ECF4CLIM - A EUROPEAN COMPETENCE FRAMEWORK FOR A LOW CARBON ECONOMY AND SUSTAINABILITY THROUGH EDUCATION

RM-DS04-IN02

DEVELOPMENT OF EDUCATIONAL MATERIALS FOR SUSTAINABILITY

University

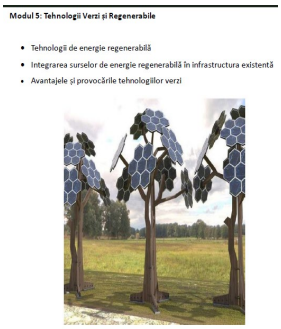
The selected intervention consists of the development of a course "Sustainable Development in a Technological Society", course for students from the technical faculties.

It is structured in 8 modules: (M1) Introduction to Sustainable Development, (M2) Technical Aspects of Sustainable Development, (M3) Sustainable resource management, (M4) Responsible technological development, (M5) Green and Renewable Technologies, (M6) Climate Change and Technical Adaptation, (M7) Global Collaboration and the Future of Technical Sustainability, (M8) Practical Sustainable Development Projects.

The first draft was completed in Spring 2024 and reviewed with students and teachers in the SCT/SCC, as well as in a broader context. The feedback was incorporated, and the final version was ready and tested in the autumn 2024.

Resources

Human	
Time	
Costs	



To more info:

- https://www.youtube.com/watch?v=g6kxxweevww&t=2s
- https://ecf4clim.eu/materials-from-demonstration-sites/

Relevant difficulties

The initiative to develop and pilot a course on sustainability was a forward-looking step toward integrating environmental and social responsibility into higher education. However, several challenges emerged throughout the process, offering valuable lessons and recommendations for future curricular innovations in similar academic contexts:

- Curriculum Integration - Incorporating a new interdisciplinary course into existing technical programs is a complex process. Sustainability, by nature, spans multiple disciplines, and aligning its content with the traditionally rigid and technically focused curricula of engineering required negotiation and curriculum adjustments. Ensuring that the course fit within credit structures was a key challenge.
- Academic Engagement and Awareness - Initial engagement from faculty members varied. Some teachers lacked familiarity with sustainability concepts or did not immediately see their relevance to their specific technical field. Promoting the importance of sustainability in engineering education and gaining the support of academic staff required sustained dialogue and demonstrations of practical relevance.
- Content Development and Interdisciplinary Approach - Designing course content that was both technically rigorous and interdisciplinary posed a challenge. The development team had to ensure that the course balanced theoretical understanding of sustainability with sector-specific applications. Creating such content required collaboration across departments, which was not always easy to coordinate.
- Student Engagement and Expectations - Students in technical faculties are often trained to focus on concrete, solution-oriented problems. Introducing broader concepts such as systems thinking, social responsibility, and long-term environmental impacts required a shift in mindset. Active teaching methods, such as project-based learning and real-world case studies, helped increase interest and relevance.
- Evaluation and Feedback Mechanisms - Identifying appropriate evaluation tools to measure learning outcomes, student engagement, and interdisciplinary understanding required careful planning. Furthermore, incorporating student and faculty feedback to improve the course in real time demanded flexibility and an iterative approach to course design.

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 Engagement	 Connections	 Change	 Action
The course actively fostered engagement by encouraging students to reflect on their values and roles in addressing sustainability within their professional and personal lives. Through structured learning, collaborative discussions, and interdisciplinary interaction, students were empowered to internalise environmental responsibility. The integration of student and teacher feedback during course development further emphasised the collective ownership of sustainability values. This ongoing reflection nurtured a culture of care, responsibility, and ethical commitment to sustainable development in the university community.	The course helped students explore the multifaceted and interdependent nature of sustainability challenges. By examining environmental issues through the lens of technical systems—energy production, resource use, technological development—students learned to navigate the complexity of sustainability in real-world contexts. The modular structure (from technical aspects to global collaboration) provided a systemic perspective, helping students recognise interrelated causes and consequences and the need for interdisciplinary thinking.	The intrvention inspired students to reimagine the role of technology and engineering in building a sustainable future. Modules on renewable technologies, responsible innovation, and climate adaptation encouraged learners to envision green futures where technical knowledge serves ecological and societal well-being. Students began integrating sustainability into their career ambitions and technical projects, aligning their learning with a broader mission of sustainable transformation.	This course translated theory into concrete learning and applied sustainability in a technical context. Students not only acquired knowledge but also acted on it by designing and evaluating sustainable solutions in practical projects. They practised environmental impact assessment, incorporated green principles into engineering work, and took personal and academic steps to reduce their carbon footprints. The university environment itself benefited as students and educators began to embody sustainable behaviours, reinforcing the institution's role as a site of meaningful, systemic change.

Analytical Framework

Individual Competences

Students emerged with stronger critical thinking, practical skills, personal responsibility, and communicative confidence—tools that will support their contributions to a more sustainable future.

- ✓ Critical and reflective thinking - Students reported a stronger ability to analyse complex problems and to think more deeply about the broader implications of their actions. They became more reflective in assessing environmental trade-offs and more discerning in evaluating sustainable choices.
- ✓ Improved environmental awareness and responsibility - Participants demonstrated increased awareness of their personal environmental impact and a sense of responsibility for integrating sustainability into daily decisions—both within academic and personal contexts.
- ✓ Application of theoretical knowledge to practice - Learners successfully transferred academic knowledge into real-life scenarios, gaining practical skills in designing, evaluating, and contributing to green projects. This helped them bridge the gap between abstract concepts and practical solutions.
- ✓ Integration of technical and sustainability skills - Students developed the ability to merge their engineering or technical expertise with sustainability principles, improving their capacity to design environmentally conscious solutions and systems.
- ✓ Growth in communication and expression - The course created opportunities for students to articulate their ideas more clearly and confidently, particularly during debates, presentations, and collaborative activities. This also contributed to their openness to diverse perspectives and new ideas.
- ✓ Initiative and independent learning - Participants exhibited greater autonomy and curiosity in their learning process. They showed initiative in exploring sustainability themes and applying what they learned beyond course requirements.

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Collective Competences

The course successfully cultivated collective competences essential for sustainability-oriented professionals. Through interdisciplinary collaboration, shared decision-making, and mutual support, students developed the capacity to work collectively toward common environmental goals—an indispensable skill set for tackling complex societal challenges.

- ✓ Teamwork and collaborative problem-solving - Students learned to work together more effectively, leveraging one another's strengths and combining diverse skills to generate solutions. Groups facilitated joint decision-making and highlighted the value of working in coordinated, supportive teams.
- ✓ Co-creation across disciplines - The course created opportunities for students having different preferences and performances in different disciplines to co-develop sustainability solutions. Such collaboration broadened perspectives and allowed for more creative and holistic responses to environmental challenges.
- ✓ Inclusive and respectful communication - Participants practised open and respectful communication, where all voices were valued. Group work encouraged inclusive dialogue and the appreciation of different viewpoints, contributing to richer outcomes and stronger group cohesion.
- ✓ Shared focus on sustainability goals - Students remained aligned on common objectives throughout the development of the course. The shared focus on environmental responsibility gave the group work coherence and helped translate abstract principles into actionable outcomes.
- ✓ Collective engagement in green mindsets - Beyond completing tasks, students supported and reinforced each other's commitment to sustainability. Working as a group strengthened their motivation and deepened their sense of shared purpose in pursuing more sustainable behaviours and solutions.

Technical-material Competences

The course offered a structured opportunity for engineering and technology students to integrate ecological awareness into their disciplinary perspective and project work. It enabled future engineers to evaluate the environmental impact of their work, design more sustainable solutions, and act as responsible agents in the transition to a greener society.

- ✓ Understanding of environmental impact in technical contexts - Students developed a clearer awareness of how technology affects the environment. They learned to assess the ecological implications of energy production, resource consumption, and infrastructure development, integrating sustainability principles into their technical knowledge base.
- ✓ Reduction of carbon footprint through informed decision-making - Participants reported an improved ability to recognise and reduce their personal and professional carbon footprints. This awareness was translated into practical actions and became an evaluative dimension in student project work.
- ✓ Integration of green principles into engineering solutions - The course fostered a shift in design thinking. Students began to incorporate sustainability as a core value in their technical proposals, treating environmental impact as a criterion for responsible engineering and innovation.
- ✓ Resource efficiency and conscious consumption - Students showed increased attention to energy use and resource efficiency, both personally and in the context of the university. This awareness reflects a maturing understanding of sustainability as a systemic challenge, influenced by everyday habits and technological systems alike.
- ✓ Greening the academic environment - The course contributed to creating a more environmentally conscious university culture. Through project-based learning and reflective discussions, students and educators alike took responsibility for promoting sustainable behaviours and reducing the institution's environmental footprint.

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