GREEN AND DIGITAL SKILLS DEVELOPMENT FOR EUROPEAN ENGINEERING PHD CANDIDATES

BEST PRACTICES GUIDE

Co-funded by
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INDEX

1. INTRODUCTION

The Tecskill project is an international collaboration initiative between four European universities: the University of Évora (Portugal), the University of Extremadura (Spain), Högskolan i Gävle (Sweden), and the University of Parma (Italy). TECSKILL promotes international and innovative training experiences through workshops, talks, and social events. As part of this project, an innovative methodology has been proposed for the structured collection of training experiences at the four partner universities after the corresponding training workshops have been delivered. The process combined technological tools (digital templates hosted on SharePoint), collaborative data monitoring and validation actions, and teacher and student feedback mechanisms.

In this way, the record of experiences developed allows for the evaluation of the effectiveness of the methodologies used, the measurement of the development of digital and green competencies, the facilitation of collaboration between universities, and the dissemination of results. This guide summarizes the results of applying this methodology, offers real examples of workshops, and summarizes the assessment of students and teachers.

2. REPORT OBJECTIVES

This guide has the general objective of compiling, analyzing, and disseminating the good practices derived from the implementation of the methodology proposed in R4.1, applied in the training programs linked to results R4.2, R4.3, R4.4, and R4.5.

Below are the specific objectives:

- Describe the training program developed within the framework of results R4.2 to R4.5, detailing its structure, sessions, and methodological approach.
- Identify the competencies and methodologies addressed throughout the sessions.
- Gather significant experiences from students and teachers during the development of the activities, identifying good practices and areas for improvement.
- Analyze the satisfaction levels of participants (students and teachers) regarding the program, the methodology, and the results obtained.
- Facilitate the transfer of the methodology to other educational contexts.

3. TRAINING PROGRAM

The training program of the TECSKILL project is composed of a series of workshops designed to strengthen the digital and green skills of engineering PhD candidates. The structure of the program is characterized by short and modular sessions, the combination of theory and practice, and a thematic and methodological approach.

Short and modular sessions. Most of the program's workshops (55%) have a total duration of 5 hours, generally structured into a first theoretical part and a second part focused on collaborative group work. Approximately 26% of the workshops last 10 hours, as their development was distributed across different training activities. Finally, around 19% of the total sessions have durations shorter than 5 hours, mainly intended to introduce specific tools or methodologies.

The duration of the sessions is presented in Table 3.1.

TablE 3.1 Duration of the sessions

ID	Title	Duration
01	Data measurement with sensors and problem solving trough programming in Arduino	10 h
02	Innovative solutions based on circular economy and eco designing/prototiping in research projects	10 h
03	Machine Learning for digitalization of non-linear systems	5 h
04	Simulation in digital twin development	5 h
05	Develop virtual instrumentation solutions for data acqusition and process supervisory control using NI-LabView	10 h
06	Develop low-cost automated wired and wireless prototype solutions with Arduino hardware (Arduino programming)	10 h
07	Workshop on schedule, cost and resource planning for sustainable projects	5 h
08	Digital research project management with KANBAN	2.5 h
09	Design thinking methodology for the development of innovative sustainable ideas for research projects	10 h
10	Work Flow of a sustainable research project	5 h
11	Resource and communication management in sustainable and digital research projects	2.5 h
12	First steps to develop a sustainable research project	12.5 h
13	Artificial Inteligent in research	5 h

14	Advanced search, filtering and data management	10 h
15	Inductrial property of a research	10 h
16	Digital multivariable analysis	2.5 h
17	Intelligent digitized in research projects	5 h
18	Sustainable logistics	5 h
19	Sustainability research project - energy	5 h
20	Intelligent digital Data Acquisition and sensor calibration	5 h
21	Principles of sustainability with state-of-the-art digital control methodologies	5 h
22	Supervisory control and data acquisition with SCADA system	10 h
23	Develop automated solutions with increased complexity through the development of a model / algorithm / PLC-programming	10 h
24	Circular economy to minimize environmental impact	5 h
25	Selecting an optimal material/product for our research project, based on multiple criteria (economic, technical, environmental).	5 h
26	Environmental assessment of technology with a focus on life cycle analysis (LCA) in construction, energy and transport	5 h
27	Digital models to simulate and predict behaviours in research projects	5 h
28	Recycling strategies in research projects in order to improve their sustainability	5 h
29	Digital models to simulate and predict behaviours in research projects	5 h
30	Represent and solve mathematical models, data analysis and data visualization using MATLAB (MatLab programming).	5 h
31	Sustainability and Life Cycle Assessment	5 h

Combination of theory and practice. Each session begins with a conceptual introduction and continues with practical activities such as programming, prototyping, simulations, data analysis, or real case problem-solving. This enables the immediate application of the knowledge acquired.

Thematic approach. The sessions are grouped into thematic areas related to digitalization and sensing, circular economy and sustainability, project management and research skills, energy and simulation, and automation and control. This organization allows students to progressively build their competencies.

Methodological approach. The methodological design of the program was based on the use of active learning methodologies, which promote student participation, interdisciplinary work, and the practical application of knowledge.

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4. RESULTS OF THE DEVELOPED METHODOLOGY

The implementation of the methodology for gathering experiences developed within the Tecskill project made it possible to systematize the information from 31 training workshops delivered during the activities carried out at the four partner universities (Annex I). Additionally, input was received from 25 teachers, providing a representative sample of experiences across the different university contexts. The coordinating team reviewed each record and verified its consistency, applying predefined quality criteria.

4.1. COMPETENCES DEVELOPED THROUGHOUT THE SESSIONS

The templates, analyzed during consortium meetings, allowed the identification of the most frequently addressed competencies. Among the most frequently developed digital competencies are Digital Competencies 14, 15, 16, 17, and 19. Likewise, the most frequently addressed green competencies in the workshops include Green Competencies 4, 5, 7, 9, and 11.

Moreover, the data analysis reveals an increasing synergy between digital and green competencies, which represents one of the most significant achievements of the applied methodology. Table 4.1 summarizes the proportion of workshops in which each type of competency was developed.

Table 4.1 Competencies developed in training workshops.

Type of competency developed	Number of workshops	Percentage
Green and digital competences	20	65%
Only green competences	2	6%
Only digital competences	9	29%

More than half of the workshops combined digital and green competencies, demonstrating a cross-cutting approach that promotes both digital and ecological transition simultaneously. The purely digital workshops focused mainly on automation and programming, while those exclusively oriented toward green competencies addressed efficient resource use and environmental management.

The relationship between the different workshops (1–31) and the digital (DC) and green competencies (GC) is shown in Figure 4.1.

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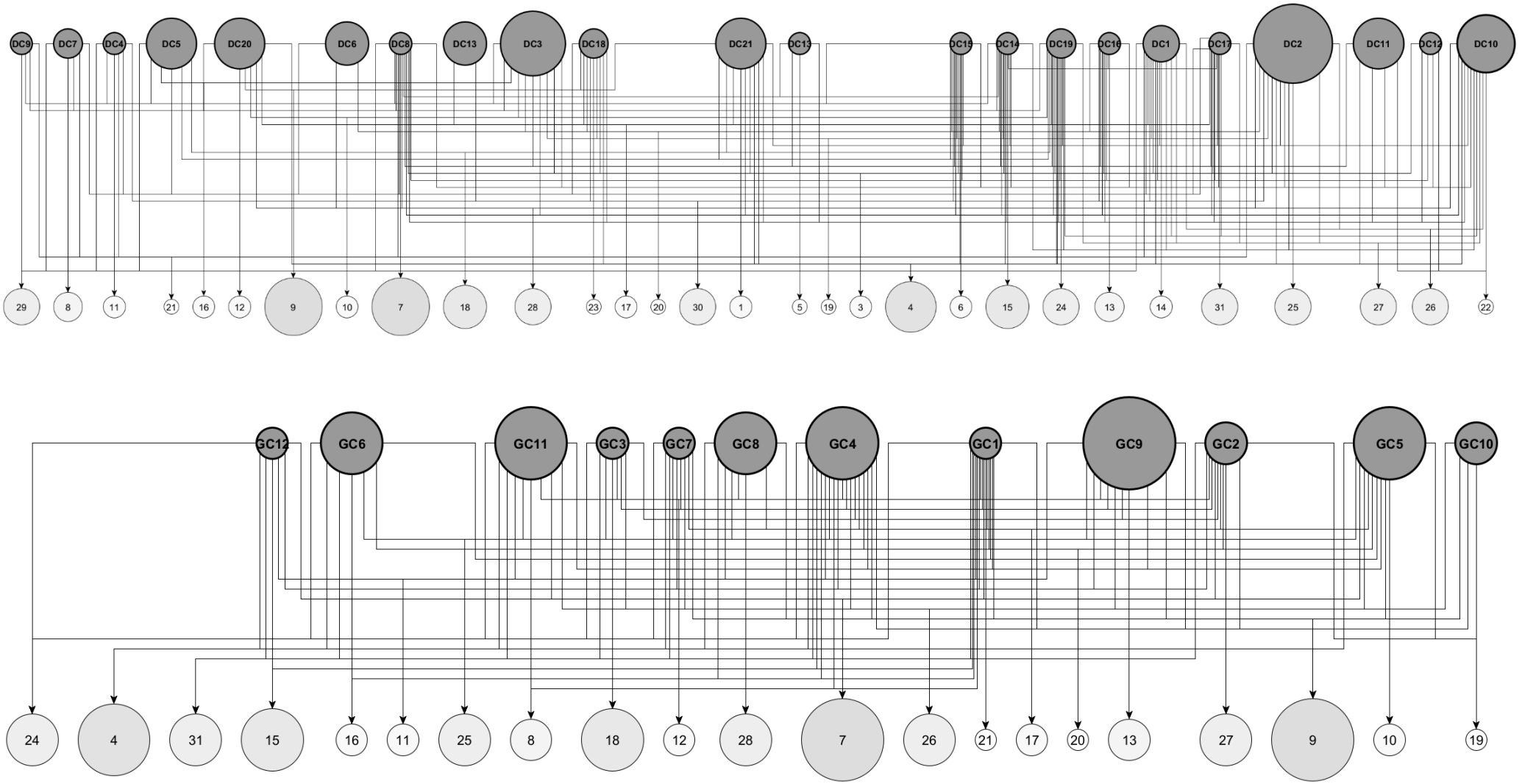

Figure 4.1 Relationship between workshops and competencies addressed.

4.2. METHODOLOGIES USED

Regarding the analysis of the methodology applied during the development of the workshops, the results reveal a clear commitment to active and collaborative methodologies, focused on project development and the resolution of real challenges. The most used methodologies are summarized in Table 4.2.

Table 4.2 Methodologies used in the implementation of the training workshops.

Methodologies	Number of workshops	Percentage
Project-Based Learning	17	57%
Challenge-Based Learning	10	33%
Research-Based Learning	6	20%
Collaborative Learning	4	13%
Problem-Based Learning	2	7%
Others	4	13%

The predominance of project-based learning reflects the practical orientation of the Tecskill project, encouraging the direct application of technical knowledge in real contexts. Challenge-based learning emerges as a complementary approach, promoting innovation, interdisciplinary work, and the pursuit of sustainable solutions. Finally, research-based learning reinforces knowledge transfer between teaching and applied research.

Regarding the qualitative analysis, common points were identified in the positive assessment of collaborative workspaces, the usefulness of templates, and the value of structured feedback to improve future editions of the training activities.

Lastly, Table 4.3 presents a SWOT analysis of the methodology used, developed based on the assessments collected during consortium meetings.

Table 4.3 SWOT analysis of the developed methodology.

Strengths	Weaknesses
• Active methodologies that promote meaningful and autonomous learning. • High involvement and motivation from participants thanks to practical work and collaboration. • Natural integration of digital and green skills within the training process.	• The use of templates requires additional time and planning from instructors to achieve in-depth results. • High dependence on the technical or digital experience of instructors. • Need for more structured coordination.

• Interdisciplinary approach that fosters critical thinking and knowledge transfer.	• Difficulty in scaling the model to large groups without compromising methodological quality.
Opportunities	**Threats**
• Consolidate an experience-collection methodology that is replicable across universities. • Take advantage of the global shift towards experiential learning and sustainability to attract funding and institutional support. • Strengthen teacher training in innovative methodologies to maintain pedagogical quality.	• Limited human and material resources may hinder proper implementation (time, staff, technical support). • Differences in teaching culture or institutional resistance to non-traditional methodologies. • Risk of fragmentation if shared evaluation and monitoring criteria are not systematized. • Risk of teacher and participant overload if activities are not properly integrated into academic programs.

4.3. COLLECTED EXPERIENCES

This section presents only a summary of the experiences carried out. All complete information, including detailed descriptions of each activity and its results, is available in Annex I. In addition, Anexxe II and Anexxe III presents teacher and student satisfaction survey, respectively.

The analysis of the training experiences recorded in the TECSKILL workshop templates shows a high level of involvement and overall satisfaction among doctoral students. The activities, predominantly practical and collaborative in nature, encouraged interaction among participants from different universities and research areas, generating a cooperative learning environment.

93% of the workshops reported active and sustained participation from students, with particularly high engagement levels in those involving tools such as Arduino, LabVIEW, SCADA, and MATLAB. In 82% of the activities, instructors reported effective collaboration among students from different research areas, leading to enriching interdisciplinary outcomes. Additionally, 68% of participants indicated that thematic diversity (engineering, energy, sustainability, ICT, materials, etc.) enhanced mutual learning by combining technical and environmental perspectives. No significant incidents of demotivation or misalignment with the content were reported.

In most workshops, students displayed highly active participation. The diversity of profiles (mechanical, electronics, energy, ICT, sustainability, materials, etc.) was not a barrier but rather a factor of mutual enrichment. Doctoral students shared approaches, knowledge, and tools from their respective fields, which allowed for more creative solutions and a broader understanding of the problems addressed.

Satisfaction surveys were prepared for both instructors and students in order to measure their perception of the quality and effectiveness of the workshops. Consolidated results from both surveys are included in Annex II (instructors) and Annex III (students).

Regarding competency development, Tables 4.4 and 4.5 present the level of difficulty perceived by students for each competency and the average degree of achievement on a scale of 1 to 5 (where 5 represents the highest level of competency mastery).

The experiences of instructors participating in the training activities were highly enriching and allowed the identification of key aspects to improve future editions. In several sessions, instructors observed the need for more time dedicated to group work and practical application of content. Although part of this work was addressed through additional activities completed at home by students or through personalized tutoring outside of class time, instructors agreed that, in order to optimize learning, it would be advisable to extend in-person hours in some future sessions.

Instructors also noted that student motivation increased significantly when the competencies developed were directly linked to their doctoral research line. This increase in motivation not only boosted individual performance but also spread to the entire group, generating a highly engaged and participatory environment. This finding was key for the consortium's decision to evaluate the impact of the competencies developed on the progress of doctoral theses, with the aim of more accurately measuring the real transfer of learning. The results obtained are presented in Results Report 5.1 of Work Package 5.

Another conclusion drawn by instructors was that, being PhD students, their attitude and level of engagement were notably higher than those usually observed in undergraduate or master's students. Doctoral candidates demonstrated strong willingness toward autonomous and collaborative work, high interest in practical sessions, and great ability to connect the content with their research projects. This motivated and proactive profile was decisive to the success of the training activities and contributed significantly to the high level of quality achieved..

Table 4.4 Difficulty and level of achievement of digital competencies.

Digital Competencies	Perceived Difficulty by Students	Average Achievement Level
DC1	Medium	2.90/4
DC2	Medium	2.94/4
DC3	High	2.51/4
DC4	Medium	2.72/4
DC5	Medium	2.97/4
DC6	Medium	2.63/4
DC7	Medium	2.63/4
DC8	High	2.54/4
DC9	Medium	2.75/4
DC10	Medium	2.79/4
DC11	High	2.58/4

DC12	High	2.53/4
DC13	Medium	2.83/4
DC14	Medium	2.62/4
DC15	Medium	2.69/4
DC16	Medium	2.72/4
DC17	Medium	2.72/4
DC18	Medium	2.82/4
DC19	Medium	2.84/4
DC20	Medium	2.61/4
DC21	Medium	2.66/4
Overall Average	**Medium**	**2.71/4**

Table 4.5 Difficulty and level of achievement of green competencies.

Specific Competencies	Perceived Difficulty by Students	Average Achievement Level
GC1	Low	2.83/4
GC2	Medium	2.62/4
GC3	Medium	2.69/4
GC4	Low	2.82/4
GC5	Low	3.01/4
GC6	Medium	2.75/4
GC7	Low	2.81/4
GC8	Low	2.88/4
GC9	Medium	2.76/4
GC10	High	2.54/4
GC11	Medium	2.70/4
GC12	Medium	2.66/4
Overall Average	**Medium**	**2.76/4**

Tables 4.4 and 4.5 show that the TECSKILL program has contributed to strengthening the technical skills of doctoral candidates, as well as to the development of transversal competencies aimed at sustainability, interdisciplinary collaboration, and responsible innovation.

5. ANEXXES

- Anexxe I. Collected templates

TRAINING LESSONS INFORMATION/EVALUATION

Title	Data measurement with sensors and problem solving trough programming in Arduino		
Summary	During the class activity the students will be directly involved in the development of a simple data acquisition system capable of measuring light and/or temperature and publishing real-time data on a customized dashboard accessible over the internet. The main background of industrial automation is implemented by means of microcontroller programming techniques using C++ language, data transmission over a serial communication channel, data flow management and the customization of an online dashboard for data visualization. The proposed framework is generic and can be applied to many other scenarios, like process control of more complex systems and data logging.		
Face to Face class duration (hours)	5 h	**Workgroup duration (hours)**	5 h
Resources	Arduino IDE 2.0 or later, Node-RED		
Green Competences	Not involved.		
Digital Competences	DC3; DC 8; DC 11; DC 13; DC 14; DC 15; DC16; DC17; DC18; DC19; DC21.		
Number of MOOCs	2 MOOC		
Teaching methodology	Project-based learning		
Training Experience	The feedback was positive: students really enjoyed the hands-on part and seeing real-time results. Some mentioned they needed more time to customize the dashboard and found the C++ programming a bit challenging if they had less experience. Next time, more technical support and better team task organization could help.		

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TRAINING LESSONS INFORMATION/EVALUATION

Title	Innovative solutions based on circular economy and eco-designing/prototiping in research projects		
Summary	This lesson explores the development of innovative materials for use in sustainable packaging, aiming to replace conventional plastics within the framework of the circular economy. The core message is to draw inspiration from nature as a source of ideas and materials that can drive human progress. In the first part, students will examine examples of natural resources applied across various fields; including physics, energy, pharmacology, food science, materials science, and conceptual innovation. The second part will focus on the creation of sustainable materials derived from polysaccharides, proteins, plant extracts, and other bio-based sources, illustrated through real-world case studies. The session concludes with a hands-on group challenge in which students will design an innovative, active, and sustainable packaging solution or a smart eco-friendly device.		
Face to Face class duration (hours)	4 h	**Workgroup duration (hours)**	6 h
Resources	Different types of sustainable materials will be provided and shown		
Green Competences	GC 1; GC 2; GC 3; GC 4; GC 7; GC 9; GC 11; GC 12		
Digital Competences	Not involved.		
Number of MOOCs	8 MOOC		
Teaching methodology	Challenge-based learning, and Research-based learning.		
Training Experience	Students appreciated the link between sustainability, biomaterials and innovation. Participants valued the real-life examples and the group challenge, which fostered teamwork and critical thinking. Suggested improvements include more hands-on materials or prototypes to enhance interaction. Overall, students gained awareness and practical knowledge about bio-based packaging alternatives and circular design strategies.&		

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TRAINING LESSONS INFORMATION

Title	Machine Learning for digitalization of non-linear systems		
Summary	The purpose of the lecture is to give an introduction to the analysis of data from machines in industry and "demystify" the subject, since it often is made more complicated than necessary. Machines are here "denoted" systems, and some definitions of nonlinear and dynamic systems are given. It is briefly explained what is meant by system identification, i.e. how we get a models parameter values. A different approach is feature extraction, in which case features that capture the information in the output signals of the system are calculated. Digital twins, a popular word with many definitions, are mentioned. Some examples form systems in the industry are given. At the end the students do a computer exercise in which they analyze given data using some typical methods.		
Face to Face class duration (hours)	2,5 h	**Workgroup duration (hours)**	2,5 h
Resources	Matlab/ Simulink		
Green Competences	Not involved		
Digital Competences	DC 1; DC 2; DC 3; DC 8; DC 12; DC 14; DC 15; DC 16; DC 17; DC 18; DC 19; DC 21		
Number of MOOCs	2 MOOC		
Teaching methodology	Project-based learning		
Training Experience	Students appreciated the clear explanations of complex terms like system identification, feature extraction, and digital twins. The 5h duration was considered appropriate. The computer-based exercise at the end was especially valued, as it allowed students to apply the concepts directly to real data. Overall, participants gained a practical understanding of how to analyze machine data and build simple models of nonlinear and dynamic systems.		

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TRAINING LESSONS INFORMATION

Title	Simulation in digital twin development		
Summary	During the session, participants were introduced to how simulation methods, with particular reference to fluid-dynamic simulation, can be used to develop advanced control and design models for industrial plants. A particular focus was given to sustainability issues such as the preservation of natural resources (water) and the removal of pollutant compounds from industrial effluents. Specifically, three case studies applied to heat treatment, air filtration and irrigation plants were shown, illustrating the methodologies and concepts used for the development of control framweworks. During the workgroup session, the students were divided into three groups, and asked to choose a specific context and, based also on the state of the art and unexplored gaps in the literature, develop their proposal for the development of a digital twin with the aid of simulation tools.		
Face to Face class duration (hours)	3 h	**Workgroup duration (hours)**	2 h
Resources	Nothing		
Green Competences	GC 4; GC 5; GC 6; GC 7; GC 8; GC 11; GC 12		
Digital Competences	DC 1; DC 2; DC 10; DC 11; DC 14; DC 15; DC 18; DC 19; DC 20; DC 21		
Number of MOOCs	0		
Teaching methodology	Project-based learning		
Training Experience	The experience was extremely positive. The type of workgroup proposed would have taken much longer than the 2 hours available, and the students' proposals remained in an early stage. A formula that would give the students more time to develop their proposal could be considered. For example, a project discussion session spaced a few days/weeks/months later than the lecture		

TRAINING LESSONS INFORMATION

Title	Develop virtual instrumentation solutions for data acqusition and process supervisory control using NI-LabView		
Summary	This course focuses on the development of virtual instrumentation systems for data acquisition and process supervisory control using NI LabVIEW. Students are introduced to graphical programming through an intensive, hands-on approach that emphasizes practical learning and system integration. The program includes a crash course on LabVIEW, a module on Data Acquisition (DAQ) systems, and laboratory sessions dedicated to acquiring and analyzing electrical signals with National Instruments DAQ cards. Through a project-based methodology, students gain experience in designing, programming, and testing complete measurement and control solutions. By the end of the course, participants will be able to develop and implement efficient, real-world data acquisition and supervisory control systems using LabVIEW.		
Face to Face class duration (hours)	5 h	**Workgroup duration (hours)**	5 h
Resources	NI-LabView (software & hardware)		
Green Competences	Not involved		
Digital Competences	DC 3; DC8; DC 10; DC 13; DC14; DC15; DC16; DC 17; DC 19; DC 21		
Number of MOOCs	4 MOOC		
Teaching methodology	Project-based learning		
Training Experience	After completing the course, participants had the opportunity to expand their skills through advanced training in LabVIEW programming, data acquisition, and process automation. Some continued with projects involving IoT integration, machine learning, or SCADA systems, while others applied their knowledge in research or industrial internships. These experiences strengthened their technical and digital competencies and enhanced their ability to apply virtual instrumentation in real-world engineering contexts.		

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TRAINING LESSONS INFORMATION

Title	Develop low-cost automated wired and wireless prototype solutions with Arduino hardware (Arduino programming)		
Summary	This workshop introduced participants to Arduino programming and the development of low-cost digital prototypes using sensors, actuators, and microcontrollers. Through a practical, hands-on approach, students learned how to design and implement automated wired and wireless systems for concept validation. The session concluded with a challenge-based activity, in which participants developed functional prototypes integrating hardware and software components. This experience enhanced their digital content creation and technical problem-solving skills, fostering creativity and innovation in hardware prototyping.		
Face to Face class duration (hours)	5 h	**Workgroup duration (hours)**	5 h
Resources	ARDUINO (software & hardware)		
Green Competences	Not involved		
Digital Competences	DC 8; DC 10; DC 11; DC 12; DC 13; DC 14; DC 15; DC 16; DC 17; DC 18; DC 19; DC 21		
Number of MOOCs	4 MOOC		
Teaching methodology	Challenge-Based Learning and Project-Based Learning		
Training Experience	After completing the workshop, participants had the opportunity to continue developing their skills through collaborative projects focused on embedded systems, IoT applications, and automation technologies. Working in teams, they designed and improved Arduino-based prototypes that integrated wireless communication, sensors, and data processing features. Participants responded with great enthusiasm to the Arduino workshop, quickly engaging with the hands-on activities and collaborative design challenges. Many arrived with limited programming experience but gained confidence as they successfully built and tested their own wired and wireless prototypes. The mix of teamwork, experimentation, and immediate feedback created a dynamic learning atmosphere where creativity thrived.		

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TRAINING LESSONS INFORMATION

Title	Workshop on schedule, cost and resource planning for sustainable projects		
Summary	The workshop on planning schedules, costs, and resources for sustainable projects using MS Project taught participants how to efficiently manage project timelines, budgets, and resource allocation. Attendees learned to create project plans, track progress, and integrate sustainability criteria into resource planning. Through hands-on exercises, they mastered the tools to optimize project performance. The workshop concluded with best practices for balancing environmental impact and project efficiency.		
Face to Face class duration (hours)	2,5 h	**Workgroup duration (hours)**	2,5 h
Resources	MS Project		
Green Competences	GC 1; GC 2; GC 4; GC 5; GC 11; GC 12		
Digital Competences	DC 5; DC 8; DC 15; DC 19; DC 21		
Number of MOOCs	3 MOOC		
Teaching methodology	Project-based learning and Challenge-based learning.		
Training Experience	Participants praised the workshop for its engaging and interactive format, highlighting the practical exercises that effectively demonstrated the application of design thinking in sustainable projects. Many attendees reported feeling more confident in using these techniques to enhance their project outcomes and foster greater innovation in their sustainability efforts.		

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TRAINING LESSONS INFORMATION

Title	Digital research project management with KANBAN		
Summary	The workshop introduced participants to the fundamentals and practices of Kanban systems using a board and cards game. Attendees learned how to visualize workflows, manage tasks, and improve efficiency by simulating real-world project scenarios. The game helped them understand key Kanban concepts like limiting work-in-progress and continuous improvement. Through interactive exercises, they practiced applying Kanban principles to enhance team collaboration. The session concluded with discussions on implementing Kanban in various work environments.		
Face to Face class duration (hours)	1 h	**Workgroup duration (hours)**	1,5 h
Resources	JIRA		
Green Competences	GC 1; GC 4; GC 5; GC 7		
Digital Competences	DC 3; DC 4; DC 5; DC 7; DC 8; DC 9; DC 14; DC 15; DC 19; DC 21		
Number of MOOCs	1 video about Kanban systems applications		
Teaching methodology	Project-based Learning and Challenge-based learning.		
Training Experience	Participants praised the workshop for its engaging and interactive format, highlighting the practical exercises that effectively demonstrated the application of design thinking in sustainable projects. Many attendees reported feeling more confident in using these techniques to enhance their project outcomes and foster greater innovation in their sustainability efforts.		

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TRAINING LESSONS INFORMATION

Title	Design thinking methodology for the development of innovative sustainable ideas for research projects		
Summary	The workshop "Design Thinking to Boost Outcomes of Sustainable Projects" focuses on applying design thinking principles to enhance the success and impact of sustainable initiatives. Participants will learn to empathize with stakeholders, define problems clearly, ideate innovative solutions, prototype, and test these solutions in real-world contexts. By integrating creative and user-centric approaches, the workshop aims to improve project outcomes, foster sustainability, and drive positive environmental and social change. Key takeaways include practical tools, collaborative exercises, and strategies for implementing design thinking in sustainability projects.		
Face to Face class duration (hours)	5 h	**Workgroup duration (hours)**	5 h
Resources	Miro, Google Workspace		
Green Competences	GC 1; GC 4; GC 5; GC 7; GC 8; GC 9; GC 10		
Digital Competences	DC 18; DC 20; DC 21		
Number of MOOCs	1 video about Design Thinking fundamentals		
Teaching methodology	Challenge-based learning.		
Training Experience	Participants praised the workshop for its engaging and interactive format, highlighting the practical exercises that effectively demonstrated the application of design thinking in sustainable projects. Many attendees reported feeling more confident in using these techniques to enhance their project outcomes and foster greater innovation in their sustainability efforts.		

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TRAINING LESSONS INFORMATION

Title	Work Flow of a sustainable research project		
Summary	This workshop explored the essential stages and principles for designing and managing research projects with a focus on long-term sustainability. Participants examined how to integrate environmental, social, and ethical considerations into each phase of the research workflow — from initial concept to dissemination and impact assessment. The session began by outlining the foundations of sustainable research, emphasizing the importance of aligning project goals with the Sustainable Development Goals and institutional sustainability strategies. It then guided attendees through practical steps for project planning, including stakeholder engagement, responsible resource management, and data stewardship.		
Face to Face class duration (hours)	2 h	**Workgroup duration (hours)**	3 h
Resources	Trello and Miro		
Green Competences knowledge indicators	GC1; GC 2; GC 4; GC 5; GC 9; GC 11		
Digital Competences knowledge indicators	DC 3; DC 19; DC 20		
Number of MOOCs	3 MOOC		
Teaching methodology	Project-Based Learning		
Training Experience	Through interactive activities and case studies, the workshop encouraged reflection on challenges such as funding constraints, ethical dilemmas, and balancing scientific excellence with sustainability commitments. By the end, participants gained a structured understanding of how to embed sustainability across the research workflow, fostering projects that are not only scientifically robust but also socially responsible and environmentally conscious.		

TRAINING LESSONS INFORMATION

Title	Resource and communication management in sustainable and digital research projects		
Summary	This workshop explores effective resource management strategies for sustainable and digital research projects. Participants will learn how to optimize financial, human, and technological resources while maintaining sustainability goals. The session covers tools for budgeting, project planning, team collaboration, and leveraging digital technologies to enhance research outcomes. Practical case studies and interactive exercises will help participants apply key concepts to real-world research projects.		
Face to Face class duration (hours)	1 h	**Workgroup duration (hours)**	1,5 h
Resources	Trello, Miro and Excel		
Green Competences	GC 1; GC 4; GC 7; GC 8; GC 9; GC 11; GC 12		
Digital Competences	DC 3; DC 4; DC 5; DC 6; DC 7; DC 8; DC 9; DC 14; DC 19; DC 20		
Number of MOOCs	0		
Teaching methodology	The workshop combines theory with hands-on activities, including group discussions, case studies, and interactive simulations to ensure practical learning and engagement.		
Training Experience	Through collaborative activities, participants gained practical experience in managing resources efficiently within research projects, with a strong emphasis on sustainability and the use of digital tools. Working in teams, they simulated real project scenarios where they applied budgeting, planning, and communication strategies using platforms such as Trello. By collaborating on shared digital workspaces, they developed essential project management, teamwork, and digital literacy skills, preparing them to lead or support sustainable research initiatives in academic and professional environments.		

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TRAINING LESSONS INFORMATION

Title	First steps to develop a sustainable research project		
Summary	During the sessions, participants will work on the fundamental steps involved in developing a sustainable research project proposal aimed at engineering doctoral students. The main goal is for participants, through collaborative work, to design an innovative, coherent, and feasible proposal that integrates sustainability principles and aligns with the frameworks and priorities of current European calls for research funding. Throughout the classes, key questions will be addressed, such as what to research, why it is relevant, for what purpose, how it will be carried out, and when each phase will take place. These guiding questions will help participants structure their ideas and ensure the internal logic and methodological coherence required for a competitive research proposal. Good practices, real examples, and practical recommendations will also be presented to support the writing of different sections of the proposal, including the title, background, justification, scope, general and specific objectives, methodology, and work plan. Furthermore, attention will be given to innovation, expected impact, and alignment with the Sustainable Development Goals.		
Face to Face class duration (hours)	4 h	**Workgroup duration (hours)**	8,5 h
Resources	Drawio, research template		
Green Competences	GC 1; GC 2; GC 4; GC 5; GC 7; GC 8; GC 9; GC 10; GC 11; GC 12		
Digital Competences	DC 1; DC 4; DC 5; DC 6; DC 7; DC 8; DC 17; DC 18		
Number of MOOCs	12 MOOC		
Teaching methodology	Project-based learning, Challenge-based learning, Research-based learning.		
Training Experience	The initial objectives set for the course were successfully achieved. Despite coming from diverse research areas, the doctoral students collaborated effectively in groups, demonstrating that it is not necessary to share the same research line to work productively. This diversity of backgrounds resulted in more varied and enriching project proposals. It would be advisable to include a greater number of examples in future editions, as many students initially lacked a clear understanding of how to design a sustainable research project and needed more concrete illustrations to grasp the concept fully. Additionally, it would be beneficial to extend the duration of the sessions, since the students needed to continue working collaboratively after the training in order to produce a complete and high-quality outcome. Finally, it is worth highlighting that the interactions and discussions during the sessions were very positive for learning; the students were highly engaged and actively participated throughout the process.		

TRAINING LESSONS INFORMATION

Title	Artificial Inteligent in research		
Summary	AI for Researchers explores the integration of AI into research, highlighting its applications, ethical considerations, and future implications. It discusses how AI tools enhance reading, data analysis, methodology selection, and writing while emphasizing responsible use through guidelines on reliability, transparency, respect, and accountability. Initially met with skepticism, AI has gained acceptance in academia, prompting a shift from traditional success metrics—such as publication quantity—to quality, innovation, and societal impact.		
Face to Face class duration (hours)	2,5 h	**Workgroup duration (hours)**	2,5 h
Resources	AI sofware Avidnote		
Green Competences	GC 1; GC 5; GC 6; GC 9		
Digital Competences	DC 1; DC 2; DC 10; DC 14; DC 15; DC 16; DC 17; DC 19; DC 21		
Number of MOOCs	Topic overview of 10 minutes and PhD Studerts seminar.		
Teaching methodology	The teaching methodology consists of lectures combined with interactive discussions, actively engaging both the teache and PhD students to foster critical thinking and collaborative learning.		
Training Experience	Students engaged actively throughout the workshop, showing increasing curiosity and confidence in integrating AI tools into their research practices. While some were initially skeptical, they quickly adapted and explored various applications for literature analysis, data interpretation, and academic writing. Collaborative group work encouraged peer learning, allowing students to exchange strategies and critically evaluate the strengths and limitations of AI-assisted research. They reflected on ethical issues such as transparency, reliability, and accountability, recognizing the importance of maintaining academic integrity when using generative tools. The interactive and reflective nature of the sessions fostered both digital competence and critical awareness, enabling participants to apply AI technologies thoughtfully and respons bly. By the end of the training, students had strengthened their research planning and writing abilities, while developing a balanced, informed perspective on the role of AI in academic work.		

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TRAINING LESSONS INFORMATION

Title	Advanced search, filtering and data management		
Summary	This lesson focuses on bibliometric research within the field of industrial engineering. Students work in groups to explore a specific topic and perform a bibliometric analysis to identify the state of the art, based on scientific documents retrieved through advanced keyword searches. The session begins with an introduction to bibliometrics, its aims, key metrics, and commonly used analytical tools. Each group selects a free bibliometric software, learns how to use it, and then teaches the class its main features. Students then carry out the analysis using both the chosen software and Microsoft Excel for data management and visualization. The final outcome is a conference-style paper and presentation, to be delivered in 2025. Through this activity, participants strengthen their digital research, data analysis, and collaboration skills, while gaining experience in bibliometric methods and academic communication.		
Face to Face class duration (hours)	2 h	**Workgroup duration (hours)**	8 h
Resources	Scopus database; Microsoft Excel; free bibliometric sofware as those proposed during class (e.g., Vosviewer, Gephi, SCImat, CiteSpace etc.)		
Green Competences	Not involved in this class.		
Digital Competences	DC 1; DC 2; DC 3; DC 8; DC 10; DC 11; DC 12; DC 14; DC 15; DC 16; DC 17		
Number of MOOCs	0		
Teaching methodology	Challenge-based learning		
Training Experience	The class manifested interest towards the topic. Some of the students ignored these topic before. Aspect to be improved: since students have to collaborate during the year for drafting the conference paper, a more structured calendar with meetings and deadlines should have been proposed.		

TRAINING LESSONS INFORMATION

Title	Inductrial property of a research		
Summary	This session provides an overview of Intellectual Property (IP) within the European Union, emphasizing its importance in protecting innovation and promoting fair competition. Students explore the different forms of industrial property, including patents, utility models, and industrial designs, understanding how each safeguards technical inventions and creative design solutions. The workshop also examines brands and industrial secrets, discussing their strategic role in building market identity and preserving competitive advantage. A key focus is placed on conflict management in IP, introducing mechanisms such as mediation, conciliation, and arbitration as effective alternatives to litigation for resolving disputes. Through practical examples and discussions, participants learn how to identify, protect, and manage research outcomes responsibly, ensuring legal compliance and ethical conduct in innovation. The session aims to foster awareness of the economic and social value of intellectual property in the context of research and technological development.		
Face to Face class duration (hours)	5 h	**Workgroup duration (hours)**	5 h
Resources	Power Point and access to offcial webs to protect an invention. Contracts and Licences models. Simulated practice: dispute over ownership of university research		
Green Competences	GC 1; GC 4; GC 12		
Digital Competences	DC 1; DC 8; DC 12; DC 14; DC 15; DC 16; DC 17; DC 19		
Number of MOOCs	2 MOOC		
Teaching methodology	Challenge-based learning. Simulated Case.		
Training Experience	The training provided a comprehensive overview of intellectual property rights within the European context, including patents, utility models, industrial designs, trademarks, industrial secrets, and conflict resolution methods. Students appreciated the clarity in explaining complex legal concepts and the relevance of protecting innovation in research and development. Practical examples of real-world cases helped ground theoretical knowledge. An aspect to improve could be including short role-playing activities to practice conflict mediation and application of IPR strategies.		

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TRAINING LESSONS INFORMATION

Title	Digital multivariable analysis		
Summary	The workshop focused on the application of the Analytic Hierarchy Process (AHP) to complex decision-making processes. Participants learned how to systematically prioritize project variables, such as budgets and technical aspects, while simultaneously integrating sustainability criteria. Through different case studies, students developed expertise in using AHP to make informed decisions that balance environmental impact with project efficiency. The workshop concluded with valuable insights on best practices for optimizing project performance in alignment with sustainability goals.		
Face to Face class duration (hours)	1 h	**Workgroup duration (hours)**	1,5 h
Resources	Classroom with flexible modular forniture, whiteboards, and pens.		
Green Competences knowledge indicators	GC 1; GC 4; GC 6; GC 8		
Digital Competences knowledge indicators	DC 3; DC 5; DC 17; DC 20		
Number of MOOCs	0		
Teaching methodology	Challenge-based learning and Project-based learning.		
Training Experience	Participants praised the workshop for its engaging and interactive format, highlighting the case studies that effectively demonstrated the application of AHP in sustainable projects. Many attendees reported feeling more confident in using these techniques to enhance project outcomes and drive greater innovation in their sustainability efforts.		

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TRAINING LESSONS INFORMATION/EVALUATION

Title	Intelligent digitized in research projects		
Summary	This workshop explores the role of maintenance as a core element of the circular economy, emphasizing how proactive and predictive strategies contribute to equipment longevity, reliability, and resource efficiency. Participants examine how emerging digital technologies, particularly machine learning, are transforming maintenance from a reactive process into a data-driven and intelligent system. The session introduces industrial solutions for data acquisition, storage, and analysis, highlighting how sensor data and performance indicators can be used to detect early signs of deterioration. Students apply machine learning techniques to classify maintenance needs, optimize inspection schedules, and prevent failures before they occur. By integrating digitalization with sustainable maintenance practices, the workshop provides participants with practical insights into how technology can support both operational efficiency and environmental responsibility in industrial systems.		
Face to Face class duration (hours)	2.5 h	**Workgroup duration (hours)**	2.5 h
Resources	Matlab with Predictive Maintenance Toolbox		
Green Competences	GC1; GC2; GC4; GC5; GC7; GC8; GC11; GC12		
Digital Competences	DC1; DC13; DC17; DC18; DC19; DC20; DC21		
Number of MOOCs	0		
Teaching methodology	There will be a combination of theoretical lectures and group-wise practical tasks.		
Training Experience	The training focused on proactive and predictive maintenance using machine learning and industrial data systems. Students valued learning about digital tools to optimize equipment lifespan and reliability within the context of the circular economy. Duration (around 2.5 hours) was sufficient to cover data collection, classification methods, and maintenance strategies.		

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TRAINING LESSONS INFORMATION/EVALUATION

Title	Sustainable logistics		
Summary	The lecture will outline the topic of sustainable logistics, what the challneges for the logistics sector are and what can be done to improve the siutation. The seminar will focus on how digital technologies can help with the trnsformation to a more sustainable logistics ector. Here, the doctoral students will apply the knowledge they have received in previous lectures to the challenge. In groups, they are requested to propose at least one idea for research into the area.		
Face to Face class duration (hours)	2,5 h	**Workgroup duration (hours)**	2,5 h
Resources	Classrooms and areas for group discussions		
Green Competences	GC 1; GC 2; GC 4; GC 5; GC 6; GC 7; GC 8; GC 9; GC 12		
Digital Competences	DC 5; DC 19; DC 20		
Number of MOOCs	0		
Teaching methodology	Lecture and group work exercise		
Training Experience	The training effectively combined theoretical lectures with practical group exercises focused on sustainable and digital logistics. Students appreciated the real-world challenge aspect, applying knowledge creatively to propose research ideas		

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TRAINING LESSONS INFORMATION

Title	Sustainability research project - energy		
Summary	This class focuses on Photovoltaic-Thermal (PVT) solar collectors, an emerging technology that combines photovoltaic and thermal systems to generate both electricity and heat. Students explore key concepts such as solar radiation, solar angles, and energy efficiency, learning how PVT systems contribute to sustainable energy solutions. Through research-based and collaborative activities, participants analyze current studies, model system performance, and discuss innovations for improving sustainability in energy engineering.		
Face to Face class duration (hours)	2h	**Workgroup duration (hours)**	3h
Resources	Excel (for performance calculations, solar system syzing), Matlab (for thermal and solar simulations)		
Green Competences	GC2; GC5; GC7; GC9; GC10		
Digital Competences	DC1; DC2; DC3; DC14; DC15; DC18		
Number of MOOCs	0		
Teaching methodology	Research-Based Learning , Collaborative Learning and Project-Based Learning		
Training Experience	The workshop objectives were successfully achieved. Students from diverse backgrounds collaborated effectively in groups to analyze and model Photovoltaic-Thermal (PVT) solar collectors, enriching the discussion with different perspectives. The research-based and collaborative methodology encouraged active participation, peer learning, and critical thinking about sustainability in energy engineering. However, for future editions, including more practical examples and simulation exercises would help participants gain deeper technical insight. Overall, student engagement and teamwork were excellent, contributing to a productive and meaningful learning experience.		

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TRAINING LESSONS INFORMATION

Title	Intelligent digital Data Acquisition and sensor calibration		
Summary	As societies increasingly rely on digital infrastructure to deliver essential services, the need for robust cybersecurity and risk assessment has become critical. This workshop addresses an often-overlooked but potentially severe threat: Intentional Electromagnetic Interference (IEMI). Participants explore how deliberate electromagnetic disturbances can disrupt or damage electronic systems, posing risks to communication networks, transportation systems, energy grids, and other vital technologies. The session combines theoretical insights with practical case studies to demonstrate how risk and impact analyses can be applied to evaluate system vulnerabilities and develop effective protection strategies. By the end of the workshop, students gain a deeper understanding of IEMI as part of the broader cybersecurity and resilience landscape, learning how to integrate preventive measures into the design and management of digitalized infrastructures.		
Face to Face class duration (hours)	2 h	**Workgroup duration (hours)**	3 h
Resources	ANSYS, Matlab, Power BI		
Green Competences	GC 1; GC 2; GC 4; GC 5; GC 6		
Digital Competences	DC 2; DC 3; DC 6; DC 14; DC 15; DC 16; DC 18		
Number of MOOCs	2 MOOC		
Teaching methodology	Research-Based and Problem-Oriented Learning		
Training Experience	Students described the workshop as both technically demanding and insightful, as it addressed a rarely discussed but highly relevant threat to modern digital systems. They valued the simulations and risk analysis exercises, which made complex concepts more tangible, and appreciated the collaborative group work that brought together diverse engineering perspectives. Feedback emphasized the usefulness of real-world case studies, while suggesting more time for exploring hardware-based mitigation strategies. Overall, the workshop effectively strengthened participants' technical awareness, analytical thinking, and resilience-oriented approach to cybersecurity in digital infrastructures.		

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TRAINING LESSONS INFORMATION

Title	Principles of sustainability with state-of-the-art digital control methodologies		
Summary	This workshop introduces the principles of sustainability applied to modern digital control systems in engineering. Participants explore how advanced control methodologies—such as model predictive control, adaptive control, and AI-assisted optimization—can improve energy efficiency, reduce waste, and support sustainable industrial processes. Through a combination of theory and practical demonstrations, students learn to integrate sustainability indicators into system design and performance evaluation. Collaborative activities and simulations allow participants to analyze real-world case studies where digital control technologies contribute to achieving sustainable production and resource management. By the end of the session, students gain a comprehensive understanding of how innovative control strategies can drive both technological advancement and environmental responsibility in modern engineering contexts.		
Face to Face class duration (hours)	2,5 h	**Workgroup duration (hours)**	2,5 h
Resources	Matlab/Simulink, Python, Excel, Google Workspace		
Green Competences	GC 1; GC 2; GC 3; GC 4; GC 9		
Digital Competences	DC 1; DC 2; DC 4; DC 7; DC 8; DC 9; DC 14; DC 15; DC 16; DC 20; DC 21		
Number of MOOCs	4 MOOC		
Teaching methodology	Research-Based Learning with Project-Based Learning		
Training Experience	Students actively engaged in connecting digital control methodologies with sustainability principles, applying theoretical knowledge through collaborative simulations and real-world case studies. They valued the hands-on and project-based approach, which enhanced their technical and analytical skills. Feedback was highly positive, though several participants suggested extending the workshop duration to explore more advanced modeling tools. Overall, the experience strengthened their ability to integrate innovation, efficiency, and environmental responsibility in engineering design.		

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TRAINING LESSONS INFORMATION

Title	Supervisory control and data acquisition with SCADA system		
Summary	This workshop introduces students to Supervisory Control and Data Acquisition systems, focusing on their role in monitoring and controlling industrial processes. Participants learn about the architecture and main components of SCADA, including sensors, programmable logic controllers, human–machine interfaces, and communication networks. Through hands-on exercises, they design and simulate process control systems, collect and analyze real-time data, and address cybersecurity considerations in industrial automation. The session combines theory and practical application to strengthen students' technical, analytical, and problem-solving skills in modern process supervision and digital industry environments.		
Face to Face class duration (hours)	5 h	**Workgroup duration (hours)**	5 h
Resources	SCADA simulation software, Programmable Logic Controllers, Excel		
Green Competences	Not involved.		
Digital Competences	DC 10, DC 11; DC 12; DC13; DC 14; DC 15; DC 18		
Number of MOOCs	0		
Teaching methodology	Project-Based Learning with Hands-On and Experiential Learning		
Training Experience	Students appreciated the hands-on and collaborative approach, which strengthened their technical and digital skills. Feedback highlighted the usefulness of real-time simulations and teamwork, though several participants suggested extending the duration of the workshop to allow more in-depth project development and inclusion of real industrial case studies. Overall, the training effectively connected theory with practice and fostered engagement and problem-solving in industrial automation contexts.		

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TRAINING LESSONS INFORMATION

Title	Develop automated solutions with increased complexity through the development of a model / algorithm / PLC-programming		
Summary	This workshop focuses on the design and implementation of automated solutions by developing models, algorithms, and programmable logic controller programs. Students explore the principles of industrial automation, including process control, system integration, and digitalization. Through guided exercises, they learn to translate physical processes into logical control sequences using modeling and programming tools. Participants work collaboratively to design increasingly complex automated systems, simulating real industrial environments. The session emphasizes problem-solving, accuracy, and optimization in control logic design. By combining theory with hands-on practice, students gain practical experience in automation engineering and strengthen their digital and analytical skills for future applications in intelligent manufacturing and process control.		
Face to Face class duration (hours)	5 h	**Workgroup duration (hours)**	5 h
Resources	PLC programming software, Matlab/simulink, Excel, Arduino kits and sensors		
Green Competences	Not involved.		
Digital Competences	DC 8; DC13; DC 14; DC 15; DC 16; DC 17; DC 18		
Number of MOOCs	5 MOOC		
Teaching methodology	Project-Based Learning and Hands-On Training		
Training Experience	Students responded very positively to the workshop, showing great enthusiasm for developing complex automation solutions. The hands-on structure helped them understand the link between control theory and industrial applications, while teamwork enhanced communication and decision-making skills. Feedback indicated high satisfaction with the practical exercises, though some participants suggested extending the duration to allow deeper exploration of advanced programming logic and system integration. Overall, the training successfully improved students' technical competence, analytical reasoning, and confidence in designing efficient automated systems for industrial contexts.		

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TRAINING LESSONS INFORMATION

Title	Circular economy to minimize environmental impact		
Summary	This workshop introduces the principles of the circular economy as a framework for minimizing environmental impact in engineering and research. Participants explore strategies to extend product lifecycles, reduce waste, and optimize resource use through sustainable design and innovation. The session combines theoretical foundations with practical analysis using digital tools such as Life Cycle Assessment software and sustainability metrics. Collaborative activities and case studies help students evaluate real examples of circular practices in industry and research contexts. By the end of the workshop, participants are able to design and justify circular solutions that balance environmental, economic, and technical criteria, contributing to more sustainable production and consumption models.		
Face to Face class duration (hours)	2,5 h	**Workgroup duration (hours)**	2,5 h
Resources	Simapro, Excel, Miro and Google Workspace		
Green Competences	GC 1; GC 3; GC 4; GC 6; GC 7; GC 11; GC 12		
Digital Competences	DC 14; DC 16; DC 17; DC 19		
Number of MOOCs	3 MOOC		
Teaching methodology	Challenge-Based Learning		
Training Experience	Students demonstrated high motivation and engagement throughout the workshop. They collaborated effectively to design circular strategies that balanced environmental, economic, and technical considerations. Feedback highlighted the value of combining real-world case studies with digital tools, which made complex sustainability concepts more tangible. The experience deepened their understanding of circular economy principles, enhanced their teamwork and analytical skills, and encouraged a proactive mindset toward sustainable engineering and research practices.		

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TRAINING LESSONS INFORMATION

Title	Selecting an optimal material/product for our research project, based on multiple criteria (economic, technical, environmental).		
Summary	This workshop focuses on the selection of optimal materials or products for research projects using multi-criteria decision-making methods. Students learn to evaluate and compare alternatives based on economic, technical, and environmental criteria, applying both qualitative and quantitative approaches. Through guided exercises and case studies, participants use digital tools such as Excel or Material Selection Software to analyze performance, cost, and sustainability indicators. Collaborative discussions encourage critical thinking about trade-offs and the impact of material choices on product lifecycle and research outcomes. By the end of the session, students are able to apply systematic, data-driven methods to make informed, sustainable, and technically sound material selection decisions for engineering and research projects.		
Face to Face class duration (hours)	2,5 h	**Workgroup duration (hours)**	2,5 h
Resources	CES EduPack, Excel and online databases, SimaPro		
Green Competences	GC 3; GC 4; GC 5; GC 6; GC 7; GC 9; GC 10; GC 12		
Digital Competences	DC 1; DC 2; DC 10; DC 14; DC 15; DC 16; DC 17; DC 19		
Number of MOOCs	1 MOOC		
Teaching methodology	Project-Based Learning and Collaborative Learning		
Training Experience	The workshop objectives were successfully met, as students demonstrated strong engagement in applying multi-criteria decision-making methods to real material selection problems. Feedback from students was highly positive, particularly regarding the use of digital tools for analysis and visualization. Some participants, however, suggested extending the duration of the session to allow more time for exploring advanced tools such as Life Cycle Assessment software. Overall, the training provided valuable insights into data-driven and sustainability-oriented research practices, enhancing students' analytical, collaborative, and digital competences.		

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TRAINING LESSONS INFORMATION

Title	Environmental assessment of technology with a focus on life cycle analysis (LCA) in construction, energy and transport		
Summary	This workshop focuses on the environmental assessment of technologies through the application of life cycle analysis in the fields of construction, energy, and transport. Students learn to evaluate the environmental performance of materials, products, and systems across all stages of their lifecycle—from resource extraction to disposal. Through theoretical sessions and hands-on exercises, participants use digital tools to quantify impacts such as carbon footprint, energy consumption, and waste generation. Collaborative projects and case studies allow them to compare alternative technologies and propose strategies for improving sustainability. By the end of the session, students are equipped to apply life cycle thinking in research and engineering, supporting responsible and evidence-based decision-making in sustainable development.		
Face to Face class duration (hours)	2,5 h	**Workgroup duration (hours)**	2,5 h
Resources	SimaPro, Ecoinvent		
Green Competences	GC 3; GC 4; GC 5; GC 6; GC 7; GC 9; GC 10; GC 12		
Digital Competences	DC 1; DC 2; DC 10; DC 14; DC 15; DC 16; DC 17; DC 19		
Number of MOOCs			
Teaching methodology	Research-Based Learning and Project-Based Learning.		
Training Experience	Students actively engaged in the learning process and showed great interest in applying life cycle analysis to real-world engineering challenges. They appreciated the hands-on exercises and the opportunity to compare environmental impacts across different sectors. Feedback indicated that the practical case studies were particularly useful for understanding the complexity of sustainability assessment. Some participants suggested extending the workshop duration to allow deeper exploration of databases and advanced analytical methods. Overall, the experience successfully enhanced students' technical competence, digital research skills, and awareness of environmental responsibility in technology development.		

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TRAINING LESSONS INFORMATION

Title	Digital models to simulate and predict behaviours in research projects		
Summary	This workshop focuses on the use of digital modeling and simulation tools to predict behaviors and outcomes in research projects. Participants learn how to create, analyze, and interpret digital models that represent physical, environmental, or social systems. Through theoretical explanations and hands-on exercises, students explore different modeling techniques, data integration methods, and simulation scenarios. The session emphasizes the importance of data accuracy, model validation, and predictive analysis in research. Collaborative projects allow participants to apply simulation tools to their own disciplines, enhancing their ability to design and evaluate complex systems. By the end of the workshop, students are able to use digital models to support decision-making, optimize research design, and anticipate performance or behavior patterns in real-world applications.		
Face to Face class duration (hours)	2,5 h	**Workgroup duration (hours)**	2,5 h
Resources	Matlab, ANSYS, R		
Green Competences	GC1; GC 2; GC 4; GC 5; GC 9; GC 11		
Digital Competences	DC 2; DC 3; DC 10; DC 20; DC 21		
Number of MOOCs	3 MOOC		
Teaching methodology	Project-Based Learning and Research-Based Learning		
Training Experience	Students showed strong engagement and enthusiasm for using digital modeling tools to simulate and predict behaviors relevant to their research. They valued the opportunity to apply computational methods to real problems and appreciated the balance between theory and practice. Feedback highlighted the collaborative work environment as particularly enriching, as it allowed participants from diverse backgrounds to share approaches and insights. Some students suggested extending the duration of the workshop to explore more advanced simulation techniques and model validation processes. Overall, the training effectively strengthened participants' analytical, digital, and collaborative skills, enhancing their ability to design robust and predictive research models.		

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TRAINING LESSONS INFORMATION

Title	Recycling strategies in research projects in order to improve their sustainability		
Summary	This workshop explores how recycling strategies can be integrated into research projects to enhance their overall sustainability. Participants examine methods to reduce waste, reuse materials, and design research processes that minimize environmental impact. The session introduces key principles of circular research design, emphasizing material efficiency, life cycle thinking, and innovation through upcycling and resource recovery. Through case studies and group analysis, students identify opportunities to apply recycling approaches within their own research fields. Practical exercises focus on assessing material flows, measuring environmental benefits, and developing improvement plans. By the end of the workshop, participants are equipped to design sustainable and resource-efficient research projects, aligning with broader environmental and institutional sustainability goals.		
Face to Face class duration (hours)	2,5 h	**Workgroup duration (hours)**	2,5 h
Resources	Not involved.		
Green Competences	GC 1; GC 2; GC 3; GC 4; GC 7; GC 8; GC 9		
Digital Competences	Not involved.		
Number of MOOCs	1 MOOC		
Teaching methodology	Challenge-Based Learning and Collaborative Learning.		
Training Experience	Students responded enthusiastically to the workshop, demonstrating strong commitment to integrating recycling and sustainability principles into their research work. Collaborative tasks promoted cross-disciplinary exchange and innovative thinking, as participants adapted recycling methods to diverse research contexts. Feedback was very positive, particularly regarding the use of real-world examples and hands-on exercises, which made sustainability applications more tangible. The workshop effectively enhanced students' awareness of sustainable resource management, as well as their analytical and collaborative competences, encouraging them to take an active role in promoting circular practices in academia.		

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TRAINING LESSONS INFORMATION

Title	Digital models to simulate and predict behaviours in research projects		
Summary	The workshop invited participants to explore how digital models and simulations can transform research into a more predictive and experimental process. Instead of relying solely on theoretical assumptions, students created virtual environments capable of reproducing complex behaviors and testing multiple scenarios. They discovered how computational modeling allows them to anticipate results, identify key variables, and optimize processes across scientific and engineering disciplines. Rather than focusing on formulas, the session emphasized interpretation—understanding what models reveal about system dynamics and decision-making. By the end, participants were able to approach research questions with a data-driven mindset, integrating simulation as both a design and forecasting tool.		
Face to Face class duration (hours)	3 h	**Workgroup duration (hours)**	2 h
Resources	Matlab		
Green Competences	Not involved.		
Digital Competences	DC 1; DC 4; DC 5; DC 7; DC 18; DC 19; DC 20; DC 21		
Number of MOOCs	0		
Teaching methodology	Sequence of mini design challenges		
Training Experience	Participants described the workshop as both demanding and rewarding. Many arrived with limited modeling experience but quickly gained confidence through experimentation and group support. The diversity of backgrounds enriched discussions, producing creative solutions and unexpected insights. Students particularly appreciated the challenge-based structure, which made the learning process engaging and immediately applicable. A common suggestion was to dedicate more time to exploring data integration and model validation, as these proved to be the most technically complex steps. Overall, the training inspired a sense of autonomy and curiosity, showing how simulation can expand the boundaries of research.		

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TRAINING LESSONS INFORMATION

Title	Represent and solve mathematical models, data analysis and data visualization using MATLAB (MatLab programming).		
Summary	This workshop introduces participants to MATLAB programming as a tool for representing, solving, and analyzing mathematical models in research and engineering contexts. Students learn to handle data efficiently, perform statistical analysis, and create visualizations that support evidence-based decision-making. Through guided exercises, they develop scripts and functions to model complex systems, simulate behaviors, and interpret numerical results. The session emphasizes problem-solving, analytical reasoning, and computational thinking, enabling participants to transform theoretical concepts into practical applications. By the end of the workshop, students are capable of using MATLAB to process data, validate models, and communicate results effectively through clear and meaningful graphical representations.		
Face to Face class duration (hours)	2,5 h	**Workgroup duration (hours)**	2,5 h
Resources	Matlab, Simulink		
Green Competences	Not involved.		
Digital Competences	DC 1; DC 2; DC 4; DC 10; DC 13; DC 14; DC 15; DC 16; DC 18; DC 19		
Number of MOOCs			
Teaching methodology	Problem-Based Learning		
Training Experience	Students responded very positively to the workshop, appreciating its practical orientation and the immediate applicability of MATLAB to their own research. Many participants noted that the step-by-step coding exercises helped them overcome initial difficulties with syntax and structure, building confidence throughout the session. The combination of guided instruction and self-directed exploration was particularly effective, fostering creativity in model design and visualization. Feedback suggested that extending the duration of the workshop would allow more time for exploring advanced features such as machine learning toolboxes and data automation.		

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TRAINING LESSONS INFORMATION

Title	Sustainability and Life Cycle Assessment		
Summary	The workshop immersed participants in the mindset of evaluating environmental impact from a holistic, systems-based perspective. Rather than addressing sustainability as an abstract concept, students examined how every stage of a product or process—from raw material extraction to end-of-life disposal—carries measurable consequences. Using real data and case studies, they compared alternative design and production pathways, revealing trade-offs between environmental, social, and economic dimensions. The session blended theory and analysis, encouraging participants to move from awareness to measurable action through the use of digital assessment tools.		
Face to Face class duration (hours)	2,5 h	**Workgroup duration (hours)**	2,5 h
Resources	OpenLCA		
Green Competences	GC 1; GC 3; GC 4; GC 6; GC 7; GC 11; GC 12		
Digital Competences	DC 1; DC 2; DC 10; DC 14; DC 15; DC 16; DC 17; DC 19		
Number of MOOCs	2 MOOC		
Teaching methodology	Collaborative Learning		
Training Experience	Students found the experience highly relevant to their own research, especially those in engineering, design, and environmental sciences. They appreciated how the workshop connected environmental theory with quantitative assessment tools, helping them see sustainability as both measurable and improvable. Some participants expressed the need for more time to refine their models and explore sensitivity analysis, reflecting their growing technical curiosity. Overall, the course enhanced not only their digital and analytical competences but also their ethical awareness of how technological decisions affect the planet's future.		

- Anexxe II. Teacher satisfaction survey.

TECSKILL Erasmus+ Project: Professors Survey

* Obligatoria

1. How many training sessions have you given within the TECSKILL project? (1, 2, 3, 4...) *

2. During the sessions, have you worked on digital or green competences or both? *

- ◯ Digital competences
- ◯ Green competences
- ◯ Both competences

3. How satisfied are you with the teaching methodology proposed in the project? *

- ◯ LOW
- ◯ MEDIUM
- ◯ HIGH

4. Do you think this methodology is suitable for training engineering PhD students? *

- ◯ LOW
- ◯ MEDIUM
- ◯ HIGH

5. Answer yes or no to the following questions. *

	YES	NO
Did you use project-based learning (PBL) as the main strategy in your classes?	○	○
Did you propose real or simulated challenges (CBL) in the classes to stimulate critical thinking and creativity?	○	○
Did you implement Research-based learning (RBL) allowing students to explore and formulate hypotheses and analyze data?	○	○
Did you use gamification during the training sessions?	○	○
Did you facilitate the active role of the student as the protagonist of his or her learning?	○	○
Do you feel comfortable applying these methodologies for engineering PhD students?	○	○

6. Lessons learned: do you propose any changes or improvements for future similar trainings that you have detected during your participation in the project?

- Anexxe III. Student satisfaction survey.

TECSKILL Erasmus+ Project: Student Satisfaction Survey

* Obligatoria

1. How many TECSKILL project trainings have you participated in? *

- ◯ 1
- ◯ 2
- ◯ 3
- ◯ 4

2. Please rate your level of satisfaction (low, medium, high) on the following questions regarding TECSKILL training *

	LOW	MEDIUM	HIGH
The activities of the training programmes were well-organized.	◯	◯	◯
I found the content of the training sessions to be practical and applicable.	◯	◯	◯
The methodology used during training is suitable for engineering PhD students.	◯	◯	◯
Support was readily available whenever I encountered difficulties.	◯	◯	◯
During the training programmes, the collaboration among participants was encouraged.	◯	◯	◯

I gained valuable insights from interacting with other participants.	○	○	○
I appreciated the opportunity to visit different countries and explore their cultures.	○	○	○
I had the chance to bond and engage with other participants during extracurricular activities.	○	○	○
Thanks to the activities carried out during the training programmes, I can better evaluate sustainability issues in research.	○	○	○
I am more skilled in using digital tools for data analysis and research.	○	○	○

	LOW	MEDIUM	HIGH
The activities carried out during the training programmes were relevant to my academic and professional goals.	○	○	○
The training programmes I attended met my expectations.	○	○	○
Should other editions of TECSKILL Erasmus+ project be organised in the future, I would recommend other PhD students to attend.	○	○	○
I would participate in a similar project in the future if given the chance.	○	○	○

GREEN AND DIGITAL SKILLS DEVELOPMENT FOR EUROPEAN ENGINEERING PHD CANDIDATES

This project has been funded with support from the European Commission. This publication document reflects the views only of the author, and the Commission cannot be held responsible for any use which may be made of the information contained therein.

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Co-funded by
the European Union

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