



Circular STEM

Boosting Circular Economy Competences for STEM Teachers

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Training Methodology and Competence Framework

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A3. Training Methodology and Competence Framework

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 - Institute for Contemporary Education (ICE) (Serbia) - <https://www.linkgroup.eu/institutecontemporaryeducation>
 - Politeknika Ikastegia Txorierri (Spain) - www.txorierri.net
 - EKA University of Applied Sciences (Latvia) - www.eka.edu.lv
 - EIT RawMaterials (Germany) -

Website:

<https://circularstem.eu/>

Social media Circular STEM Circular STEM

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Training Methodology and Competence Framework

1.0 Methodology proposal

1. **Learning Objectives:** This step involves aligning competencies with specific learning objectives for both teachers and their students. This is crucial for ensuring that the training is goal-oriented and measurable.
2. **Develop a Competence Framework:**
 - **Framework Structure:** Categorizing competencies into domains such as Knowledge, Skills, and Attitudes provides a clear and organized structure for the framework.
 - **Alignment with Standards:** Ensuring alignment with frameworks like the European sustainability competence framework (GreenComp) and EQF level 4 helps maintain relevance and standardization.
 - **Progression Levels:** Defining different levels of mastery allows for a structured progression in learning, accommodating various levels of prior knowledge and experience.
3. **Develop Teachers' Training:**
 - **Pedagogical Approach:** Choosing a learner-centered approach with active learning, problem-solving, and project-based learning is effective for adult education and facilitates deeper understanding.
 - **Content Development:** Developing content that covers circular economy concepts, STEM applications, and digital tool usage, while being gender-sensitive, ensures comprehensive and inclusive education.
 - **Interactive and Practical Components:** Including hands-on activities, case studies, role-playing, and digital simulations enhances engagement and practical understanding, which is essential for effective learning.

2.0 Introduction to Competency Framework

1. Types of competence frameworks and their structure

Overall, 20 competence frameworks were reviewed for the purposes of identifying the core structure of a framework (see Appendix 1). All competence frameworks could be divided into two major categories – those designed generally for the population, such as DigComp2.2. or

EntreComp, and those designed for a specific organization, for example, UNDP or OECD (see Table 1).

Table 1. Competence frameworks

Purpose of the framework	Features	Examples
General	Workplace	• EntreComp • GreenComp • DigComp
	Education	• EntreComp • DigCompEdu • DigComp for European Schools
	General	• DigCompConsumers • DigCompOrg • DigComp2.2.
Organizational	Core competencies for the entire workforce	• OECD competency framework • UN Women values and competency framework

Overall, organizational competence frameworks are more general and do not contain specific levels in contrast to general competence. Therefore, for the purposes of this analysis, only general competencies were selected. A typical structure of competence framework consists of the following major components:

- Aim and justification. Limitations
- Comparison to other relevant frameworks
- Methodology of the development of the framework, including some resources, if such were used
- Competence areas, competencies, and levels
- Examples of how competencies could be assessed and applied
- Glossary
- Considering the area of circular economy and STEM, the following frameworks were selected for detailed analysis:
 - EntreComp
 - GreenComp
 - DigComp2.2.
 - DigCompEdu
 - DigComp for European Schools

2. Structure of selected competence frameworks

Structure of EntreComp

The aim of EntreComp is to outline competencies that are required for the development of entrepreneurial intention and activities. EntreComp structure of competencies is summarized in Table 2.

Table 2: EntreComp competencies

Competence areas	Competences
Ideas and opportunities	Spotting opportunities Creativity Vision Valuing ideas Ethical and sustainable thinking
Resources	Self-awareness & self-efficacy Motivation and perseverance Mobilizing resources Financial and economic literacy Mobilizing others
Into action	Taking the initiative Planning and management Copying with ambiguity, uncertainty, and risk Working with others Learning through experience

Each competence is provided with 3 descriptors. There are 4 major levels within this competence framework, all of which are viewed on the continuum of actions, which is characterized by two key actions or sub-levels per level (see Table 3).

Table 3. EntreComp Levels

Level	Key action
Foundation	Discover Explore
Intermediate	Experiment Dare
Advanced	Improve Reinforce
Expert	Expand Transform

The final output of the framework is the description of students' abilities per each competence per each level. This description allows to design tasks and to assess the overall performance for teachers and for self-assessment.

Structure of GreenComp

The aim of GreenComp is to outline competences that are essential for the development of the mindset of environmental sustainability. GreenComp contains 4 major areas of competences and 3 specific competences per area (see Table 4).

Table 4: GreenComp competences:

Competence areas	Competences
Embodying sustainability	Valuing sustainability Supporting fairness Promoting nature
Embracing complexity in sustainability	Systems thinking Critical thinking Problem framing
Envisioning sustainable future	Futures literacy Adaptability Exploratory thinking
Acting for sustainability	Political agency Collective action Individual initiative

Each competence is provided with an example and descriptor. Examples point to the interconnectedness of economic, social, and environmental issues. There is a section on problem-solving issues in the context of sustainability.

Structure of DigComp 2.2.

The aim of DigComp 2.2 is to outline competencies that are essential for any type of activity in digital systems. DigComp 2.2. consists of 5 major areas of competencies and some specific competencies per area in relation to digital activities (see Table 5).

Table 5: DigComp 2.2 competences

Competence areas	Competences
Information and data literacy	• Searching and filtering data • Evaluating data • Managing data

Communication and Collaboration	• Interaction • Information Sharing • Engaging in activities • Collaborating • Netiquette knowledge • Managing digital identity
Digital content creation	• Developing content • Integration and re-elaboration of content • Copyright and licenses • Programming
Safety	• Protection of devices • Protection of various types of data • Protection of health and well-being • Protection of environment
Problem-solving	• Solving technical problems • Identifying needs and responses • Creative use of digital technologies • Identification of digital gaps

Similarly to EntreComp, DigComp 2.2 has 4 levels (foundation, intermediate, advanced, highly specialized) and descriptors of activities at 3 levels – knowledge, skills, and attitudes - per each level. The actions that are typically used in the framework include the following: search, identify, filter, evaluate, organize, choose, identify, and create.

Structure of DigCompEdu

DigCompEdu was designed for educators essential for their professional growth and teaching. DigCompEdu consists of 6 areas of competencies and some specific competencies per area in relation to digital activities (see Table 6).

Table 6: DigCompEdu

Competence areas	Competences
Professional engagement	• Organisational communication • Professional collaboration • Reflective practice • Digital CPD
Digital resources	• Selecting • Creating and modifying • Managing, protecting, sharing
Teaching and learning	• Teaching • Guidance • Collaborative learning • Self-regulated learning

Assessment	• Assessment strategies • Analysing evidence • Feedback and planning
Empowering learners	• Accessibility and inclusion • Differentiation and personalization • Actively engaging learners
Facilitating learners' digital competence	• Information and media literacy • Communication and Collaboration • Content creation • Responsible use of resources • Problem-solving

Similarly to other frameworks, this one also provides descriptors for each competence. There are 6 competence levels: foundation, intermediate, and advanced, and each level contains 2 sub-levels, characterized by the following actions: development of awareness, exploration, integration, expertise provision, leadership, and innovation.

Structure of DigComp for European Schools

DigComp for European Schools was designed to indicate competencies and the levels that students of European schools should be able to develop. The structure of competencies is taken from DigComp 2.2. Descriptors of each area of competencies are provided for each major schooling level: nursery, primary school, and secondary school. Furthermore, teachers are provided with recommendations for the outcomes of activities for each area for different levels.

Summary of the review of relevant frameworks

All frameworks have a similar structure: competence areas that have group-specific competencies, competence levels, and descriptors. Examples of outputs and actions for each level and competence are also provided. In the case of frameworks for educators, recommendations are provided related to activities that can help develop competencies.

Typically, frameworks have 4 levels. At the primary level, learners acquire an awareness of the field and basic skills to identify, find, and select proper information or engage in a particular action. At the intermediate level, learners can conduct primary analysis of needs, recognize patterns, and select information for basic problem-solving. At the advanced level, learners can solve more complex problems, requiring deeper analysis and knowledge of the field. At the expert level, learners can engage in creative activities and innovations.

All frameworks promote hard and soft skills, specifically, technical knowledge of the field and communication and collaboration skills.

3. STEM frameworks

There are various STEM frameworks designed for specific institutions, for example, the STEM Education Framework of the New York Academy of Sciences of STEM Framework for Flemish Schools.

The STEM Framework of New York Academy consists of core competencies (A), instructional design (B), and implementation strategies (C). Similarly to other frameworks, core competencies are assessed at 4 levels: undeveloped, basic, developing, and exemplary. Competency areas and specific competencies are summarized in Table 7.

Table 7. STEM Framework of New York Academy of Sciences

Competence areas	Competences
A. Essential skills	• Critical thinking • Problem-solving • Creativity • Communication • Collaboration • Data literacy • Digital literacy and computer science
A. Supporting Attributes	• STEM mindset • Agency and persistence • Social and cultural awareness • Leadership • Ethics
B. Instructional design	• Research-based pedagogy • STEM content integration • Real-world application • Project-or problem-based learning • Scaffolding • Assessment • Cultural sensitivity and Relevance • Technology integration
C. Implementation	• Accessibility • Alignment to local contexts • Professional development and learning supports • Evidence of effectiveness • Access to materials and practitioner support • Scalability

Thus, this framework provides guidance for competencies that are essential for both learners and teachers in the promotion of STEM competencies. The STEM Framework for Flemish Schools is also similar in nature to this framework because it focuses on the development of technical

knowledge of the field and the promotion of collaboration and research activities among students through teaching.

4. Proposed structure for the development of STEM framework for circular economy

Similar to other frameworks, it is suggested here to conduct interviews with experts in the field to identify the core areas of STEM and circular economy that should be implemented in the framework.

There are 3 core and 5 enabling elements in the circular economy. The core elements should be viewed as the ultimate goal while enabling elements are those that support the development of competencies for the emergence of core competencies in the area of the circular economy.

Table 8. Circular economy competencies for STEM

Competence areas	Competences
Sustainability	• Environmental sustainability • Economic sustainability • Social sustainability • Principles of organizational management
Resource use and management	• Different types of resources • Principles of recycling and reusable resources • New sustainable resources
Waste use and management	• Waste types • Waste production • Waste management • Waste use for sustainability • Consumer vs. industrial waste
Water use and management	• Different types of water resources are used in economic activities for different purposes • Consumer vs. industrial water use • Water waste
Energy use and management	• Different types of energy • Energy use for sustainability • Consumer vs. industrial energy use

Each area of competencies should be described and provided levels, similar to other frameworks.

5. Final proposal of the competence matrix CM combining Circular economy competencies for STEM, digital and entrepreneurial competencies, Table 9

TEACHERS' COMPETENCES TO BE DEVELOPED

Step 1	Define needed competences
Step 2	Define skill for each competence
Step 3	Define the ability to create this skill
Competencies	
<i>Knowledge</i>	<i>Skills, Abilities, and Attitudes</i>
1. Circular Economy Concepts	
Principles and practices of sustainability, resource management, and waste reduction	Interdisciplinary teaching: Integrating circular economy with STEM subjects
Awareness of how these disciplines intersect and relate to the circular economy	Curriculum development: Designing curricula that incorporate a circular economy
2. Systems Thinking	
Familiarity with systems theory and the principles of systems thinking	Proficiency in teaching complex systems and their interdependencies
Understanding of how ecological, economic, and social systems interact within the circular economy	Ability to guide students in mapping and analyzing systems
	Ability to guide students in understanding the impact of changes within these systems
3. Sustainability and Environmental Knowledge	

Sustainability and ecological footprint	Sustainability Awareness
Climate change	
Biodiversity	
Renewable energy sources	Responsible consumer behavior Resource management skills
Pollution and waste	
Knowledge of how the circular economy contributes to sustainable development	Capability to impart knowledge about environmental challenges and sustainability solutions
4. Innovation and Problem-Solving Skills	
Understanding creative problem-solving methodologies	Ability to encourage creative thinking and innovation among students
	Proficiency in guiding students through the problem-solving process, from identifying problems to developing and testing solutions
Innovative thinking	Embracing curiosity and willingness to explore new ideas
	Thinking outside the box and challenging conventional approaches
	Identifying and seizing opportunities for innovation
	Being open to change and willing to embrace new ideas and technologies
5. Collaboration and Teamwork	
Collaboration	Placing group goals above personal satisfaction and recognition
	Reach a consensus about goals and methods for completing projects or tasks
	Recognizing others' contributions, giving credit where it's due

	Identify obstacles and address problems cooperatively
Stress Management	Recognizing personal stress triggers and understanding how stress manifests in oneself
	Ability to manage and control emotions effectively in stressful situations
	Expressing needs, setting boundaries, and effectively communicating with others to manage stress-inducing situations.
Communication	Verbal Communication
	Non-verbal Communication
	Active Listening
6. Digital Literacy and Technology Integration	
Research and online resources	Conducting effective online research using search engines and databases
	Evaluating the credibility and reliability of online sources
	Accessing and utilizing open educational resources (OER) for teaching and learning
Data analytics	Collecting and organizing data from various sources
	Applying statistical techniques to analyze and interpret data
Use of different digital tools	Proficiency in using productivity software such as word processors, spreadsheets, and presentation tools
	Familiarity with collaboration tools for remote teamwork and communication
	Proficiency in using learning management systems for online teaching and learning

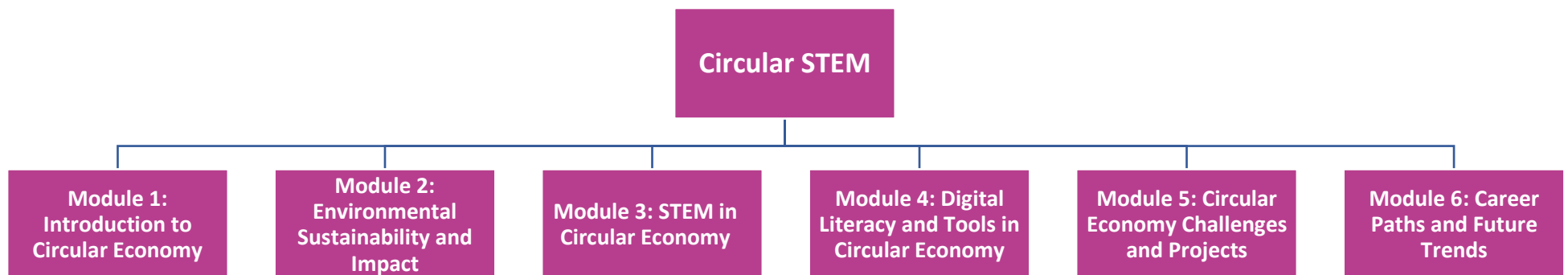
Appendix 1. Reviewed competence frameworks

Various competence frameworks were reviewed (see Table 1).

No.	Competence framework	Link	Purpose
1.	DigComp 2.2. for citizens	https://publications.jrc.ec.europa.eu/repository/handle/JRC128415	To outline digital competencies that are essential for carrying out digital tasks and non-digital tasks through digital tools for citizens of Europe
2.	DigCompOrg	https://joint-research-centre.ec.europa.eu/european-framework-digitally-competent-educational-organisations-digcomporg/digcomporg-framework_en	To support the transition of educational institutions to digitally savvy educational institutions through the identification of digital needs and integration of required digital solutions into learning, teaching, and administration of processes. This purpose is reflected in the full name of the framework – European Reference Framework for Digitally-Competent Educational Organisations
3.	DigCompEdu	https://publications.jrc.ec.europa.eu/repository/handle/JRC107466	To outline a set of digital competencies that educators should have to conduct teaching and learning using digital solutions.
4.	DigCompConsumers	https://publications.jrc.ec.europa.eu/repository/handle/JRC103155	To outline digital competencies that European consumers should have to engage safely in e-commerce.
5.	EntreComp	https://publications.jrc.ec.europa.eu/repository/handle/JRC101581	To outline competencies that are essential for the development of the entrepreneurship capacity of citizens and organizations of Europe in order to facilitate entrepreneurship learning. The framework was developed in response to the lack of common definitions of entrepreneurship competencies.
6.	GreenComp	https://publications.jrc.ec.europa.eu/repository/handle/JRC128040	To outline competencies that are essential for sustainable development, including those to protect the health of the natural environment and people and that can be integrated into education systems.
7.	LifeComp	https://publications.jrc.ec.europa.eu/repository/handle/JRC120911	To outline competencies essential for employment and personal growth, social inclusion, and active citizenship, including learning competencies.
8.	CEFR	https://www.coe.int/en/web/common-european-framework-reference-languages/level-descriptions	To provide the conceptual foundation for the development of common language syllabuses and curricula, design textbooks and examinations, and other resources across Europe in order to boost the quality of language teaching and learning.

9.	Competence Framework for Democratic Culture	https://rm.coe.int/prems-008318-gbr-2508-reference-framework-of-competences-vol-1-8573-co/16807bc66c	To outline competencies required for building democratic cultures
10.	UNESCO competency framework	https://en.unesco.org/sites/default/files/competency_framework_e.pdf	To outline competencies required of UNESCO staff to promote and act consistent with common organizational goals and values.
11.	UN Women values and competency framework	https://www.unwomen.org/sites/default/files/Headquarters/Attachments/Sections/About%20Us/Employment/UN-Women-values-and-competencies-framework-en.pdf	To outline values and competencies of the UN Women organization that relate to the performance of staff in order to align actions of staff for achieving gender equality,
12.	Core behavioral competences for UNDP	https://www.undp.org/sites/g/files/zskgke326/files/2021-12/CoreBehaviouralCompetencies.pdf	To outline core competencies, related to attitudes and behavior, which are required of any professional working for the organization.
13.	OECD competency framework	https://www.oecd.org/careers/competency_framework_en.pdf	To outline core competencies required of any professional working for the OECD organization.
14.	ResearchComp	https://research-and-innovation.ec.europa.eu/system/files/2023-04/ec_rtd_research-competence-presentation.pdf	To outline competencies required for pursuing and managing research activities.
15.	DigComp for European schools	https://www.eursec.eu/BasicTexts/2020-09-D-51-en-2.pdf	To outline competencies that graduates of European schools should have upon graduation.
16.	STEM education framework (New York Academy of Sciences)	https://www.nyas.org/media/13051/gsa_stem_education_framework_dec2016.pdf	To identify the most effective practices in teaching science, technology, engineering, and mathematics and promote their implementation in teaching STEM subjects.
17.	STEM framework for Flemish schools	https://onderwijs.vlaanderen.be/sites/default/files/2021-07/STEM-kader%20%28Engels%29.pdf	To provide solutions for the mutual integration of STEM subjects at schools and the implementation of STEM programs at schools
18.	UNESCO. Global framework of reference for digital literacy skills for indicator 4.4.2.	https://unesdoc.unesco.org/ark:/48223/pf0000265403	To provide the outline of digital literacy skills required in the contemporary world.
19.	World Bank. Digital skills: Frameworks and programs	https://openknowledge.worldbank.org/server/api/core/bitstreams/7d01c8ae-dca0-55cf-ad21-b2df0a03d207/content	To outline digital skill areas that populations across the world have to be able to pursue activities on the job market.
20.	UN leadership framework	https://unsceb.org/united-nations-system-leadership-framework	To identify the leadership elements that make the UN a successful organization and that motivate the UN staff for action and change.

3.0 Training structure



Proposed list of modules

	Name of module	Responsible partner
MODULE 1	Introduction to Circular Economy	Politeknika Txorierri
MODULE 2	Environmental Sustainability and Impact	ICE
MODULE 3	STEM in Circular Economy	Dlearn
MODULE 4	Digital Literacy and Tools in Circular Economy	EKA
MODULE 5	Circular Economy Challenges and Projects	Portugal
MODULE 6	Career Paths and Future Trends	EIT Raw Materials

Module 1: Introduction to Circular Economy (partner/developer)

Main objective: Module 1 introduces participants to the Circular Economy, emphasizing its role in sustainable resource management. It aims to deepen awareness and understanding, fostering critical thinking about the environmental, economic, and social implications of transitioning from a linear to a circular model. The module explores the global relevance of Circular Economy principles, highlighting their universal application for addressing resource depletion and promoting sustainable development.

Participants will examine key components such as reduce, reuse, recycle, and recover strategies, with a focus on how businesses can innovate and contribute to sustainable growth. Additionally, the module delves into the policy implications of Circular Economy adoption, considering the role of governments in facilitating this transition. Real-world case studies illustrate successful implementations across diverse industries, demonstrating positive environmental and economic impacts. Addressing challenges associated with the Circular Economy transition is integral, prompting participants to identify obstacles and explore innovative solutions. The module empowers participants with knowledge and skills to actively contribute to the Circular Economy, fostering a sense of responsibility for sustainable practices in both professional and personal spheres.

Topics		Learning Outcomes	
	Knowledge and understanding	Skills	Values and attitudes

1. Introduction to Circular Economy	1. Definition and basic concepts and principles. Differences between linear and circular economy 2. Waste as a resource. Closed material cycle 3. Extension of product lifespan 4. Economic benefits and business opportunities 5. Role of Innovation and Technology 6. Collaboration and regulations 7. Global impact and sustainability 8. Education and Awareness 9. Water Use and Management 10. Energy Use and Management	1. Understanding of basic concepts 2. Analytical skills 3. Critical thinking 4. Application of principles 5. Communication skills 6. Versatility in problem-solving 7. Innovative thinking 8. Sustainability awareness 9. Collaboration and teamwork 10. Monitoring and evaluation 11. Resource Management 12. Technical Skills 13. Engineering Skills 14. Economic Skills	1. Sustainability 2. Innovation 3. Responsibility 4. Versatility 5. Solidarity 6. Social justice 7. Consumption Awareness 8. Education 9. Transparency 10. Collective action 11. Efficiency 12. Environmental Awareness
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Theoretical part on the topic, an introduction aimed at building motivation and awareness for the circular economy		
To be developed by partners; max 500 words ● Understanding Circular Economy: Basic principles, importance, and global impact. ● Differences from Linear Economy: Contrasting circular and linear economic models. ● Benefits of Circular Economy: Environmental, economic, and social advantages.		
Activities for students: Circular economy challenges to be used as inspiration for lesson topics		
Activity 1 Title	Materials needed	Description
To be developed by partners;	• •	Maximum 800 word
Student engagement tools, methods & activities (digital tools, lab experiments, games, role plays etc.)		
Type	Title	Description
- o Digital tool - o Lab experiment - o Game - o Role play - o Other		To be proposed by partners; List 1 – 3 engagement tools, describe each with a maximum 200-word
Assessment tools & methods		
Type - to be proposed by partners		

- o Questionnaire - o Essay - o Project on the topic - o Other _____	- o List 10 questions with possible answers - o Define length and any specific rules - o Define the framework - o Provide description/instructions
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Module 2: Environmental Sustainability and Impact (partner/developer)

Main objective: The main objective of environmental sustainability is to create a harmonious balance between human activities and the natural environment to ensure the long-term well-being of the planet. Achieving ecological balance involves reducing the negative impact of human activities on ecosystems, promoting the preservation of biodiversity, and supporting the recovery of endangered species. Sustainability also entails promoting efficient use of resources, reducing harmful gas emissions, and encouraging the use of renewable energy sources. Achieving environmental sustainability requires global cooperation and education to raise awareness about the importance of environmental conservation. The goal is to reduce waste and promote recycling, creating a more sustainable approach to resource management. Environmentally sustainable practices also include supporting local economies, empowering communities, and promoting responsible consumer behavior. The central objective is to create long-term solutions that maintain the ability of future generations to meet their needs. Achieving sustainability involves promoting responsibility at all levels of society, from individuals to corporations and governments. Ultimately, environmental sustainability aims to create a world where people, nature, and the economy operate in harmony, contributing to a healthier and more balanced global ecosystem.

Topics		Learning Outcomes	
	Knowledge and understanding	Skills	Values and attitudes

1. Environmental Sustainability and Impact	1. Sustainability and ecological footprint 2. Climate change 3. Biodiversity 4. Responsible consumer approach 5. Renewable energy sources 6. Pollution and waste 7. Global collaboration 8. Legislation and policy 9. Economic perspectives 10. Social impact 11. Environmental sustainability 12. Social sustainability 13. Principles of Organizational Management	1. Sustainability Awareness 2. Analytical skills 3. Knowledge of climate change 4. Responsible consumer behavior 5. Resource management skills 6. Communication skills 7. Interdisciplinary Understanding 8. Social Awareness 9. Legislation and Political Literacy 10. Global Collaboration Skills 11. Leadership 12. Teamwork 13. Project Management 14. Understanding of Social and Environmental Issues	1. Environmental Awareness 2. Responsibility 3. Connection with Nature 4. Social Justice 5. Climate Change Awareness 6. Innovativeness 7. Resource Conservation 8. Education 9. Global Awareness 10. Duty to future generations 11. Ethics and Integrity 12. Diversity and Inclusion
Theoretical part on the topic, an introduction aimed at building motivation and awareness for the circular economy			
To be developed by partners; max 5000 words ● Global Environmental Challenges: Climate change, pollution, resource depletion. ● Circular Economy in Environmental Protection: Role in reducing carbon footprint, waste management. ● Sustainable Living Practices: Everyday actions to support sustainability.			

Activities for students: Circular economy challenges to be used as inspiration for lesson topics		
Activity 1 Title	Materials needed	Description
To be developed by partners;	. .	Maximum 800 word
Student engagement tools, methods & activities (digital tools, lab experiments, games, role plays etc.)		
Type	Title	Description
- o Digital tool - o Lab experiment - o Game - o Role play - o Other		To be proposed by partners; List 1 – 3 engagement tools, describe each with maximum 200 word
Assessment tools & methods		
Type - to be proposed by partners		
- o Questionnaire - o Essay - o Project on the topic - o Other _____	- o List 10 questions with possible answers - o Define length and any specific rules - o Define the framework - o Provide description/instructions	

Module 3: STEM in Circular Economy (partner/developer)

Main Objective: Integrating STEM into the Circular Economy aims to instigate a transformative shift toward sustainable and regenerative practices. This entails cultivating innovation, optimizing resource use, and advancing technology to establish a holistic and resilient circular economy. The primary objective is to foster a culture of creativity within STEM disciplines, propelling inventive solutions for sustainable production and consumption. STEM expertise is harnessed to develop efficient methods for managing resources, minimizing waste, and maximizing circular resource flows. The focus extends to driving the development and implementation of sustainable technologies that promote circularity and environmental stewardship. Applying STEM principles to design processes is crucial, emphasizing product longevity, reparability, and recyclability. Collaboration across STEM disciplines and industries is encouraged to create interdisciplinary solutions addressing the complexity of circular economy challenges. Equipping individuals with STEM skills and knowledge is pivotal for effective participation in the circular economy landscape. Digital technologies within STEM are leveraged to optimize processes, enhance transparency, and enable real-time monitoring of circular economy initiatives. STEM-driven innovations play a significant role in improving waste management strategies, with a focus on reduction, recycling, and responsible disposal. Guided by STEM insights, sustainable business models are developed that prioritize circularity, sustainability, and responsible resource use, fostering a collective commitment to environmental stewardship within STEM communities.

Topics		Learning Outcomes	
	Knowledge and understanding	Skills	Values and attitudes

2. STEM in Circular Economy	1. Environmental Awareness 2. Technological Innovations - IoT, AI 3. Sustainable Production 4. Resource Efficiency 5. Digitization in Circular Economy 6. Interdisciplinary Approach 7. Education and Workforce Development 8. Monitoring and Evaluation 9. Global Dimension of Circular Economy	1. Understanding of Circular Economy Principles 2. Application of STEM Principles in Product Design 3. Effective Resource Management 4. Innovation in Recycling Technologies 5. Interdisciplinary Problem Solving 6. Digitization and Process Monitoring 7. Sustainable Production and Design 8. Education and Workforce Development 9. Assessment of Impact and Awareness of Global Environmental Challenges	1. Innovation and creativity 2. Sustainability 3. Education and Awareness 4. Transparency and accountability 5. Interdisciplinarity 6. Global Awareness 7. Social Justice 8. Resource Efficiency 9. Equity in Technology Access 10. Engagement and Activism
Theoretical part on the topic, an introduction aimed at building motivation and awareness for the circular economy			
To be developed by partners; max 500 words ● STEM Role in Sustainable Solutions: How science, technology, engineering, and maths drive a circular economy. ● Real-World STEM Applications: Case studies of STEM innovations in recycling, renewable energy, etc. ● Practical STEM Projects: Hands-on activities and experiments related to sustainability.			

Activities for students: Circular economy challenges to be used as inspiration for lesson topics		
Activity 1 Title	Materials needed	Description
To be developed by partners;	• •	Maximum 800 word
Student engagement tools, methods & activities (digital tools, lab experiments, games, role plays etc.)		
Type	Title	Description
- o Digital tool - o Lab experiment - o Game - o Role play - o Other		To be proposed by partners; List 1 – 3 engagement tools, describe each with maximum 200 word
Assessment tools & methods		
Type - to be proposed by partners		
- o Questionnaire - o Essay - o Project on the topic - o Other _____		- o List 10 questions with possible answers - o Define length and any specific rules - o Define the framework - o Provide description/instructions

Module 4: Digital Literacy and Tools in Circular Economy (partner/developer)

Main Objective: The main objective of the research on Digital Literacy and Tools in the Circular Economy is to promote the integration of digital technologies to enhance sustainability practices. We aim to develop diverse digital skills to support participants in the economy in efficiently utilizing resources. Our goal is to raise awareness about the importance of digital tools in optimizing circular processes and to encourage innovation and transparency throughout the supply chain. Simultaneously, we seek to foster collaboration among various stakeholders, promoting dialogue on digital solutions in achieving sustainability goals in the circular economy. We examine the impact of digital literacy on changes in consumer habits, encouraging more responsible and sustainable choices. Through our research, we aim to identify the most effective digital tools and technologies that support the transition to more sustainable and environmentally friendly business practices. Our objective is to create guidelines for the implementation of digital solutions that promote the circular economy, contributing to global efforts to preserve resources and reduce environmental impact.

Topics		Learning Outcomes	
	Knowledge and understanding	Skills	Values and attitudes

3. Digital Literacy and Tools in Circular Economy	1. Digital Literacy 2. Technological Solutions 3. Supply Chain Management 4. Environmental Impact Assessment 5. Consumer Behavior 6. Innovation and Collaboration 7. Policy and Regulations 8. Educational Initiatives 9. Global Perspective	11. Application of Circular Economy Principles 12. Use of Digital Tools 13. Integrating technology into the supply chain 14. Assessment of Environmental Impact 15. Promotion of Sustainable Consumer Behavior 16. Innovation and Collaboration 17. Contemporary Understanding of Policies and Regulations 18. Stakeholder Education 19. Adaptability to Global Perspectives 20. Creation of Implementation Guidelines	21. Sustainability 22. Transparency 23. Innovation 24. Education 25. Collaboration 26. Social Responsibility 27. Data Reliability and Security 28. Justice 29. Flexibility 30. Proactivity
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Module 4: Digital Literacy and Tools in Circular Economy (partner/developer)

Main Objective: The main objective of the research on Digital Literacy and Tools in the Circular Economy is to promote the integration of digital technologies to enhance sustainability practices. We aim to develop diverse digital skills to support participants in the economy in efficiently utilizing resources. Our goal is to raise awareness about the importance of digital tools in optimizing circular processes and to encourage innovation and transparency throughout the supply chain. Simultaneously, we seek to foster collaboration among various stakeholders, promoting dialogue on digital solutions in achieving sustainability goals in the circular economy. We examine the impact of digital literacy on changes in consumer habits, encouraging more responsible and sustainable choices. Through our research, we aim to identify the most effective digital tools and technologies that support the transition to more sustainable and environmentally friendly business practices. Our objective is to create guidelines for the implementation of digital solutions that promote the circular economy, contributing to global efforts to preserve resources and reduce environmental impact.

Topics		Learning Outcomes	
	Knowledge and understanding	Skills	Values and attitudes
Theoretical part on the topic, an introduction aimed at building motivation and awareness for the circular economy			
To be developed by partners; max 500 words ● Digital Technologies in Circular Economy: Overview of relevant digital tools and their applications. ● Using Digital Simulations: Interactive simulations for understanding resource management and circular processes. ● Online Collaborative Tools: Platforms for project collaboration and communication.			
Activities for students: Circular economy challenges to be used as inspiration for lesson topics			
Activity 1 Title	Materials needed	Description	

Module 4: Digital Literacy and Tools in Circular Economy (partner/developer)

Main Objective: The main objective of the research on Digital Literacy and Tools in the Circular Economy is to promote the integration of digital technologies to enhance sustainability practices. We aim to develop diverse digital skills to support participants in the economy in efficiently utilizing resources. Our goal is to raise awareness about the importance of digital tools in optimizing circular processes and to encourage innovation and transparency throughout the supply chain. Simultaneously, we seek to foster collaboration among various stakeholders, promoting dialogue on digital solutions in achieving sustainability goals in the circular economy. We examine the impact of digital literacy on changes in consumer habits, encouraging more responsible and sustainable choices. Through our research, we aim to identify the most effective digital tools and technologies that support the transition to more sustainable and environmentally friendly business practices. Our objective is to create guidelines for the implementation of digital solutions that promote the circular economy, contributing to global efforts to preserve resources and reduce environmental impact.

Topics		Learning Outcomes	
	Knowledge and understanding	Skills	Values and attitudes
To be developed by partners;	•	Maximum 800 word	
Student engagement tools, methods & activities (digital tools, lab experiments, games, role plays etc.)			
Type	Title	Description	

Module 4: Digital Literacy and Tools in Circular Economy (partner/developer)

Main Objective: The main objective of the research on Digital Literacy and Tools in the Circular Economy is to promote the integration of digital technologies to enhance sustainability practices. We aim to develop diverse digital skills to support participants in the economy in efficiently utilizing resources. Our goal is to raise awareness about the importance of digital tools in optimizing circular processes and to encourage innovation and transparency throughout the supply chain. Simultaneously, we seek to foster collaboration among various stakeholders, promoting dialogue on digital solutions in achieving sustainability goals in the circular economy. We examine the impact of digital literacy on changes in consumer habits, encouraging more responsible and sustainable choices. Through our research, we aim to identify the most effective digital tools and technologies that support the transition to more sustainable and environmentally friendly business practices. Our objective is to create guidelines for the implementation of digital solutions that promote the circular economy, contributing to global efforts to preserve resources and reduce environmental impact.

Topics		Learning Outcomes	
	Knowledge and understanding	Skills	Values and attitudes
- o Digital tool - o Lab experiment - o Game - o Role play - o Other		To be proposed by partners; List 1 – 3 engagement tools, describe each with maximum 200 word	
Assessment tools & methods			
Type - to be proposed by partners			

Module 4: Digital Literacy and Tools in Circular Economy (partner/developer)

Main Objective: The main objective of the research on Digital Literacy and Tools in the Circular Economy is to promote the integration of digital technologies to enhance sustainability practices. We aim to develop diverse digital skills to support participants in the economy in efficiently utilizing resources. Our goal is to raise awareness about the importance of digital tools in optimizing circular processes and to encourage innovation and transparency throughout the supply chain. Simultaneously, we seek to foster collaboration among various stakeholders, promoting dialogue on digital solutions in achieving sustainability goals in the circular economy. We examine the impact of digital literacy on changes in consumer habits, encouraging more responsible and sustainable choices. Through our research, we aim to identify the most effective digital tools and technologies that support the transition to more sustainable and environmentally friendly business practices. Our objective is to create guidelines for the implementation of digital solutions that promote the circular economy, contributing to global efforts to preserve resources and reduce environmental impact.

Topics		Learning Outcomes	
	Knowledge and understanding	Skills	Values and attitudes
- o Questionnaire - o Essay - o Project on the topic - o Other _____		- o List 10 questions with possible answers - o Define length and any specific rules - o Define the framework - o Provide description/instructions	

Module 5: Circular Economy Challenges and projects (partner/developer)

Main Objective: The main objective of exploring Circular Economy Challenges and Projects is to identify and address barriers hindering the transition to a circular economy, fostering sustainable practices and resource efficiency. This involves understanding the complexities and obstacles faced by businesses and industries in adopting circular economy principles. The goal is to promote innovative solutions and projects that contribute to the development of circular economy models, overcoming challenges such as resource scarcity and environmental degradation. Additionally, the objective is to raise awareness about the economic, social, and environmental benefits of circular economy initiatives, encouraging broader participation and collaboration. Through the examination of challenges, the aim is to inform policymakers and stakeholders to formulate effective strategies for supporting circular economy projects. The focus is on creating a comprehensive understanding of the interconnected challenges, fostering a holistic approach to sustainable development. Ultimately, the objective is to facilitate the implementation of viable circular economy projects on a global scale, driving positive impacts on both local and global levels.

Topics		Learning Outcomes	
	Knowledge and understanding	Skills	Values and attitudes

4. Circular Economy Challenges and Projects	1. Implementation Challenges 2. Economic Sustainability 3. Social Impact 4. Environmental Impact 5. Innovations in Projects 6. Strategic Planning 7. Role of Policy 8. Collaboration and Partnerships 9. Measuring Project Success	31. Analytical Skills 32. Strategic Thinking 33. Innovation 34. Social Skills 35. Economic Literacy 36. Responsible Business Practices 37. Change Management 38. Performance Measurement 39. Teamwork 40. Communication Skills	41. Sustainability and Responsibility 42. Innovation and Creativity 43. Collaboration and Partnerships 44. Education and Awareness 45. Social Responsibility 46. Justice and Equality 47. Long-Term Vision
Theoretical part on the topic, an introduction aimed at building motivation and awareness for the circular economy			
To be developed by partners; max 500 words ● Interactive Problem-Solving: Engaging students in circular economy challenges. ● Design Thinking in Circular Solutions: Encouraging creative and sustainable design approaches. ● Group Projects: Students work on circular economy projects, implementing STEM and digital skills.			
Activities for students: Circular economy challenges to be used as inspiration for lesson topics			
Activity 1 Title	Materials needed	Description	

To be developed by partners;	• •	Maximum 800 word
Student engagement tools, methods & activities (digital tools, lab experiments, games, role plays etc.)		
Type	Title	Description
- o Digital tool - o Lab experiment - o Game - o Role play - o Other		To be proposed by partners; List 1 – 3 engagement tools, describe each with maximum 200 word
Assessment tools & methods		
Type - to be proposed by partners		
- o Questionnaire - o Essay - o Project on the topic - o Other _____		- o List 10 questions with possible answers - o Define length and any specific rules - o Define the framework - o Provide description/instructions

Module 6: Career Paths and Future Trends (partner/developer)

Main Objective: The main objective is to identify and pursue dynamic career paths that reflect contemporary trends in the job market. Through researching promising sectors and technological innovations, the goal is to adapt skills and knowledge to achieve successful professional evolution. Focus on developing competencies relevant to digital transformation and global connectivity to gain a competitive edge. Promote agility and adaptability to successfully navigate rapid changes in the job market. Explore extensive opportunities in the sustainability and social responsibility domain, emphasizing career paths that contribute positively to communities and the environment. Cultivate interpersonal skills and collaboration abilities to respond to the growing emphasis on teamwork and leadership. Actively monitor trends in remote work and flexible working conditions, developing skills necessary for successful virtual collaboration. Pay attention to building a personal brand and online professional presence to enhance visibility in the job market. Commit to lifelong learning to maintain relevance in a rapidly changing business environment. Lastly, set the goal of achieving a balance between personal satisfaction and professional success.

Topics		Learning Outcomes	
	Knowledge and understanding	Skills	Values and attitudes

5. Career Paths and Future Trends	1. Current Labor Market Trends 2. Digital Transformation 3. Technological Innovations 4. Global Connectivity 5. Sustainability and Social Responsibility 6. Interpersonal Skills 7. Remote Work and Flexible Working Conditions 8. Personal Development and Education 9. Personal Branding 10. Balance Between Professional and Personal Life	48. Analytical Skills 49. Technological Skills 50. Global Awareness 51. Sustainability and Social Responsibility Skills 52. Interpersonal Skills 53. Adaptability 54. Lifelong Learning 55. Strategic Thinking 56. Personal Branding Skills 57. Work-Life Balance	58. Adaptability 59. Lifelong Learning 60. Innovation 61. Global Awareness 62. Sustainability and Social Responsibility 63. Interpersonal Collaboration 64. Work-Life Balance 65. Career Responsibility 66. Social Connection 67. Ethical Conduct
Theoretical part on the topic, an introduction aimed at building motivation and awareness for the circular economy			
To be developed by partners; max 500 words ● Circular Economy and STEM Careers: Exploration of career opportunities in green technologies and sustainable industries. ● Future Trends in Sustainability: Emerging technologies and trends in the circular economy. ● Course Recap and Reflection: Review of key concepts and self-reflection on learning outcomes.			

Activities for students: Circular economy challenges to be used as inspiration for lesson topics

Activity 1 Title	Materials needed	Description
To be developed by partners;	• •	Maximum 800 word

Student engagement tools, methods & activities (digital tools, lab experiments, games, role plays etc.)

Type	Title	Description
- o Digital tool - o Lab experiment - o Game - o Role play - o Other		To be proposed by partners; List 1 – 3 engagement tools, describe each with maximum 200 word

Assessment tools & methods

Type - to be proposed by partners	
- o Questionnaire - o Essay - o Project on the topic - o Other _____	- o List 10 questions with possible answers - o Define length and any specific rules - o Define the framework - o Provide description/instructions

4.0 Next steps:

1. **Partners provide feedback** on proposed Competence matrix through the [Feedback form](#) -> Improvement of the Competence matrix. (Deadline 15. February 2024.)
2. **Selection of the modules to be developed by each partner** -> Work on modules development (deadline 15. March 2024.)
3. **Peer Review-** Assessment of each module by 2 partners (other than developer) - feedback form to be provided (deadline 22. March 2024.)
4. **Improvement of modules** based on the feedback from partners (deadline 1. April 2024.)
5. **Training in Belgrade** - each partner presents own module (April 9, 10)
6. **Feedback from the training collection** -> final improvement of module

