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STEAMigPOWER

STEAM approaches at higher education for mIGrants, refugees and asylum seekers' emPOWERment

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A5: Guidelines to deliver the STEAM courses

WP3: STEAMigPOWER Intensive Program

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Fundació Solidaritat UNIVERSITAT DE BARCELONA
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ORTA DOĞU TEKNİK ÜNİVERSİTESİ MIDDLE EAST TECHNICAL UNIVERSITY
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ABSTRACT

The STEAMigPOWER project addresses the pressing need for the social and economic integration of migrants, refugees, and asylum seekers (MRAS) by utilizing the transformative potential of STEAM (Science, Technology, Engineering, Arts, and Mathematics) education. This report presents comprehensive guidelines for delivering five intensive courses focused on critical sustainability topics: Eco-Building Construction, 5Rs (Refuse, Reduce, Reuse, Repurpose, Recycle), Sustainable & Renewable Energy, Sustainable Development, and Climate Change. Each course combines theoretical knowledge with interactive and practical activities, tailored to diverse participant profiles and learning needs. By promoting inclusive and engaging methodologies, the program encourages critical thinking, collaboration, and problem-solving skills, empowering participants to become advocates for sustainability and global citizenship. The report includes detailed instructions for facilitators, adaptable educational materials, and evaluation metrics to ensure successful course implementation. This initiative exemplifies the role of education in addressing global challenges, equipping participants to drive meaningful change in their communities while advancing the principles of sustainable development.

1. INTRODUCTION

The STEAMigPOWER project aims to address the social and economic integration challenges faced by migrants, refugees, and asylum seekers (MRAS) in Europe by leveraging the transformative potential of STEAM (Science, Technology, Engineering, Arts, and Mathematics) education. Recognizing the under-representation of these groups in higher education, the project aims to provide them with essential skills and knowledge to promote social inclusion and sustainable development. The courses developed within STEAMigPOWER address critical environmental challenges, focusing on topics such as climate change, sustainable construction, waste management, and renewable energy. Delivered through a combination of a 2-day Introductory Blended Program and a 5-day On-Site Intensive Programme, the courses focus on cultivating a deeper understanding of sustainability principles, while encouraging collaboration and cultural exchange. By providing both theoretical knowledge and practical tools, the program equips participants to actively contribute to society and the workforce.

This report outlines the guidelines for delivering the STEAMigPOWER courses, providing educators and facilitators with the necessary tools and resources to implement each course effectively. The following sections will detail the structure and content of each course, focusing on their objectives, teaching methods, required materials, and expected learning outcomes. By offering comprehensive guidelines, this report aims to ensure the successful replication and adaptation of the courses across different educational institutions and audiences, enhancing their impact and sustainability beyond the project's lifecycle. The courses provided are:

- Course 1: EcoBuilding Construction (provided by UMinho, Portugal)
- Course 2: 5Rs: Refuse, Reduce, Reuse, Repurpose, Recycle (provided by UniPG, Italy)
- Course 3: Sustainable & Renewable Energy (provided by METU, Turkey)
- Course 4: Sustainable Development (provided by FSUB, Spain)
- Course 5: Climate Change (provided by AUTh, Greece)

Sections 2-6 present the key aspects of the 5 courses of the Intensive Programme, while all the required material (presentations, course-specific documents and guidelines created by the respective partner etc.) are attached as Annexes (as pdf files, where applicable, or in another digital format, e.g. video files, image files, etc.).

2. ECO-BUILDING CONSTRUCTION (COURSE 1)

2.1 Overview of the course Eco-Building Construction

The "Eco-Building Construction" course, designed by the University of Minho (UMinho) in Portugal, aims to empower participants to explore sustainable construction practices through interactive and practical challenges. This course highlights the importance of sustainability in building practices and encourages participants to consider environmental impacts when engaging in construction activities. The primary focus of the course is to foster critical thinking, problem-solving, and collaboration skills while introducing concepts of Life Cycle Assessment (LCA) and bridge structure design.

The course is structured into two main parts, combining interactive lectures and hands-on activities. The morning session begins with an Introduction and Quiz to engage participants with sustainability topics, followed by the Sustainable Bridge Challenge (SBC) Part 1. During this segment, participants form teams, select a bridge design, and use provided materials to build their bridge prototypes. The challenge continues in the afternoon with Part 2, where teams test their bridges for maximum load capacity, record results using an Excel sheet, and present their digital storytelling projects to share their experiences and insights from the activity. The best presentations are selected through voting, using quiz apps or paper ballots.

To ensure a successful learning experience, the course provides detailed preparation guidelines for trainers. The necessary materials include wooden sticks, paper straws, glue, tape, scissors, a glue gun, and a laptop with Excel for tracking results. Pre-printed truss templates, such as Fink, Howe, Pratt, and Warren designs, are also essential to guide participants in building their bridges. Trainers must be advised to ensure safety precautions during the activities, especially when handling scissors and glue guns, and to manage the materials and results in real time using the provided Excel sheet.

The key guidelines for trainers include specific dimensions for bridge construction: the length should be between 40-44 cm, with a span of 38 cm and a width/height of 6 cm. Scoring criteria for the challenge are based on the load-to-weight ratio and the Global Warming Potential (GWP) index of the materials used. Bonus points are awarded for original and innovative bridge designs. Trainers are encouraged to create an engaging and supportive environment, where participants can experiment with different design approaches and learn from their successes and failures.

The learning outcomes of the EcoBuilding Construction course are multifaceted. Participants will gain a deeper understanding of the impact of construction activities on sustainability and learn how to apply LCA concepts to evaluate environmental impacts. They will explore the mechanics of bridge structures, focusing on tension and compression forces, and develop critical thinking skills by analyzing and improving their designs. Additionally, participants will enhance their collaboration and problem-solving abilities through teamwork and hands-on experimentation.

Practical tips for trainers emphasize the importance of ensuring participant safety and maintaining a well-organized learning environment. Trainers should use newspapers to catch debris during bridge testing and track results in real time using digital tools. Facilitators are encouraged to adapt the activities to the participants' skill levels and to foster a collaborative and inclusive atmosphere throughout the course.

In summary, the "Eco-Building Construction" course offers a dynamic and interactive learning experience that combines sustainability principles with practical engineering challenges. By participating in this course, learners not only acquire essential knowledge in sustainable construction but also develop valuable skills in teamwork, critical thinking, and problem-solving, which are crucial for their future academic and professional endeavors.

2.2 Eco-Building Construction EduPack_v1: educational material for successful delivery of the course

The current version[1] of the material needed (EduPack) for the successful delivery of the course is provided as a compressed folder of named "C1-Eco-Building Construction EduPack_v1"[2]. The contents of the EduPack are

[1] Version 1 on 15-Jan-2025
[2] https://drive.google.com/file/d/1kOOiNCtnAxbCetEs2XZ4YazQhVG-LmMC/view?usp=sharing

presented in the following sections. Variations and suggested adjustments on the material will be added to this report and the linked educational material after the completion of the delivery of this course by all the respective STEAMigPOWER partners, in order to be scalable and reproducible based on the specific needs and characteristics of the target audience/group of trainees.

2.2.1 C1-SM1: Eco-Building Construction Course Description (DOCX)

This document provides an overview of the Eco-Building Construction course, detailing its objectives, course outline, materials needed, and methodology. It outlines the Sustainable Bridge Challenge (SBC) activity, which involves constructing and testing bridges made from various materials. The document also includes step-by-step instructions for conducting the challenge, tips for organizers, and expected learning outcomes, such as understanding Life Cycle Assessment (LCA) and environmental impact indicators.

2.2.2 C1-SM2: Eco-Building Construction Course Final (PPTX)

This presentation contains the main lecture content for the Eco-Building Construction course. It covers key topics such as the environmental impact of the construction sector, sustainable building materials, and Life Cycle Assessment (LCA). It also introduces participants to circular economy concepts in construction and provides an introduction to the practical bridge-building activity. The presentation includes explanations of different bridge types and forces acting on them, along with real-world case studies to contextualize the concepts.

2.2.3 C1-SM3: Practical Activity (PPTX)

This presentation outlines the instructions and requirements for the hands-on practical activity of the course—the Sustainable Bridge Challenge. It details the structural requirements for the bridges, the types of truss designs available, and the materials and tools provided. The presentation also explains the testing process, including how to measure load capacity using yogurt pots filled with sand or water, and how to record the results to determine the winning team based on both functional performance and environmental impact.

2.2.4 C1-SM4: Sustainable Bridge Challenge Worksheet (DOCX)

This document serves as a comprehensive guide for participants of the Sustainable Bridge Challenge. It describes the methodology for the activity, including the dimensions of the bridges, the scoring system based on the Global Warming Potential (GWP) index, and instructions for testing the load capacity of the bridges. The worksheet includes templates for different truss designs, guidelines for weighing materials, and safety precautions for using tools like scissors and glue guns.

2.2.5 C1-SM5: Interactive Activity Quiz (DOCX)

This document provides the content for an interactive online quiz titled "What do I know about sustainability in construction?" It includes questions designed to test participants' knowledge of sustainability-related topics in the construction sector, such as CO2 emissions from cement production, waste percentages in construction, and the pillars of sustainability. The quiz requires participants to use their mobile phones or raise their hands to answer, creating an engaging and informative session.

2.2.6 C1-SM6: Truss Printable Models (DOCX)

This document contains printable templates for various truss designs used in the Sustainable Bridge Challenge. The templates include measurements and instructions for constructing truss bridges using different materials. These models help participants visualize and build bridges with specific structural configurations, such as Pratt, Warren, and Howe trusses.

2.2.7 C1-SM7: Sustainable Score Activity (XLSX)

This Excel sheet is used to record the materials used by each team in the Sustainable Bridge Challenge and calculate the sustainability score. The sheet tracks the quantity of materials, their associated GWP values, and the load capacity achieved by each bridge. The tool automatically calculates the scores and displays the results to determine the winning team based on both functional and environmental performance.

2.2.8 C1-SM8: Multimedia Folder

This folder contains images and videos captured during the bridge-building activity. The multimedia content showcases the construction process, testing phases, and final presentations by the participants. These visuals can be used for digital storytelling, course promotion, and demonstrating best practices in sustainable construction activities.

3. 5RS: REFUSE, REDUCE, REUSE, REPURPOSE, RECYCLE (COURSE 2)

3.1 Overview of the course Eco-Building Construction

The "5Rs: Refuse, Reduce, Reuse, Repurpose, Recycle" course, provided by the University of Perugia (UniPG) in Italy, is designed to raise awareness about sustainable consumption and waste management practices through interactive and practical activities. The course emphasizes the importance of adopting a circular economy mindset and encourages participants to rethink their consumption habits to minimize waste generation and reduce their environmental impact. By exploring the principles of the 5Rs, participants learn to make more responsible and sustainable choices in their daily lives.

The course is structured as an engaging workshop with a combination of theoretical lectures and practical laboratory activities. It begins with an introduction to the core concepts of the 5Rs and their significance in promoting sustainability. The workshop then delves into specific modules that focus on the waste hierarchy, waste prevention strategies, and hands-on activities that allow participants to apply their knowledge in practical scenarios. Real-life examples and case studies are incorporated to help learners connect theory with practice.

Participants are introduced to various waste management strategies, including separating waste based on packaging symbols and calculating the ecological footprint of everyday products. Through activities such as the Ecological Rucksack and the Ecological Footprint of Food, they gain insights into the environmental impact of different products throughout their life cycles. These activities not only enhance understanding but also foster critical thinking and problem-solving skills by challenging participants to explore innovative ways to reduce waste and promote sustainability.

The course also includes optional advanced modules that explore the sustainability and recycling of various materials, as well as innovative technologies such as CO_2 recycling for energy production. These modules provide participants with a deeper understanding of the life cycles of materials and the concept of cradle-to-cradle design, which aims to eliminate waste entirely by creating products that can be fully reused or recycled at the end of their useful life.

By the end of the course, participants will have a comprehensive understanding of circular economy principles and practical strategies to incorporate the 5Rs into their personal and professional lives. The course aims to equip participants with the knowledge and tools to reduce their environmental footprint, promote sustainable behaviors, and contribute to a more sustainable future.

3.2 5Rs EduPack_v1: educational material for successful delivery of the course

The current version[3] of the material needed (EduPack) for the successful delivery of the course is provided as a compressed folder of named "C2-5Rs EduPack_v1"[4]. The contents of the EduPack are presented in the following sections. Variations and suggested adjustments on the material will be added to this report and the linked educational material after the completion of the delivery of this course by all the respective STEAMigPOWER partners, in order to be scalable and reproducible based on the specific needs and characteristics of the target audience/group of trainees.

3.2.1 C2-SM1: 5Rs Course Description (DOCX)

This document provides a detailed outline of the 5Rs course, highlighting its objectives, structure, and learning outcomes. It covers the core principles of the 5Rs (Refuse, Reduce, Reuse, Repurpose, Recycle) and the importance of integrating these practices into everyday life. The document outlines laboratory activities, including calculating the ecological rucksack (material footprint), separate waste collection, and assessing the ecological footprint of food. It also discusses optional advanced modules on recycling materials and converting CO2 into energy, depending on the participants' knowledge levels.

[3] Version 1 on 15-Jan-2025
[4] https://drive.google.com/file/d/1VfGvSsV-NKLgrAvnr6SJGQk4ZZq9zRpL/view?usp=sharing

3.2.2 C2-SM2: 5Rs Introduction (PPTX)

This presentation introduces the core concepts of the 5Rs, emphasizing the hierarchy of sustainable waste management. It explains each step in detail, starting from refusing wasteful products to recycling as the last resort. The slides provide practical examples and recommendations for reducing waste, such as using reusable items and minimizing single-use plastics. The presentation also covers the transition from a linear to a circular economy model and encourages participants to apply the 5Rs in their personal and professional lives.

3.2.3 C2-SM3: Module 1 - Waste Hierarchy (PPTX)

This presentation focuses on waste classification and management. It covers the types of waste, including municipal, special, hazardous, and non-hazardous waste, and explains their environmental impact. The presentation discusses the European waste hierarchy, including material recovery, energy recovery, and disposal methods. It includes practical advice on waste prevention and separate collection, along with insights into the regulatory framework governing waste management in Europe.

3.2.4 C2-SM4: Module 2 - Materials (PPTX)

This module explores the sustainability and recycling of various materials. It introduces the life cycle of materials, from extraction and processing to recycling and disposal. The presentation highlights the environmental impact of material production, including emissions and resource depletion, and stresses the importance of sustainable manufacturing practices. It also covers the concept of cradle-to-cradle design and provides real-world examples, such as the environmental impact of solar panels and the recycling of electronic devices.

3.2.5 C2-SM5: Module 3 - CO2 Recycling (PPTX)

This module presents a practical example of the circular economy by demonstrating the conversion of CO2 into methane using the ProGeo methanation reactor. The presentation covers the Sabatier reaction, which converts CO2 and hydrogen into methane and water under specific conditions. It discusses the use of catalysts, such as nickel or ruthenium, and outlines the next steps in optimizing the reactor's performance. The presentation also explains how hydrogen can be produced using a novel electrolyzer, reducing the cost and making the technology more accessible. The presentation also contains two videos that are described below as separate supplementary materials.

3.2.6 C2-SM6: ProGeo Subtitled Video (MP4)

This video provides a subtitled demonstration of the ProGeo methanation reactor in action. It shows how the reactor converts CO2 into methane, contributing to a circular economy. The video includes an explanation of the process, the working conditions, and the potential applications of the technology in reducing greenhouse gas emissions. This video is included in supplementary material "C2-SM5: Module 3 - CO2 Recycling (PPTX)".

3.2.7 C2-SM7: Video - Electrolysis Process (MOV)

This video demonstrates the electrolysis process used to produce hydrogen from water. It shows the practical application of the electrolyzer described in the Module 3 presentation, highlighting how hydrogen can be generated efficiently without using expensive membranes. The video provides a visual explanation of the cathode and anode reactions and showcases how the process contributes to sustainable energy production. This video is included in supplementary material "C2-SM5: Module 3 - CO2 Recycling (PPTX)".

3.3 Insights and suggestions for adaptation across audiences

The following remarks/suggestions originate from real implementation/deliverance of the courses to diverse audiences and may be uses as insights for adaptation across various audiences.

- If the audience cannot fully engage adopt a more dynamic approach. Introducing additional visuals and diverse presentation formats may help sustain engagement and optimize pacing.
- The segment addressing CO_2 recycling for energy production appeared to be particularly challenging for some audiences. Simplifying or contextualizing this topic further might support better comprehension, especially among younger participants.
- The use of environmental impact calculators using real data is always positively received as a hands-on method for raising awareness. Nonetheless, it may be helpful to clarify that these tools aim to support

learning and reflection—not induce guilt—especially as some calculators request highly specific data that participants may not easily know.

- Waste separation is well covered and recognized as a key takeaway. In some contexts, participants suggested referencing local tools (e.g., municipal apps) that guide waste sorting to link course content with everyday practices. Tutors are encouraged to include similar local tools.
- Regarding the laboratory activity, while the video demonstration is informative, it cannot fully replicate the experience of engaging with the real-life prototype. In response, facilitators may adapt the activity, e.g. by inviting participants to creatively reuse food scraps (e.g., vegetable peels, bones) in team-based exercises to design "food reuse menus." This adaptation is both practical and well aligned with the course's core messages.

4. SUSTAINABLE & RENEWABLE ENERGY (COURSE 3)

4.1 Overview of the course Sustainable & Renewable Energy

The "Sustainable & Renewable Energy" course, provided by the Middle East Technical University (METU) in Turkey, is designed to promote energy literacy and raise awareness of renewable energy sources. The course aims to empower participants to adopt sustainable energy practices, reduce their carbon footprint, and understand the impact of energy consumption on climate change. Through a combination of theoretical lessons and practical activities, the course fosters critical thinking and problem-solving skills in the context of energy sustainability.

The course begins with an introduction to key energy concepts, including the types of energy (e.g., kinetic, potential, thermal) and the principles of energy conversion and thermodynamics. Participants are introduced to renewable energy sources, such as solar, wind, hydro, and biomass, along with their benefits and limitations. The course also highlights the importance of energy efficiency and conservation in reducing greenhouse gas emissions and mitigating climate change.

A significant portion of the course is dedicated to hands-on activities, following the 5E model of teaching (Engage, Explore, Explain, Elaborate, and Evaluate). Participants engage in practical projects to explore insulation materials, build energy-efficient house models, and assess the impact of different design choices on energy consumption. One of the key activities involves designing and constructing a prototype of an energy-efficient house, allowing participants to apply their knowledge and test the effectiveness of insulation materials in minimizing heat loss.

The course also includes real-life examples and case studies to contextualize the theoretical knowledge. For example, the story of William Kamkwamba, "The Boy Who Harnessed the Wind," is used to illustrate the transformative power of sustainable energy solutions in improving lives and promoting community development.

By the end of the course, participants will have gained a comprehensive understanding of renewable energy technologies and their role in achieving sustainable development. They will learn practical strategies for energy conservation and efficiency, recognize the link between energy consumption and global warming, and be equipped with the knowledge to make informed decisions regarding sustainable energy practices in their personal and professional lives.

The learning outcomes of the course include:

- Understanding the fundamentals of energy types, conversion, and efficiency.
- Exploring the different types of renewable energy sources and their applications.
- Developing practical skills in designing energy-efficient solutions.
- Gaining insights into the socioeconomic and environmental impacts of energy choices.

The "Sustainable & Renewable Energy" course encourages participants to take actionable steps towards a more sustainable future by integrating renewable energy practices into their daily lives. It equips learners with the tools and knowledge to become advocates for energy sustainability within their communities and beyond.

4.2 Sustainable & Renewable Energy EduPack_v1: educational material for successful delivery of the course

The current version[5] of the material needed (EduPack) for the successful delivery of the course is provided as a compressed folder of named "C3-Sustainable & Renewable Energy EduPack_v2"[6]. The contents of the EduPack are presented in the following sections. Variations and suggested adjustments on the material will be added to this report and the linked educational material after the completion of the delivery of this course by all the respective STEAMigPOWER partners, in order to be scalable and reproducible based on the specific needs and characteristics of the target audience/group of trainees.

[5] Version 1 on 15-Jan-2025
[6] https://drive.google.com/file/d/12d7UF4JU47BtkImhELC0tkTnSjJ_GNzM/view?usp=sharing

4.2.1 C3-SM1: Course Description (DOCX)

This document outlines the course objectives, structure, and key concepts related to sustainable and renewable energy. It introduces participants to energy types, sources, and the importance of energy efficiency. The document highlights the "Energy Savers Project at Home," which involves exploring insulation materials and designing an energy-efficient house. The course aims to develop energy literacy and promote sustainable energy behaviors, emphasizing the reduction of carbon footprints and understanding renewable energy technologies.

4.2.2 C3-SM2: Guidelines to Deliver the Course (DOCX)

This document provides detailed instructions for educators on how to deliver the Sustainable & Renewable Energy course effectively. It outlines the teaching methods, including the 5E instructional framework (Engage, Explore, Explain, Elaborate, Evaluate). It also includes practical activities, such as investigating insulation materials and creating energy-efficient house designs, to reinforce learning outcomes. The guidelines cover classroom management, materials needed, and the schedule for delivering the course.

4.2.3 C3-SM3: Theory Document (DOCX)

This document provides the theoretical foundation for the course, explaining fundamental energy concepts such as types of energy, energy conversion, and thermodynamics. It covers the impact of energy consumption on the environment and introduces participants to renewable energy sources and technologies. The document includes a discussion on carbon footprints, global warming, and strategies for energy conservation.

4.2.4 C3-SM4: Course Presentation (PPTX)

This presentation serves as the visual aid for delivering the Sustainable & Renewable Energy course. It covers key topics such as the different forms of energy, sources of electricity, renewable energy technologies, and energy-saving strategies. The presentation follows the 5E model and includes interactive activities to engage participants in exploring energy-related concepts. It also presents the real story of William Kamkwamba as an inspirational example of using renewable energy to solve real-world problems.

4.2.5 C3-SM5: Activity Sheet (DOCX)

The activity sheet provides step-by-step instructions for conducting hands-on activities, such as the "Energy Savers Project at Home." It includes detailed instructions for the heat insulation experiment, where participants test the effectiveness of different insulation materials by measuring temperature changes in bottles filled with hot water. The activity sheet also guides participants through designing a model house with effective insulation to save energy. It includes questions to prompt critical thinking and reflection on the outcomes of the experiments.

5. SUSTAINABLE DEVELOPMENT (COURSE 4)

5.1 Overview of the course Sustainable Development

The "Sustainable Development" course, provided by the University of Burgos (FSUB) in Spain, aims to introduce participants to the concept of sustainable development and its significance in addressing global challenges. The course focuses on raising awareness of the 17 Sustainable Development Goals (SDGs) established by the United Nations, encouraging critical thinking about global issues, and promoting sustainable behaviors through interactive and engaging activities.

The course is structured to provide both theoretical knowledge and practical applications. It begins with an introduction to the core principles of sustainable development, emphasizing the interconnectedness of economic, social, and environmental dimensions. Participants learn about the importance of balancing these dimensions to ensure a more equitable and sustainable future for all.

The course includes various interactive activities to engage participants and deepen their understanding of the SDGs. One such activity is the SDG Bingo Game, where participants familiarize themselves with the 17 SDGs through a fun and interactive format. Another activity, SDG Pictionary, encourages participants to visually represent and guess different SDGs, promoting creative thinking and collaboration.

In addition to these interactive games, the course incorporates discussions on local and global sustainability challenges, prompting participants to think critically about real-world issues and potential solutions. Through these discussions, participants are encouraged to identify and propose actions they can take in their personal and professional lives to contribute to the achievement of the SDGs.

The course also addresses the importance of recognizing the role of individuals, communities, and organizations in driving sustainable development. Participants are guided to explore how their actions can positively impact their local communities and the broader global context. The course fosters a sense of responsibility and empowerment, motivating participants to become active agents of change in promoting sustainability.

By the end of the course, participants will have a comprehensive understanding of sustainable development concepts and the SDGs. They will be equipped with the knowledge and tools to identify sustainability challenges and propose practical solutions. The course aims to inspire participants to adopt sustainable behaviors and contribute to the global effort of achieving the SDGs by 2030.

The learning outcomes of the course include:

- Understanding the concept of sustainable development and the importance of the 17 SDGs.

- Recognizing local and global sustainability challenges and their impacts.

- Developing critical thinking and problem-solving skills in the context of sustainability.

- Promoting collaborative and creative approaches to addressing sustainability issues.

The "Sustainable Development" course offers a dynamic learning experience that combines theoretical insights with practical activities. It empowers participants to think critically about sustainability, recognize their role in achieving the SDGs, and take action to create a more sustainable and equitable world.

5.2 Sustainable Development EduPack_v1: educational material for successful delivery of the course

The current version[7] of the material needed (EduPack) for the successful delivery of the course is provided as a compressed folder of named "C4-Sustainable Development EduPack_v1"[8]. The contents of the EduPack are presented in the following sections. Variations and suggested adjustments on the material will be added to this report and the linked educational material after the completion of the delivery of this course by all the respective STEAMigPOWER partners, in order to be scalable and reproducible based on the specific needs and characteristics of the target audience/group of trainees.

[7] Version 1 on 15-Jan-2025

[8] https://drive.google.com/file/d/1UUcUJPe9MTiWrRgVNnmY_AleYFx-mUOl/view?usp=sharing

5.2.1 C4-SM1: Course Description (DOCX)

This document outlines the structure and objectives of the Sustainable Development course. It emphasizes the importance of understanding the concept of sustainable development, the 2030 Agenda, and the 17 Sustainable Development Goals (SDGs). The course features interactive activities, such as defining sustainability and exploring SDGs through a Bingo game. Participants are encouraged to develop local action plans addressing specific challenges, fostering community involvement, and promoting critical thinking, collaboration, and problem-solving skills.

5.2.2 C4-SM2: Bingo List for Facilitators (PDF)

This document contains a comprehensive list of prompts and scenarios designed to guide facilitators during the Bingo activity. Each entry aligns with a specific SDG and includes actions categorized as sustainable or unsustainable, such as using renewable energy, reducing waste, or supporting climate action campaigns. Facilitators use this list to explain the relevance of each action to the SDGs.

5.2.3 C4-SM3: Bingo List for Participants (PDF)

This file provides participants with a simplified version of the Bingo activity, listing actions and behaviors related to sustainability. It encourages participants to think critically about their personal habits and choices in relation to the SDGs, enhancing their understanding of sustainable and unsustainable practices.

5.2.4 C4-SM4: Bingo Grids (PDF)

This document features pre-designed Bingo grids that participants use during the activity. The grids include numbers linked to actions or behaviors from the Bingo list, facilitating an interactive and engaging way to learn about the SDGs. The grids promote collaboration and competition, making the learning experience dynamic and enjoyable.

5.2.5 C4-SM5: Bingo Material (XLSX)

This Excel file contains three sheets, each one being an editable digital version of files C4-SM2, C4-SM3 and C4-SM4. It offers an easily editable and printable format for facilitators to adapt the files to different group sizes or specific learning needs.

5.2.6 C4-SM6: Pictures (DOCX)

This document includes images and prompts designed for an introductory activity on sustainability. Participants analyze the images to determine whether they represent sustainable or unsustainable practices. The activity serves as an engaging way to introduce the concept of sustainability and set the stage for the rest of the course.

5.3 Insights and suggestions for adaptation across audiences

The following remarks/suggestions originate from real implementation/deliverance of the courses to diverse audiences and may be uses as insights for adaptation across various audiences.

- The theoretical content, covering core energy concepts such as energy types, uses, and sources, proved accessible and engaging. Facilitators may successfully use daily-life examples to illustrate these concepts, which support participant understanding and sustained interest.
- The hands-on activity involving the design of an energy-efficient house can be creatively adapted to a different yet thematically aligned challenge: designing and managing a sustainable restaurant or anything else that may seem more suitable or engaging depending on the target audience. Working in teams, participants can be given a fixed budget and tasked with selecting materials and systems to make their restaurant both sustainable and cost-effective. This adaptation can maintain the activity's learning objectives while tailoring it to the audience's context. Feel free to adjust and adapt.
- If the material efficiency activity cannot be implemented due to limitations in available resources and group management dynamics simpler or smaller-scale alternatives might be considered.

6. CLIMATE CHANGE (COURSE 5)

6.1 Overview of the course Climate Change

The "Climate Change" course, developed by Aristotle University of Thessaloniki (AUTh) in Greece, is designed to raise awareness about the causes, impacts, and solutions related to climate change. The course emphasizes the socioeconomic and ethical dimensions of climate change, exploring topics such as climate justice, environmental displacement, and the disproportionate effects of climate change on vulnerable populations.

The course is structured to provide both theoretical knowledge and practical, interactive activities. It begins with an introductory lecture that covers fundamental climate science concepts, including the greenhouse effect, extreme weather events, and the role of human activities in exacerbating global warming. Participants are introduced to the concept of climate justice, which highlights the unequal distribution of climate change impacts and the ethical considerations in addressing these disparities.

A key feature of the course is its use of role-playing games and collaborative discussions. Participants calculate their personal carbon footprints at the beginning of the course using a global footprint calculator, gaining insight into their individual contributions to greenhouse gas emissions. Later, they engage in a group-based role-playing game called "Steam City," where they assume the roles of different stakeholders, such as environmental NGOs, public authorities, and industrial representatives. This activity challenges participants to navigate the complexities of implementing climate mitigation actions, balancing economic, social, and environmental factors.

The course also incorporates a roundtable discussion and consensus-building activity, where participants present their proposed climate solutions and work collaboratively to develop a comprehensive action plan. The session fosters critical thinking, negotiation, and teamwork, equipping participants with the skills needed to address real-world climate challenges. Another highlight is the use of digital storytelling to allow participants to share personal experiences or propose creative solutions to climate-related issues. This activity enhances participants' communication skills and provides a platform for sharing diverse perspectives on climate change.

By the end of the course, participants will have a deep understanding of the causes and consequences of climate change, as well as the tools to reduce their personal carbon footprints and advocate for sustainable practices in their communities. The learning outcomes include:

- Understanding fundamental concepts of climate science and the greenhouse effect.
- Recognizing the socioeconomic and ethical dimensions of climate change.
- Developing practical skills for reducing carbon footprints and implementing climate solutions.
- Enhancing collaboration, critical thinking, and problem-solving abilities.

The "Climate Change" course provides an immersive and impactful learning experience that empowers participants to take meaningful action against climate change and advocate for a more sustainable and equitable future.

6.2 Climate Change EduPack_v1: educational material for successful delivery of the course

The current version[9] of the material needed (EduPack) for the successful delivery of the course is provided as a compressed folder of named "C5-Climate Change EduPack_v1"[10]. The contents of the EduPack are presented in the following sections. Variations and suggested adjustments on the material will be added to this report and the linked educational material after the completion of the delivery of this course by all the respective STEAMigPOWER partners, in order to be scalable and reproducible based on the specific needs and characteristics of the target audience/group of trainees.

[9] Version 1 on 15-Jan-2025
[10] to be added

6.2.1 C5-SM1: Course Description (DOCX)

This document outlines the structure and objectives of the Climate Change course. It highlights the importance of raising awareness about the causes and impacts of climate change, promoting critical thinking, and fostering skills in climate justice and sustainable practices. The course includes engaging activities, such as role-playing games and digital storytelling, to provide practical applications of the concepts taught.

6.2.2 C5-SM2: Introductory Presentation (PPTX)

This presentation provides a comprehensive introduction to the course, covering fundamental climate science concepts. Topics include the greenhouse effect, extreme weather events, and climate justice. It also explores case studies, such as floods in Pakistan and droughts in Africa, to contextualize the global and local impacts of climate change. The presentation sets the stage for deeper discussions and activities throughout the course.

6.2.3 C5-SM3: Useful Links (DOCX)

This document contains links essential for the course activities. It includes a functional link to a global footprint calculator, which allows participants to assess their personal environmental impact. Additionally, it lists example links to Google Forms used by the course creators to collect and compare participants' data before and after the training. However, these forms are linked to the AUTh team's account, and the results are not accessible to external users. This document serves as a guideline for facilitators to create their own tools for data collection.

6.2.4 C5-SM4: Presentation for Training of Trainers (PPTX)

This presentation is tailored for educators and trainers delivering the course. It provides detailed guidelines on managing activities, facilitating discussions, and conducting role-playing games. The presentation also emphasizes the importance of cultural sensitivity and inclusivity, ensuring that the course content is accessible and relevant to diverse participant groups.

6.3 Insights and suggestions for adaptation across audiences

The following remarks/suggestions originate from real implementation/deliverance of the courses to diverse audiences and may be uses as insights for adaptation across various audiences.

- To make the delivery more interactive and responsive to participants' needs, a "Myth or Reality" activity can be incorporated, allowing learners to critically reflect on common beliefs and misconceptions about climate change in an engaging format.
- The individual carbon footprint activity originally designed as a single-user experience can be thoughtfully adapted. Instead of using personal data, facilitators may introduce fictional character cards that outline different lifestyles. Participants may then calculate the carbon footprint of their assigned character. This approach preserves the learning objective while making the experience more inclusive and less personal.
- The group role-playing activity may also be adapted. The original "Steam City" scenario may be reimagined as the "STEAMigPOWER Restaurant" or similar fictional infrastructure/business, where various stakeholders (e.g., NGOs, restaurant owners, suppliers, government representatives, and farmers) have to negotiate ways to make the restaurant sector more sustainable. This modified version may be more engaging and successful for some audiences, promoting constructive dialogue and collaborative problem-solving in a familiar context.

7. CONCLUDING REMARKS

The STEAMigPOWER Intensive Programme has been meticulously designed to address pressing environmental and societal challenges through an innovative and inclusive approach. By integrating STEAM (Science, Technology, Engineering, Arts, and Mathematics) education with sustainability principles, the program empowers participants to take meaningful actions towards creating a more sustainable and equitable world.

Throughout the courses, participants engage in diverse and interactive activities, such as hands-on projects, role-playing games, and collaborative discussions. These activities not only advance and enhance critical thinking and problem-solving skills but also highlight the interconnectedness of global and local challenges. The courses provide participants with the knowledge and tools to understand complex issues such as climate change, sustainable development, and renewable energy, while also encouraging practical applications of this knowledge in their daily lives and communities.

A key strength of the program lies in its emphasis on inclusivity and cultural sensitivity. By tailoring the content to accommodate the diverse backgrounds and experiences of the participants, the programme can successfully create an environment that values diversity and promotes collaboration. The role-playing games, for instance, demonstrate the complexities of decision-making in real-world scenarios, allowing participants to experience the challenges faced by different stakeholders and develop a deeper appreciation for consensus-building and compromise.

Another notable aspect of the program is its focus on empowering individuals to act as change agents. The courses inspire participants to adopt sustainable practices, advocate for climate justice, and contribute to the achievement of the United Nations' Sustainable Development Goals. Through activities like the "Energy Savers Project", "Steam City Role Play" and "SDG Bingo," participants gain practical skills and a heighten awareness of their potential to effect change. The program also recognizes the importance of developing long-term engagement. By connecting participants with local environmental groups, governmental agencies, and NGOs, the courses lay the groundwork for continued advocacy and action. These connections, coupled with the skills and knowledge gained during the programme, equip participants to tackle future challenges and contribute meaningfully to their communities.

The STEAMigPOWER program exemplifies the power of education to drive social and environmental transformation. It can successfully equip participants with the tools, knowledge, and inspiration needed to address some of the most critical challenges of our time. By providing a sense of responsibility, collaboration, and empowerment, the programme not only prepares participants for immediate action but also instills a long-term commitment to sustainability and global citizenship.

The STEAMigPOWER intensive program represents a significant step forward in integrating education with sustainability to address global challenges. By focusing on inclusive and interactive learning methods, the program has effectively empowered participants to think critically, collaborate effectively, and take action on key sustainability issues.

Regarding the guidelines of this report, they are designed to assist facilitators in delivering each course effectively. With detailed instructions and practical activities, the courses are adaptable to diverse trainee groups. The guidelines, especially as they will be dynamically updated and enriched by the partners' course delivery in diverse audiences, account for variations in participants' language proficiency, scientific knowledge, and practical skill levels, ensuring an inclusive and supportive learning environment.

In an effort to map potential difficulties in the delivery of each course in relation to the audiences' characteristics, each course was evaluated regarding the following criteria: a) language skills; b) scientific difficulty; c) practical activities; d) adaptability (Table 1).

Table 1. Evaluation of courses in relation to the required language skills; b) scientific difficulty; c) practical activities included; d) adaptability potential to diverse audiences.

Comparison of Courses Based on Key Criteria				
Course	Required Language Skills	Scientific Difficulty	Practical Activities	Adaptability
1. Eco-Building Construction	Intermediate (English required for technical terms)	Moderate (Basic engineering concepts)	Sustainable Bridge Challenge, hands-on construction	High (Easily adapted for different skill levels)
2. 5Rs	Advanced (Difficult terminology)	High (Requires understanding of chemistry and terminology)	Waste sorting, footprint calculation	Low (Suitable for older or experienced participants)
3. Sustainable & Renewable Energy	Intermediate (English required for scientific terms)	High (Requires understanding of physics and energy concepts)	Insulation testing, energy-efficient house design	Moderate (Needs adaptation for younger audiences)
4. Sustainable Development	Basic to Intermediate (Adaptable to participants' language level)	Low to Moderate (Focus on SDGs and critical thinking)	Bingo game, SDG Pictionary	High (Suitable for diverse audiences)
5. Climate Change	Intermediate (Requires technical terms and policy discussion)	Intermediate (Involves climate science, policy, and justice concepts)	Role-playing game, digital storytelling	Low to Moderate (Each team should have a desugnated volunteer or an experienced member)

As far as required language skills is concerned, courses like Sustainable Development and Eco-Building Construction require intermediate language skills, making them accessible for most participants with basic English proficiency. The 5Rs course involves advanced terminology, especially in chemistry and technical concepts, requiring a higher level of English comprehension. Climate Change and Sustainable & Renewable Energy courses involve technical and policy discussions. Facilitators should ensure participants are comfortable with scientific language or provide simplified explanations when necessary.

In regard to the scientific difficulty of each course, courses like 5Rs and Sustainable & Renewable Energy are scientifically challenging, requiring solid knowledge of chemistry, physics, and energy concepts. Facilitators should simplify content for younger or less experienced audiences. The Eco-Building Construction course presents moderate difficulty, focusing on engineering concepts that can be adapted for different knowledge levels. Sustainable Development focuses more on critical thinking and awareness, making it accessible to participants of all levels.

Concerning, the included practical activities, all courses incorporate hands-on activities to promote experiential learning and active participation. Eco-Building Construction and Sustainable & Renewable Energy involve prototype building and testing, suitable for project-based learners. 5Rs and Sustainable Development include interactive games like Bingo and Pictionary, ideal for younger participants or mixed-ability groups. The Climate Change course uses role-playing games to enhance critical thinking and collaborative problem-solving.

Finally, as far as the adaptability of each course to diverse audiences and its potential to be aaccordingly adjusted, courses like Sustainable Development and Eco-Building Construction are highly adaptable, allowing facilitators to modify activities and discussions for diverse groups. 5Rs and Climate Change require additional preparation for younger participants due to the complexity of terminology and scientific concepts. Sustainable & Renewable Energy may need significant adaptation for less scientifically experienced participants due to advanced physics and energy topics.

Generally, facilitators are encouraged to assess participants' profiles before delivering a course to tailor the language, content, and activities accordingly. Using local examples and case studies can make the courses more relevant and engaging. Group discussions and collaborative problem-solving should be encouraged to promote peer learning. Additionally, scientific content should be adjusted to match participants' knowledge levels, particularly for courses with higher scientific difficulty.

The program's focus on sustainability education provides a foundation for long-term impact. By equipping participants with the tools and knowledge needed to implement sustainable practices, the program ensures that its benefits extend beyond the classroom. The emphasis on creating a network of advocates and change agents positions the STEAMigPOWER program as a catalyst for ongoing environmental and societal progress. In conclusion, the STEAMigPOWER intensive program has successfully combined education, action, and advocacy to address some of the most pressing challenges of our time. It has empowered participants to lead the way in fostering sustainable development and climate resilience, leaving a lasting legacy of informed and engaged global citizens.