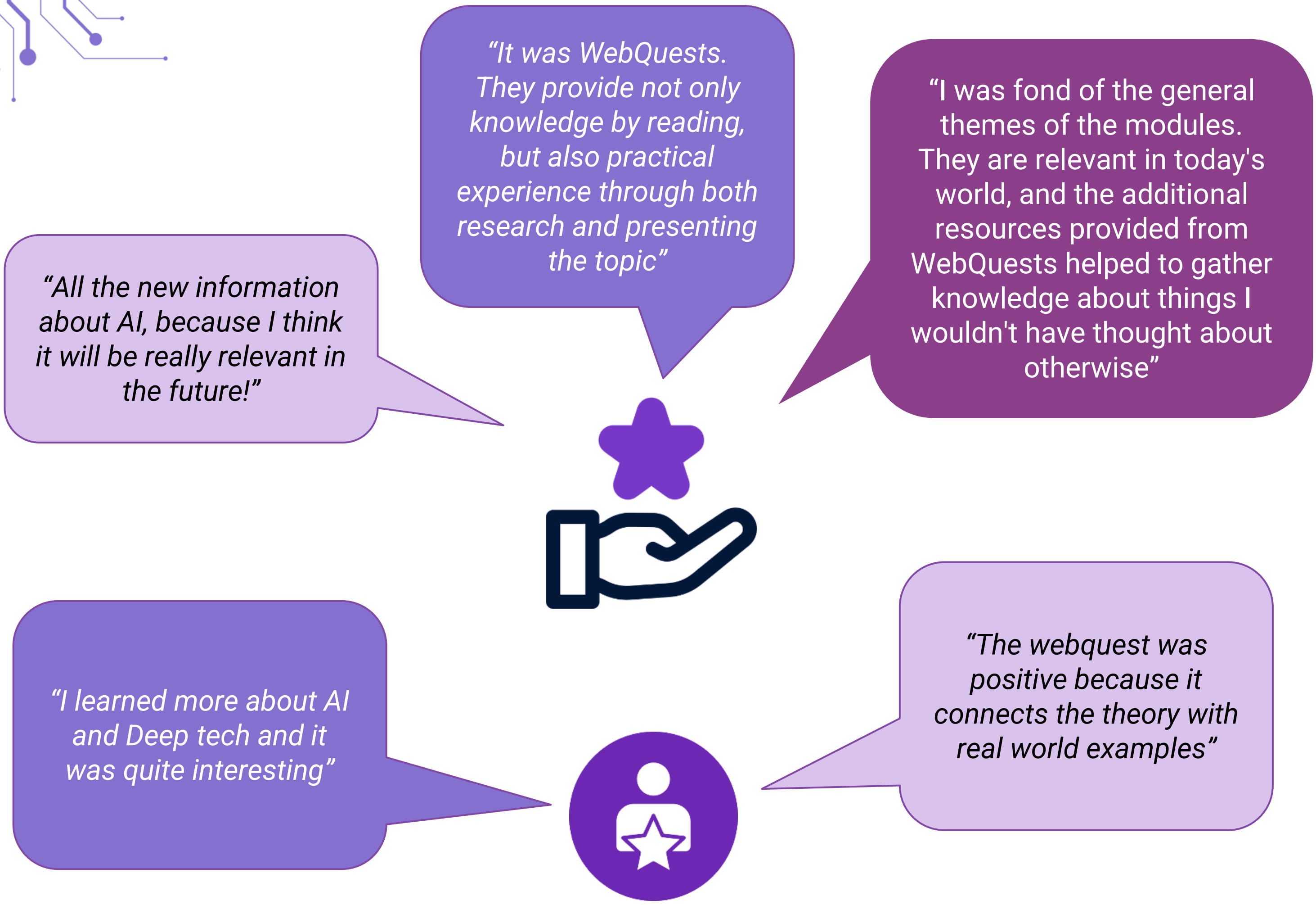

2.2. The FuturENG Digital Hackathon

The FuturENG Digital Hackathon, titled *"AI & Deep Tech for a Better Future"*, took place online on April 14–15, 2025, and brought together 45 students from the three participating universities: UMFST (Romania), Kaunas University of Technology (Lithuania), and FH Joanneum (Austria). Working in teams of 2 to 3 members, students were challenged to develop and pitch technology-based solutions to real-world problems, focusing on the following themes:

i) **AI & Deep Tech for Sustainability** –How can blockchain, IoT, or AI enhance waste management, recycling, and sustainable production?
ii) **Deep Tech for Social Good** – How can advanced technologies improve healthcare, education, or accessibility?

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iii) **Twin Transition: Digital & Green** – How can AI and deep tech drive both digital innovation and environmental sustainability across industries?

The event spanned two days. On the first day, participants were introduced to the concept and received thematic inputs from mentors on three challenge areas: AI & Deep Tech for Sustainability, Deep Tech for Social Good, and Twin Transition: Digital & Green. Teams then selected their preferred challenge and began developing a solution concept with support from mentors.

On the second day, teams presented their ideas in two parallel pitch sessions hosted via Microsoft Teams, each attended by a panel of evaluators composed of one representative from each partner organisation. Presentations followed a structured format, requiring teams to articulate a clear problem statement, propose a tech-based solution, assess its feasibility and impact, and address ethical and environmental considerations.

Evaluation was based on four criteria: Problem Understanding & Relevance, Innovativeness & Feasibility, Impact & Sustainability, and Presentation & Communication. Each judge scored teams on a scale from 1 to 5 per criterion, resulting in a maximum possible team score of 140 points. The highest-scoring team from each university was selected as a winner and invited to participate in the LTTA hosted by ISQ in Portugal.

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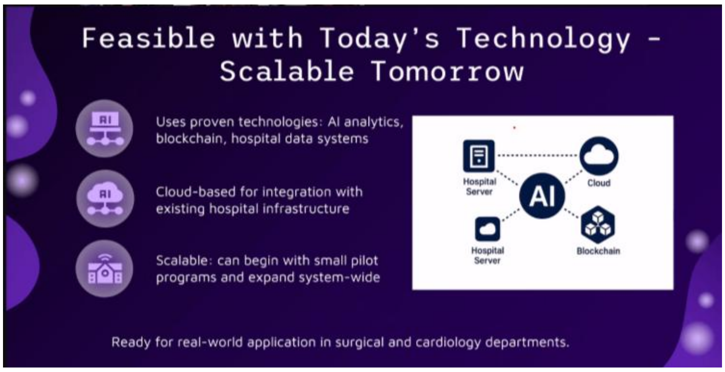
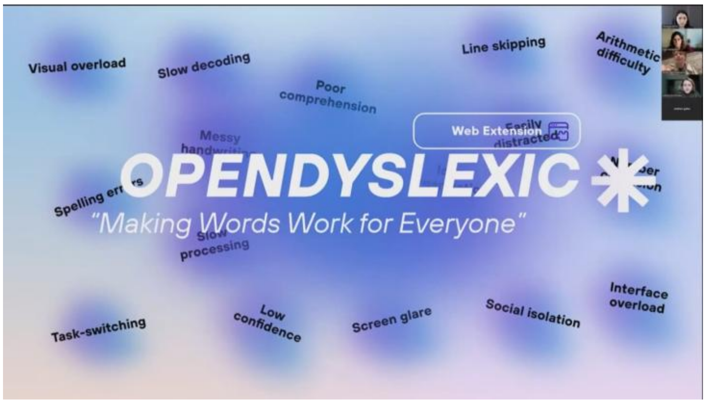
The hackathon served both as a validation mechanism for the Challenge-Based Learning methodology and as a high-engagement opportunity for students to apply the FuturENG tools in a real-life collaborative setting. It demonstrated the potential of cross-institutional, challenge-driven learning formats to foster creativity, interdisciplinary thinking, and ethical awareness in engineering education.

Meet the FuturENG tech-solutions….





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Meet the Hackathon Winning Teams & Their Solutions….

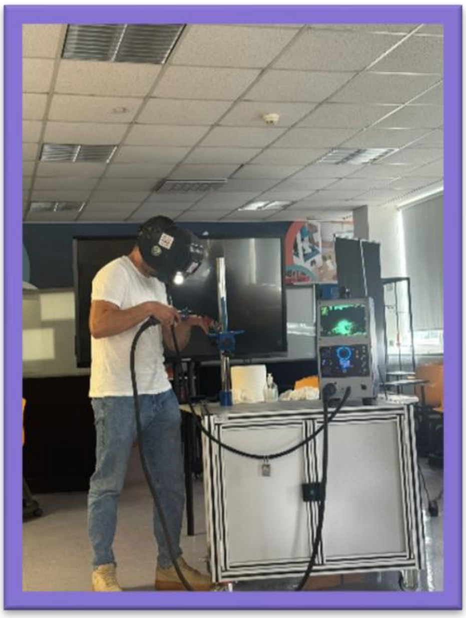
1 VR Re-education for Drunk Driving Prevention "Face the Crash" (KTU)
An impactful solution using virtual reality and electrode simulation to replicate car crash experiences—designed to emotionally engage and re-educate individuals who have caused traffic accidents due to drunk driving.

2 AI-Powered Global Health Data Integration (UMFST)
An innovative approach to make healthcare data interoperable and globally adaptable, harnessing the power of artificial intelligence to support better health outcomes worldwide.

3 Web Extension for Students with Dyslexia "Opendyslexic" (FH Joanneum)
An inclusive and thoughtful tool designed to support students with dyslexia—providing real-time reading support and accessibility through a custom-built browser extension.

2.3. Learning, Teaching and Training Activity at ISQ

The Learning, Teaching and Training Activity (LTTA) of the FuturENG project took place in Oeiras, Portugal, from 7 to 11 July 2025, hosted by ISQ. Six students from the three partner universities—UMFST (Romania), Kaunas University of Technology (Lithuania), and FH Joanneum (Austria)—participated in the activity, along with three accompanying staff members (four on the first day), who joined all scheduled visits and sessions. The student participants had previously been selected as winners of the FuturENG digital hackathon.



The LTTA programme was designed to foster teamwork, critical thinking, collaboration, and exposure to real-world engineering environments. One of the central components was a multi-day *peddy paper* activity structured around visits to ISQ's laboratories and technical departments. Each stop presented a practical challenge that required students to apply analytical and collaborative skills in order to earn points for their team. Participants were divided into two mixed teams, with one student from each university per team.

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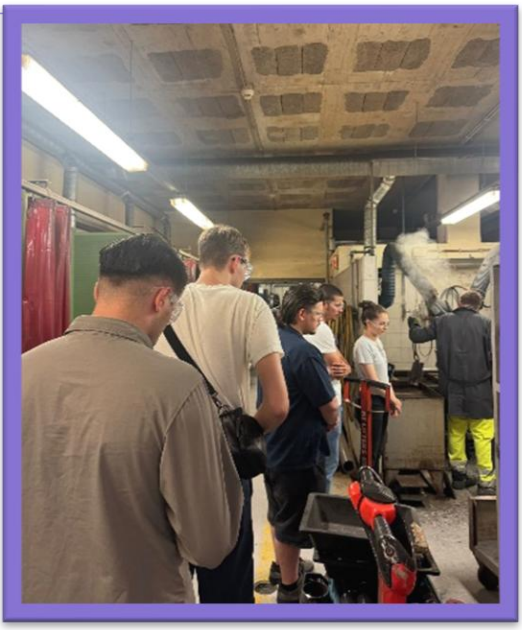
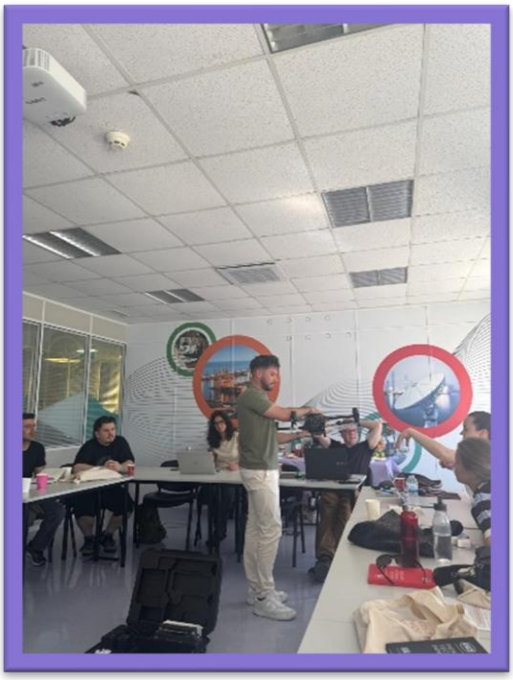


The technical visits included a wide range of laboratories, such as Metrology, Non-Destructive Testing, Additive Manufacturing, Electricity, and Virtual Welding, among others. These were complemented by a hands-on workshop titled *Design Thinking for Engineers*, in which participants developed and presented creative solutions to identified problems using structured innovation techniques.



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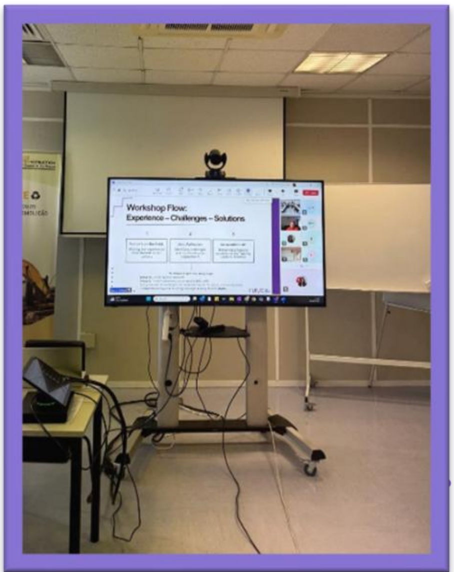
In parallel, students also took part in the *Needs Analysis Workshop* organised during the third Transnational Project Meeting (TPM3), held at ISQ on 10 July. In this session, they joined partner representatives to reflect on their experience with the WP2 learning resources. The workshop followed a three-phase methodology: (1) sharing individual feedback and challenges; (2) joint reflection in thematic groups; and (3) co-creation of actionable solutions using a World Café format. This session provided rich qualitative input for the refinement of the MOOC and CBL Toolbox and was instrumental in aligning the student experience with the project's pedagogical goals

A final evaluation was carried out through a structured questionnaire completed by participants at the end of the LTTA. All students confirmed full participation in the programme and rated the overall organisation as either *Excellent* (83%) or *Good (17%)*. The activities were considered highly relevant to their fields of study, and all respondents reported improved understanding of key topics such as Artificial Intelligence and Industry 5.0. Among the most appreciated moments were the metrology lab visit, the virtual welding session, team-based challenges, and intercultural networking opportunities.





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As illustrated by their own words, participants highlighted the following moments as particularly memorable:

"Welding because it was the only place we could simulate"

"3D Printing and welding because of the practical meaning"

"Metrology lab because of fancy science they do"

"AI camera with motion detection"

"Networking"

Students highlighted several skills gained during the week, including teamwork, communication in English, interdisciplinary thinking, and practical knowledge of advanced engineering technologies. While feedback was overwhelmingly positive, participants also suggested that future editions could include more dynamic activities and further support to balance task distribution within groups. These inputs will be taken into account when planning similar training initiatives in the future.

On a scale from 1 to 10, 50% of the participants rated the experience as a nine (9), and the remaining 50% as a perfect ten (10). This result is considered extremely positive and reflects the overall satisfaction with the programme.

3. Critical Reflection

The pilot implementation phase of the FuturENG project has offered valuable insights into the practical application of the MOOC and Challenge-Based Learning Toolbox developed under WP2. Across the three participating universities, the resources proved adaptable to different academic contexts and student profiles, supporting both autonomous and guided learning experiences. The structured use of the Moodle platform contributed to a consistent experience across institutions.

One of the key strengths observed was the engagement of students with real-world problems through the CBL methodology. The digital hackathon served as a compelling validation moment, demonstrating how collaborative

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problem-solving and creative thinking can be fostered across disciplines and national contexts. Likewise, the LTTA enabled a more hands-on and immersive learning environment, where students applied knowledge in authentic technical settings and engaged in intercultural teamwork.

Nevertheless, several areas for improvement emerged. Variations in student background and prior knowledge occasionally posed challenges in maintaining consistent levels of engagement and understanding. This highlights the need for additional scaffolding in future versions of the MOOC or for greater flexibility in adapting challenge complexity to different learner profiles. Similarly, while the CBL approach was well received, its successful implementation depended heavily on the active involvement and facilitation by staff—indicating a need for more guidance and capacity-building for educators.

The activities also confirmed the importance of integrating structured feedback moments into each phase, especially where students are asked to reflect critically on their learning journey. Initiatives such as the Needs Analysis Workshop proved essential in surfacing both individual and institutional perspectives and underscored the value of co-creation as a driver of resource improvement.

Overall, **the experience to date suggests that the FuturENG resources hold strong potential for enhancing engineering education**. However, their effectiveness depends on thoughtful integration into curricula, active facilitation, and continued refinement based on user feedback.

4. Contribution to Project Results

The activities described in this report—namely the pilot implementations, the digital hackathon, and the LTTA—have directly contributed to the validation and refinement of the two main outputs foreseen under WP2:

- **Result 1 – MOOC on Tech Essentials for Engineering Students**. The pilot activities conducted across the three partner universities provided a structured environment in which students could interact with the MOOC content in real academic settings. The platform was used consistently across all pilots via Moodle, allowing comparable observations regarding content clarity, navigation, and pedagogical alignment.

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Initial feedback suggests that the modular structure and interdisciplinary focus of the MOOC were well received by students from diverse academic backgrounds. Suggestions for improvement—particularly in relation to content depth, accessibility, and contextual examples—will inform future adjustments to ensure greater usability and scalability.

- ➔ **R2 – Challenge-Based Learning Toolbox**. The implementation of the CBL Toolbox was tested both in the pilot phase and in the context of the digital hackathon. During the pilots, students explored the tools in a semi-guided learning format, while the hackathon served as an intensive, student-led challenge environment. These complementary settings helped to validate the adaptability and relevance of the CBL approach across use cases. The LTTA further reinforced this validation by applying challenge-based principles in technical visits and group-based tasks. Feedback collected across all phases is being integrated into the finalisation of the toolbox and will support future deployment in broader educational contexts.

Overall, the combined implementation experiences have confirmed the pedagogical relevance of Result 1 and Result 2, while also identifying opportunities for improvement in terms of structure, support materials, and adaptability to different student profiles. The feedback gathered from both students and staff will serve as a foundation for improving the robustness, transferability, and long-term sustainability of the WP2 outputs.

5. Recommendations and Next Steps

Based on the implementation activities carried out under WP2, several recommendations can be formulated to support the further development, refinement, and exploitation of the FuturENG learning resources.

1. **Reinforce adaptability across disciplines and profiles.** While the MOOC and CBL Toolbox have proven effective across different academic contexts, their impact can be enhanced by offering flexible entry points for students from non-engineering backgrounds and varying levels of digital or technical proficiency.

2. **Expand educator guidance and training.** The effectiveness of the challenge-based approach relies strongly on the active facilitation provided by teaching staff. Developing short guidelines or introductory modules for educators may support broader and more autonomous uptake of the WP2 resources in different institutions.

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3. Foster continuous feedback loops. Structured feedback mechanisms, such as the ones tested during the pilots and LTTA, should be maintained and adapted for future implementations to ensure the ongoing alignment of content with student expectations and learning needs.

4. Promote further piloting and dissemination. As the WP2 resources reach a more consolidated version, additional testing phases with new student groups—possibly beyond the original consortium—could provide valuable insights into scalability and transferability. In parallel, targeted dissemination actions should be pursued through academic networks, multiplier events, and digital platforms.

Looking ahead, the project will continue to refine the MOOC and CBL Toolbox based on the data collected, ensuring their readiness for public release. Particular attention will be given to improving the clarity of course objectives, adding more practical examples and multimedia support, enhancing the integration of web-based activities such as WebQuests, and developing optional forums or tutor interaction channels on the platform. In parallel, the project team will explore the development of guidance materials for educators, supporting the adaptation of WP2 resources to different curricula and student profiles. The feedback gathered during the TPM3 Needs Analysis Workshop has been instrumental in identifying these priorities and will guide the next iteration of content and format.

6. Conclusion

The implementation of the WP2 resources—namely the Tech Essentials MOOC and the Challenge-Based Learning Toolbox—represented a key phase in the FuturENG project's journey toward enhancing engineering education through innovative, interdisciplinary and practice-oriented learning approaches.

Through pilot testing in three higher education institutions, an international hackathon, and a hands-on LTTA hosted by ISQ, the project team was able to gather valuable insights on the usability, relevance, and pedagogical effectiveness of the developed materials. The diversity of participant backgrounds, the richness of intercultural exchange, and the use of real-world engineering contexts have all contributed to validating the core educational principles of the project.

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Importantly, these activities have also highlighted areas where further development is required—particularly in terms of supporting educators, enhancing learner guidance, and deepening the practical application of theoretical content. The constructive feedback gathered through structured evaluations and co-creation sessions will serve as a basis for refining the resources and ensuring their adaptability across academic and institutional contexts.

As the project moves into its next stages, the outcomes of WP2 will feed directly into the development of educator training (WP3) and into the broader strategy for knowledge triangle cooperation. The experiences documented in this report not only confirm the potential of the FuturENG approach but also underline the importance of iterative development, collaboration, and responsiveness to learner needs in creating impactful educational tools.

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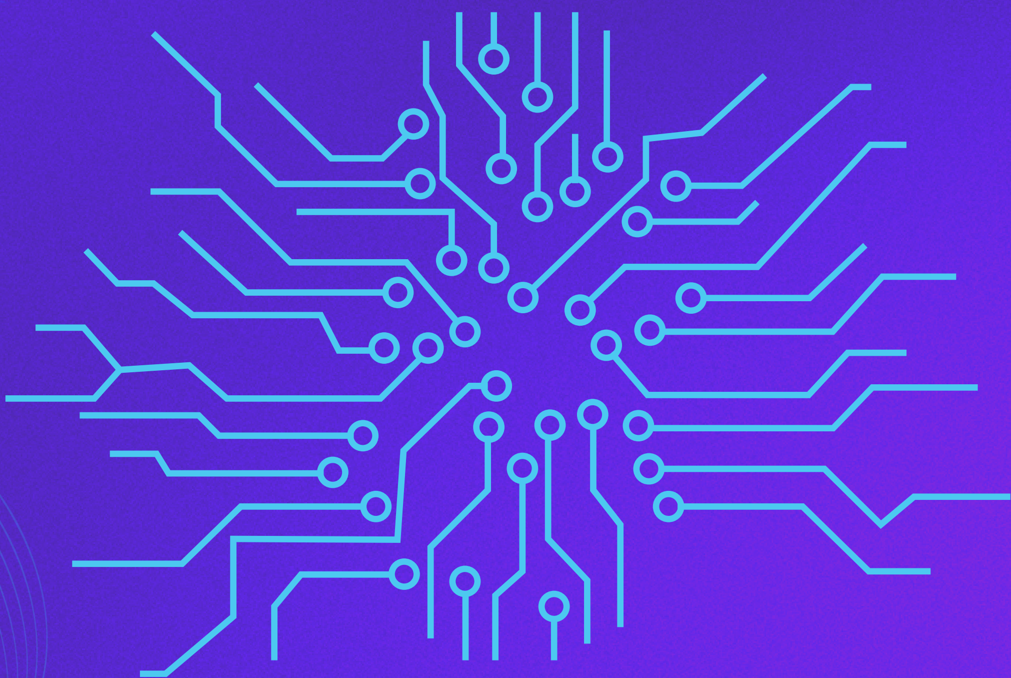
From Ideas to Impact

The FuturENG journey shows what happens when curiosity meets opportunity.



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