REthinking and FOstering Competence and skills for sUstainable transport, Shipping, and logistics
REFOCUS

D2.3 – Report on best teaching practices and needs, existing programs, and co-designing the curriculum.

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Executive Summary

REFOCUS (REthinking and FOstering Competence and skills for sUstainable transport, Shipping, and logistics) is an ERASMUS + project in higher education aimed at co-designing a future-oriented curriculum and innovative training material on sustainability and climate resilience for transport, shipping, and logistics sectors. Through the application of an innovative, engaging design-thinking approach, REFOCUS aims to stimulate innovative learning and teaching practices, ensure inclusiveness and accessibility to education and training, and raise awareness about climate change among students from different backgrounds and disciplines.

REFOCUS is organised in 5 Work-Packages (WPs). The sequence of the WPs follows a design-thinking approach (Empathize & Define – WP2, Ideate and Prototype – WP3, Test – WP4) integrating "Transition" and "Human-Centered" Design. Each WP is led by a different participating organization (WP1 - UAegean, WP2 -Cambiamo, WP3 - TUDelft, WP4 - UAntwerp, WP5 - ACG-RC), while all six participating organizations lead at least one task.

This deliverable represents the report from REFOCUS Task 2.3 "Report on best teaching practices and needs, existing programs and co-designing the curriculum" (Task leader: UAegean). The report outlines the findings of the project works regarding an extensive review of contemporary, best teaching practices applicable in higher education settings, as well applicable learning technologies features. A detailed presentation of existing, reference educational programs is presented, that will guide both the REFOCUS curriculum, courses and knowledge hub development, as well as future educational content and services development efforts. Furthermore, a thorough theoretical framework for climate change curriculum development based on design thinking principles is elaborated. In particular, the results of D2.3 can be used also to guide the following project tasks: Task 3.1 New Curriculum co-designed as an output of the learning Communities of Practice (CoP), Task 3.2 Develop six Massive Open Online Courses (MOOC) courses addressing issues of transport, shipping and logistics.

The findings of this task can be used as a reference for other parties, such as educators, academic institutions that are interested on revising their curriculum by applying an innovative approach such as the one that REFOCUS suggests.

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Definitions, Acronyms and Abbreviations

Acronym/Abbreviation	Title
AASHE	Association for the Advancement of Sustainability in Higher Education
AI	Artificial Intelligence
AR	Augmented Reality
CoP	Communities of Practice
CPD	Continuous Professional Development
D	Deliverable
FCH	Competence Hub
GHG	Greenhouse Gas
LMS	Learning Management Systems
MOOCs	Massive Open Online Courses
PBL	Problem-Based Learning
REFOCUS	REthinking and FOstering Competence and skills for sUstainable transport, Shipping, and logistics
T	Task
TIL	Transport, Infrastructure and Logistics
VR	Virtual Reality
WP	Working Package

1   Introduction

In the REFOCUS (REthinking and FOstering Competence and skills for sUstainable transport, Shipping, and logistics) project, a new approach to education is explored. As broadly acknowledged today, appropriate education responses to climate change are needed, today, in order to provide both educational resources and relevant knowledge and skills.

Within this framework, UAegean has been tasked with identifying and reviewing contemporary teaching practices and current needs for sustainable development and equitable, quality education. This deliverable provides a detailed examination of existing programs and introduces a methodology for the co-design of curriculum, aimed at assisting educators and academic institutions in enhancing their current offerings for climate change education and development.

1.1   The REFOCUS project

The REFOCUS is an ERASMUS + project in higher education that through an innovative, design-thinking inspired approach aims at developing a future-oriented curriculum and new training material for transport, shipping and logistics that leads to a micro-credential-based certification. REFOCUS, through the creation of learning Communities of Practice (CoP), connects people (learners and educators), companies and public authorities (labor market and policy actors), but also NGOs and more societal stakeholders, while sharing ideas, knowledge, and experiences to understand existing needs and determine future orientations.

REFOCUS ideates and co-designs within the learning community the new curriculum and prototypes the training material that is used in 6 training courses aiming to cover contemporary issues (sustainability, resilience, digitalisation, green operations) of the considered sectors. The developed courses are tested through an iterative evaluation process including digital and physical sessions, while four training events take place.

The outcomes of the project become available to a wider audience through the REFOCUS Competence Hub (FCH) and is presented in multiplier training events in Madrid, Spain and in Chios, Greece. Specifically, REFOCUS aims to foster competence and skills through multidisciplinary training.

The objectives of REFOCUS project are to:

- Identify student learning needs and align them with labor market needs, as well as with the EU goals for sustainability, resilience, inclusiveness, and equity.
- Improve the skills and knowledge of trainers/educators concerning sustainability and climate change.
- Engage in an interactive co-design process with educators, societal stakeholders and learners and develop training material that can be used for facilitating collaborative online learning (e.g. group discussions; group online activities) and research-based learning (e.g. case studies, problem-based learning) targeting individuals coming from disadvantaged environments.
- Engage participants coming from disadvantaged environments and improve their skills and competences so that they can increase their employability.
- Develop an online educational hub FCH where MOOC courses will be accessible to learners through interactive tools in a synchronized or asynchronous way to be more inclusive for islanders and low-income groups with lower technological resources, in line with the frugal innovation paradigm.

- Develop a transdisciplinary learning space, the learning Communities of Practice (CoP), where students can learn from different educators, from academic and real-life world and create knowledge for the challenging climate change issues.
- Assess the effectiveness of the courses and establish a seamless and continuous communication among learners, educators, and industry for co-designing new future-oriented curricula.

The consortium of REFOCUS includes 6 partners from 4 European countries: (1) University of the Aegean (project coordinator, Greece) (UAEGEAN), (2) University of Antwerp (Belgium) (UANTWERP), (3) The American College of Greece Research Center (Greece) (ACG), (4) CAMBIAMO non-profit organisation (Spain) (CAMBIAMO), (5) Andaira cooperative company, (Spain) (ANDAIRA) (6) Delft University of Technology (The Netherlands) (TU DELFT).

REFOCUS is organised in 5 Work-Packages (WPs) following the different stages of a design-thinking process: Empathise & Define – WP2, Ideate and Prototype – WP3, Test – WP4 (WP1 and 5 relate to management and dissemination respectively). Each WP is led by a different participating organization (WP1 - UAegean, WP2 - Cambiamo, WP3 - TUDelft, WP4 - UAntwerp, WP5 - ACG-RC).

The specific objectives of WP2 "Identification of Market Needs and Educational Gaps (Empathise & Define)" are to:

- Engage in an interactive co-design process with educators, stakeholders, and learners.
- Develop a transdisciplinary learning space, as the learning CoP, where different educators from academic and real-life world create knowledge for the challenging climate change issues and the need these issues to be reflected into educational programs.
- Review of the needs, best teaching practices, and existing programs.

Leader of WP2 is Cambiamo and the main participants are UAegean, ACG-RC, UAntwerp, TUDelft, Andaira. The main tasks (T) and results (deliverables, D) of WP2 are the following:

- **T2.1: Report on structuring the learning Communities of Practice (CoP).** Task leader: Cambiamo. Description: Cambiamo is responsible to report on how to develop and sustain CoPs to stimulate innovation and socio-economic development in Transport, Shipping and Logistics. The goal of this task is to create an incubator to breed new ways of thinking and doing. Cambiamo is also responsible to develop a detailed plan of activities - action items that ensure the engagement of participants throughout the project.
- **T2.2: Implement and run the Communities of Practice (CoP).** Task leader: Andaira. Description: Andaira is responsible to implement, coordinate and monitor the various CoPs. REFOCUS structures communities in all four partners' countries that are naturally not in alignment as they come from different disciplinary/sectoral standing (e.g. climate change activists, economists, public sector representatives, policy makers, transportation planners, logistic service providers, etc.).Andaira clarifies roles, expectations and agendas aiming at establishing an arrangement designed to provoke debate and reflection among participants.
- **T2.3: Report on best teaching practices and needs, existing programs and co-designing the curriculum.** Task leader: UAegean. Description: UAegean is responsible to identify and review the best teaching practices and needs and specify

the methodology/process for co-designing the curriculum. The tasks are reported as to be used as a reference from other parties, such as educators, academic institutions that are interested on revising their curriculum by applying an innovative approach such as the one that REFOCUS will implement, as well as for reviewing existing teaching practices that are considered to be successful.

Based on the paradigms identified in existing educational programs and good practices in education and training, this WP will explore the knowledge needs in the transport, shipping and logistics sectors and provide the basis for developing a sustainable educational and training program, as well as the mechanism to monitor and assess its performance.

1.2 Aim and structure of deliverable D2.3

This deliverable represents the report from T2.3 on best teaching practices and needs, existing programs and co-designing the curriculum. The objectives of this task (T2.3) are to:

- Identify and review the best teaching practices and needs in the current educational landscape.
- Conduct an analysis of existing academic programs, highlighting their key attributes.
- Specify and establish a well-defined methodology for co-designing the curriculum, ensuring it serves as a reference for educators and academic institutions interested in adopting innovative and student-centered approaches.

In this direction, this report is structured in 6 sections. Section 1 introduces the REFOCUS project and WP2 tasks and objectives. In section 2 a literature review on applied, contemporary teaching practices is conducted. Section 3 includes the best teaching practices and the current educational needs. In Section 4 existed educational programs are presented, while section 5 includes the methodology and workflow of a curriculum co-design. Section 6 concludes the deliverable.

2 Literature review on contemporary teaching practices

Education, training, and labor market institutions have witnessed a significant transformation in recent years, mostly driven by advancements in technological innovations and pedagogical research. Blended learning and digital learning technology have emerged as prominent approaches to enhance the educational experience for students in higher education, also as enablers for achieving learning outcomes in an evidence-based fashion. In this context, traditional face-to-face instruction has evolved to incorporate a variety of teaching practices, such as online courses, blended learning, and MOOCs, which the REFOCUS project has proposed to develop, more specifically. More in detail, developments such as the blended learning, often referred to as hybrid learning, combine traditional classroom instruction with online components. Specifically, blended learning provides students with flexibility in terms of when and where they can access course materials and engage with content. This flexibility accommodates diverse learning styles and schedules [REF-01]. Furthermore, existing research suggests that the integration of multimedia and interactive online elements can enhance student engagement and motivation [REF-02]. Blended learning allows instructors to tailor content to individual student needs, promoting a more personalized learning experience[REF-03].

2.1 Blended Learning: an approach for REFOCUS

As blended learning signifies the contextualized combination of traditional face-to-face instruction with online learning components, several studies ([REF-02];[REF-04];[REF-01];[REF-05]) focus on delineating and analyzing the operationalization of the particular benefits of blended learning, in higher education settings:

- Flexibility and Accessibility: Blended learning provides students with greater flexibility, hence such flexibility can be particularly advantageous for non-traditional students, such as working professionals, with diverse learning needs, beyond undergraduate or postgraduate programs' students.
- Enhanced Engagement: Blended learning often incorporates multimedia elements, interactive simulations, and gamification, which can considerably enhance student engagement and motivation.
- Personalized Learning: The digital component of blended learning allows for personalized learning experiences through adaptive learning platforms and data-driven insights into student progress.
- Improved Learning Outcomes: Research suggests that blended learning can lead to improved learning outcomes, including soft skills development, knowledge attainment, also higher retention rates and better performance on assessments.

2.2 Learning technology components

More in specific, incorporating interactive elements such as discussion forums, quizzes, and peer assessments fosters engagement and collaborative learning [REF-06]. Providing timely and constructive feedback is instrumental in online courses to help students track their progress and improve their performance [REF-07].

Furthermore, digital learning technology, today, encompasses a wide range of highly specialized tools, including learning management systems, video conferencing, virtual reality, and artificial intelligence enabled learning systems. These technologies have reshaped the landscape of higher education programs and curricula:

- Learning Management Systems (LMS): LMS platforms such as Moodle, Canvas, and Blackboard facilitate course management, content delivery, and communication between students and instructors [REF-08].

- Video Conferencing: Platforms like Zoom and Microsoft Teams have become essential for synchronous online instruction, enabling real-time interaction between students and faculty [REF-09].
- Virtual Reality (VR) and Augmented Reality (AR): VR and AR applications offer immersive learning experiences, particularly in fields like medicine, or engineering ([REF-10]; [REF-11]; [REF-12]).
- Artificial Intelligence (AI): AI-driven tools can personalize learning pathways, provide real-time feedback, as well as assist with administrative tasks [REF-13].

Lastly, one of the recent advances in teaching approaches and respective technology include MOOCs which are open-access courses that reach a global audience. MOOCs are specifically proposed to be used in REFOCUS, as they offer several value propositions:

- Scalability: MOOCs are designed to accommodate many learners simultaneously, making them a cost-effective option for institutions [REF-14].
- Accessibility and Inclusivity: MOOCs provide access to high-quality educational content to learners, regardless of their geographical location, socioeconomic status, or educational background.
- Lifelong Learning Opportunities: MOOCs offer a platform for lifelong learning and skill development, enabling individuals to acquire new knowledge and competencies throughout their lives.
- Diverse Content Delivery: MOOCs employ various media formats, including video lectures, quizzes, and peer-reviewed assignments, catering to different learning preferences [REF-15].
- Data Analytics: MOOC platforms collect vast amounts of data on student interactions, enabling instructors to analyze learner behavior and adapt the course in real-time [REF-16].
- Data-Driven Learning: MOOC platforms collect vast amounts of data on learner interactions, which can be used to personalize instruction and improve course design. This data-driven approach enhances the learning experience.

Challenges associated with MOOCs include issues related to completion rates, assessment and accreditation, and the need for effective learner support mechanisms.

	Learning Management Systems (LMS)	Video Conference Tools	MOOCs	Educational VR Technology	Educational AI Technology
Advantages					
Ease of Access and Convenience	Centralized platform for course materials	Remote learning capabilities	Wide range of course options	Immersive learning experiences	Personalized learning experiences
Flexibility	Anytime, anywhere access to resources	Real-time interaction	Self-paced learning	Simulated environments	Tailored learning experiences
Tracking and Monitoring Progress	Ability to track student progress and grades	Attendance monitoring	Progress tracking	Performance analytics	Adaptive learning
Collaborative Learning	Discussion forums and group projects	Live discussions	Collaborative assignments	Interactive simulations	Peer learning

	Learning Management Systems (LMS)	Video Conference Tools	MOOCs	Educational VR Technology	Educational AI Technology
aDisadvantages					
Technical Challenges	Learning curve for users	Connectivity issues	Reliance on internet	Equipment requirements	Dependence on data quality
Customization Limitations	Limited customization options	Interface limitations	Limited personalization	Hardware compatibility	Lack of human touch
Overwhelming Options	Excessive features may be confusing for users	Feature-heavy interfaces	Choice overload	Motion sickness	Potential bias in algorithms
Cost	Costs associated with licensing and maintenance	Subscription fees	Free or low-cost options	Equipment and development	Development and maintenance
Interaction Quality	Restricted interaction beyond discussion boards	Dependent on internet quality	Limited instructor feedback	Potential isolation	Lack of emotional intelligence

Table1. Comparative Analysis of Learning Technologies Aspects

Blended learning, and MOOCs were in specific proposed to be exploited and showcased in REFOCUS, as they employ very effective teaching practices, and essential educational advantages primarily accessibility, flexibility, and student engagement, being central requirements for the REFOCUS project priorities. Hence, The REFOCUS project has chosen to exploit a mixed approach, synthesizing the merits of a MOOCs enabled blended learning framework. Both individual approaches have their unique benefits and challenges, and their combined implementation will be further exemplified during the process of the detailed project curriculum and courses development i.e. REFOCUS learner profiles, and the specific context of climate change education for shipping and transport learners, coming from disadvantaged social or professional backgrounds.

3 Best teaching practices and current teaching needs

3.1 Contemporary teaching practices

This section includes a comprehensive analysis of current, best teaching practices, focusing on methods that prioritize student engagement, participation, and learning outcomes.

In recent years, there has been a growing interest and important research and development efforts in innovative and effective teaching approaches, regarding digital pedagogies and learning approaches in the digital or hybrid environments, primarily methods that enable students' active engagement in the learning process. Moreover, higher education in specific, has endorsed significant changes driven by evolving student needs, intertwined with markets' evolution, digital technological advancements, and the above-mentioned pedagogical innovations, that enable appropriate learning outcomes, concerning not only knowledge transfer, hard and soft skills development but also higher order mental processes, and emphasis on shaping values, and behaviours as part of the learning process.

In the following the main teaching practices relevant for higher education programs, including active learning, collaborative learning, problem-based learning, student autonomy enactment, and experiential learning are exemplified.

Active Learning: is an instructional approach that encourages students to participate actively in the learning process rather than passively absorbing information. Research has consistently shown that active learning strategies, such as group discussions, peer teaching, and interactive simulations, promote deeper understanding and retention of course material. A meta-analysis by [REF-17] found that students in active learning environments had higher exam scores and lower failure rates compared to traditional lecture-based instruction.

Differentiated instruction-personalized learning: is a pedagogical approach that acknowledges the diversity of students in higher education and tailors teaching methods to meet individual learning needs [REF-18]. Research suggests that differentiated instruction promotes inclusive classrooms, improves student motivation, and enhances learning outcomes [REF-19]. By offering varied content, process, and tool options, educators can accommodate different learning styles, abilities, and backgrounds, thus promoting equitable access to education.

Advanced Educational Technology Use: the integration of advanced educational technology, such as online learning platforms, virtual reality, and artificial intelligence, has transformed teaching and learning in higher education [REF-20]. Technology-enabled pedagogies offer opportunities for personalized learning, active participation, and immediate feedback. Research suggests that well-designed digital tools and platforms can improve student achievement, facilitate collaboration, and enhance the overall learning experience [REF-21]. However, it is essential to consider the digital divide and ensure equitable access to technology resources for all students.

Collaborative Learning: emphasizes cooperative group activities where students work together to solve problems, share ideas, and learn from each other. This approach fosters teamwork, communication skills, and a sense of community in the classroom. Johnson D. W. and Johnson R. T. [REF-22] conducted a meta-analysis that demonstrated that collaborative learning had a positive impact on student achievement, critical thinking skills, and overall satisfaction with the learning experience.

Problem-Based Learning (PBL): is an inquiry-based approach that presents students with real-world problems and challenges them to find solutions. Research suggests that PBL

enhances critical thinking, problem-solving skills, and the ability to apply knowledge in practical situations. A study by Savin-Baden and Major [REF-23] found that PBL promotes active engagement, motivation, and a deeper understanding of the subject matter.

Student Autonomy Enactment: empowering students with autonomy in their learning allows them to take ownership of their education and make decisions about their learning process. Autonomy can be fostered through self-directed learning, where students set their goals, choose learning resources, and reflect on their progress. Studies have shown that when students have a sense of control over their learning, they are more motivated and perform better academically [REF-24].

Experiential Learning: involves learning through direct experiences, such as internships, fieldwork, or hands-on projects. This pedagogical approach bridges the gap between theory and practice and allows students to apply their knowledge in real-world contexts. Kolb's Experiential Learning Theory (1984) [REF-25] highlights the importance of concrete experiences, reflective observation, abstract conceptualization, and active experimentation in the learning process. Research has shown that experiential learning enhances problem-solving abilities, critical thinking skills, and career readiness [REF-26].

Real-World Connections: connecting classroom content to real-world applications is a pedagogical strategy that enhances the relevance and transferability of knowledge [REF-27]. Numerous studies have shown that integrating real-world examples, case studies, and problem-solving activities into higher education curricula can increase student engagement, motivation, and retention of information [REF-28]. Real-world connections help bridge the gap between theory and practice, preparing students for future career challenges.

Formative Assessment: involves ongoing, in-process evaluations that provide feedback to both students and instructors to improve learning outcomes [REF-29]. Studies have consistently shown that formative assessment practices, such as quizzes, peer assessments, and self-assessments, can help students monitor their progress, identify areas for improvement, and develop metacognitive skills [REF-30]. Additionally, formative assessment informs instructors about the effectiveness of their teaching strategies, enabling timely adjustments to enhance learning.

Incorporating state of the art teaching pedagogies in the context of the REFOCUS project objectives is essential and is planned to be systematically determined as an outcome of the methodological approach to be followed to co-design the RECOCUS curriculum and the development and provision of individual MOOC courses, in the forthcoming WP3 and WP4.

As recent research also suggests, improvements in curriculum design and implementation approaches, in particular, are needed. Traditional models for curricula development, which heavily rely on lecture-based modes, have been criticized for not fostering active student participation and critical thinking [REF-31]. Emphasis in contemporary education is evolving from the traditional, lecture-based methodologies towards more interactive, student-centric paradigms, as above exemplified. Numerous studies highlight this shift, emphasizing the role of experience and active engagement in effective learning. Such a student-focused approach requires curricula that prioritize exploration, discovery, and co-creation approaches.

Nonetheless, successfully supporting diverse learner preferences and needs remains one of the most challenging and important areas in education today. Darling-Hammond et al. (2020) [REF-32] assert that diverse learning tools, including digital resources and differentiated instruction strategies, can cater to a wide range of learning styles, linguistic backgrounds, and cultural perspectives. Technology has bridged many gaps, offering platforms and tools that

personalize learning experiences and aid learners with specific needs [REF-33]. Additionally, incorporating a culturally responsive curriculum that reflects the backgrounds and experiences of all students ensuring inclusivity is essential [REF-34].

In addition, the rapidly changing educational environment necessitates regular and relevant teacher training. Ingersoll & Strong (2011) [REF-35] note that continuous professional development (CPD) not only helps educators update their skills and knowledge, foremost, it significantly impacts student achievements. Additionally, Avalos (2011) [REF-36] emphasizes that effective CPD is iterative in nature, where teachers continually reflect, learn, apply, and evaluate. Teacher training programs that focus on modern pedagogies, technology integration, and strategies to support diverse learners equip educators to cater to evolving educational needs more effectively.

3.2   Teaching needs for climate change knowledge, skills and awareness

Contemporary grand challenges require education organizations and individual educators to go beyond traditional curriculum designs, ensuring that the next generation is adequately equipped to tackle pressing global, societal issues, in particular sustainability and climate change education.

The extent, sufficiency and quality of sustainability and climate change awareness and education and training efforts are developed varies across institutions and countries, including priorities and implementation in different higher education programs, organizations, and countries in EU and worldwide. Undoubtedly, there is a growing recognition of the importance of sustainability education, with many possible, alternative or complementary forms, programmes to respond to educational needs, in the context of higher education. According to a report by the Association for the Advancement of Sustainability in Higher Education (AASHE) [REF-37], more than 1,000 colleges and universities in the United States have made a commitment to sustainability. In Europe, the European Commission has launched several initiatives to promote sustainability education in higher education [REF-38].

Education remains a crucial tool in addressing climate change, despite varied success in past efforts ([REF-39]; [REF-40]). Distinct educational strategies foster public awareness and structured formal education. While public campaigns raise immediate awareness, it's institutional education that has the potential for long-lasting influence, molding decision-making, and behavior patterns for years [REF-41]. The multifaceted nature of climate change necessitates a rich educational landscape. [REF-42].

The objectives of climate education vary across disciplines, but a unified approach involves enhancing climate change issues understanding, promoting actionable strategies, and guiding eco-conscious decisions [REF-43].

Despite extant and ongoing, important efforts, evidently there are still challenges, gaps and delays in integrating sustainability and climate change topics higher education, in sufficient and appropriate extent, depth and rigor. For example, a study by UNESCO (2020)[REF-44] found that sustainability is often taught as a separate subject rather than being integrated into existing courses. Ensuring that climate change education and training are introduced and taught effectively and comprehensively across all disciplines, most importantly in highly relevant disciplines such as transport, logistics and trade, and for different learners'/trainees' needs is a clear objective to which REFOCUS project aims at contributing.

As higher education institutions worldwide struggle with the urgent need to firstly identify climate change and promote sustainable fine grained educational needs and appropriate

teaching practices, REFOCUS will implement a prototype educational program, exemplar for cultivating inclusive, equitable state of the art knowledge and skills development, foremost pro-environmental values, and behaviors cultivation in the context of non-privileged learners needs.

4 Existing programs

This section includes current academic programs related to Transport, Shipping and Logistics with a focus on technological advancements and fighting climate change. To ensure a comprehensive and well-informed selection of programs, a systematic approach that considered various criteria was employed.

- One of the primary criteria for program selection was their alignment with the research objectives. We focused on programs that explicitly mentioned a commitment to technological advancements and sustainability efforts within the transport and logistics sector.
- Preference was given to programs offered by accredited institutions and those with a strong reputation in the field of transportation and logistics education. This ensures the quality of education and the program's recognition within the industry.
- Course catalogs and curricula of the selected programs were examined to ensure they covered topics related to technological advancements and climate change mitigation strategies in the context of transportation, shipping, and logistics.

Five master programs and five online courses are presented below.

4.1 Master Programs

Name of program: Transport, Mobility, and Innovation (EIT Urban Mobility)

- University: KTH Royal Institute of Technology
- Type: Master Program
- Description: The master's programme in Transport, Mobility and Innovation is part of the EIT Urban Mobility Master School's programme Sustainable Urban Mobility Transitions. The world's cities are changing. New technologies, business models, and global sustainability goals are transforming our cities and how we move. Today's urban planners and transport engineers face an array of challenges and are needed to take advantage of such transformations to help create urban environments that consume fewer resources, contribute less to climate change, and support more livable and healthy neighborhoods. Addressing such challenges requires embracing complexity and competence beyond the traditional urban planning and civil engineering disciplines, including entrepreneurial skills to steer innovations into practice. The Sustainable Urban Mobility Transitions programme provides such experience, preparing students to become the next urban innovators and leaders in urban mobility.
- Duration: 2 years
- Location: on-site classes
- Fees: Free
- Teaching delivery methods:
  - During the first year of studies, students engage in a combination of classroom-based learning and practical project work. They are introduced to the core concepts of Innovation and Entrepreneurship, with a particular focus on their application to urban mobility challenges. The learning experience is enriched through participation in an extended Challenge Project, providing students with hands-on experience in solving real-world problems related to urban mobility.
  - During the break between the first and second years, students participate in a Summer School program that offers an experiential learning opportunity. They

apply the skills and knowledge gained in the first year to practical scenarios in two different European cities. This immersive experience provides a deeper understanding of urban mobility challenges and innovative solutions.
- In the second year, students have the flexibility to choose from several more specialized courses. These courses are delivered through a mix of lectures, workshops, and seminars, allowing students to delve deeper into technical content, as well as innovation and entrepreneurship strategies. The program maintains a practical focus, and students will participate in a shorter challenge project, which includes an internship with a company or organization actively working to address urban mobility challenges.

- Link: https://www.kth.se/en/studies/master/transport-mobility-innovation/msc-transport-mobility-and-innovation-eit-urban-mobility-1.931633

Name of program: Management of Logistics and Innovation

- University: University of Gävle
- Type: Master Program
- Description: The programme focuses on strategies and methods for sustainable and innovative supply chain management and innovation, applied to both established and new industrial enterprises.
- Duration: 1 year
- Location: on-site classes
- Fees: Free
- Teaching delivery methods:
  1. Lectures: The program is expected to include traditional lectures where professors present theoretical concepts, models, and frameworks related to innovation management, supply chain logistics, sustainability, and other relevant topics. These lectures serve as a foundation for students' understanding of key principles.
  2. Case Studies: Case studies are likely to be a prominent teaching method. Students may analyze real-world business cases to gain practical insights into the challenges and solutions related to supply chain innovation and sustainability. This approach helps bridge the gap between theory and practice.
  3. Group Projects: Collaborative group projects are often used to encourage teamwork and problem-solving skills. Students may work together to address complex supply chain issues, develop innovative solutions, and present their findings to their peers and instructors.
  4. Industrial Projects: As mentioned in the program description, students may engage in projects within industrial firms. These hands-on experiences provide students with practical exposure to supply chain management and innovation challenges faced by real businesses.
  5. Seminars and Workshops: The program may incorporate seminars and workshops that focus on specific topics or skills, such as quality management systems, environmental management systems, and collaboration between firms. These sessions allow for interactive learning and skill development.
  6. Research Assignments: Since the program aligns with ongoing research, students may be required to conduct research assignments, literature reviews, or

research projects. This exposes them to the latest developments and encourages critical thinking.

7. Thesis Workshops: In preparation for the thesis project, students might attend workshops or seminars that guide them through the research process, including problem formulation, data collection, analysis, and presentation.

8. Guest Lecturers: Experts and practitioners from the industry may be invited as guest lecturers to provide real-world perspectives and insights. This exposes students to diverse viewpoints and current industry practices.

9. Online Resources: In addition to in-person classes, online resources such as virtual learning platforms, databases, and e-books may be provided to support students' learning and research efforts.

10. Assessment Methods: Assessment methods may include examinations, quizzes, presentations, reports, and peer evaluations. These methods are used to evaluate students' understanding of course material and their ability to apply it.

- Link: https://www.hig.se/Ext/En/University-of-Gavle/Education/Programmes/Programsidor/LADOK-ENG/Avancerad-niva/Master-Programme-in-Management-of-Logistics-and-Innovation-60-cr/Programme-description.html

Name of program: Sustainable Planning and Transport

- University: University of Hertfordshire
- Type: Master Program
- Description: The MSc Sustainable Planning is delivered in the Ebenezer Howard School of Planning, reflecting the unique location which houses the world's first garden cities and focus on exploring the contemporary planning implications of this placemaking patrimony. Planning plays a key role to play in improving the condition of life in towns, cities, and rural areas. Towns and cities themselves impact on global sustainability and can play a very influential role in tackling global environmental, social and economic problems. The breadth of material covered will give the skills to meet contemporary sustainability challenges in planning cities and rural areas. The planning system provides one of the most sophisticated mechanisms for regulating environmental change, global environmental, social and economic problems and implementing sustainability principles.
- Duration: 1 year
- Location: on-site classes
- Fees: 19,024 EUR/year
- Teaching delivery methods:

1. Integrated Teaching Approach: The program adopts an integrated teaching approach, which means that theory is combined with practical applications throughout the modules. This approach aims to provide students with a holistic understanding of management concepts and their real-world relevance.

2. Debates: Debates may be used as a teaching method to encourage critical thinking and active engagement with course material. Students might discuss and analyze various management issues, presenting and defending their viewpoints.

3. Case Studies: Case studies are commonly employed to illustrate real-world management scenarios and challenges. Students analyze these cases to develop problem-solving skills and apply theoretical knowledge to practical situations.

4. Group Work: Group work fosters teamwork and collaboration. Students may work together on projects, assignments, or presentations, simulating the collaborative nature of many workplaces.

5. Essays and Written Reports: Writing essays and reports is a fundamental academic skill. These assignments assess students' ability to research, analyze, and communicate their findings effectively in a written format.

6. Regular Quizzes: Quizzes serve as a formative assessment tool to gauge students' understanding of course material and ensure they are keeping up with the content.

7. Presentations: Presentation skills are important in professional settings. Students may be required to deliver presentations, helping them develop their ability to communicate ideas and findings orally.

8. Research Skills Development: The program places significant emphasis on developing sound research practices. This includes training students in research methodologies, data collection, analysis, and interpretation. These skills are valuable for future academic pursuits and in the knowledge-based economy.

9. Integrated Research Project: The program offers students the opportunity to undertake an Integrated Research Project. This capstone project allows students to delve deeply into a specific area of interest within management. It typically involves substantial independent research and may include a written report or presentation of findings.

10. Individual Supervision: During the Integrated Research Project, students are allocated individual supervisors who provide guidance and support. This includes one-on-one meetings and small group sessions to help students progress through the research process.

11. Transferable Skills: The program is designed to provide students with highly transferable skills that are relevant to various work environments, whether they aspire to be effective employees or future entrepreneurs. These skills include critical thinking, research, communication, and problem-solving.

- Link: https://www.herts.ac.uk/courses/postgraduate-masters/msc-management-with-logistics-and-supply-chain-management

Name of program: Environmental Engineering

- University: Delft University of Technology
- Type: Master Program
- Description: In the master programme Environmental Engineering students learn how to cope with shortage and abundance of resources such as water and waste, the effects of climate change on livability in cities, air pollution and the depletion of natural resources, such as groundwater. These challenges are of utmost relevance in a world under change that is experiencing population growth and demanding more clean resources than ever.
- Duration: 2 years
- Location: on-site classes
- Fees: 4844 EUR
- Teaching delivery methods:

1. Lectures: The program likely includes traditional lectures where instructors present theoretical concepts and foundational knowledge in environmental engineering. Lectures serve as a basis for understanding key principles.

2. Practical Exercises: Practical exercises are a fundamental component of the curriculum. Students actively engage with the course material by applying theory to solve problems, analyze data, and perform experiments related to environmental engineering.

3. Group Projects: Collaborative group projects are emphasized, enabling students to work together on real-world environmental challenges. This approach encourages teamwork, problem-solving, and practical application of knowledge.

4. Case Studies: Case studies are likely used to explore real-life environmental issues and solutions. Students may analyze and discuss case studies to gain insights into complex environmental problems and the decision-making processes involved in solving them.

5. Coding Assignments: Coding assignments are designed to enhance students' programming skills, particularly in the context of environmental engineering. These assignments may involve using software tools for modeling and data analysis.

6. Debates and Discussions: Debates and discussions are mentioned in the program description. These interactive sessions provide students with opportunities to engage in critical thinking, analyze environmental issues from different perspectives, and develop communication skills.

7. Ethical Considerations: The program emphasizes ethical considerations related to decision-making in environmental engineering. This likely involves discussions, debates, or case studies that explore the ethical implications of environmental decisions.

8. Specialization Tracks: The program offers specialization tracks in areas such as Atmospheric Environment Engineering, Resource and Waste Engineering, and Water Resources Engineering. These tracks provide specialized knowledge through a combination of lectures, projects, and practical work.

9. Individual Learning Paths: In the second year, students have the flexibility to choose individual learning paths, which may involve interdisciplinary projects, internships, studying abroad, or taking advanced modules. These experiences provide hands-on exposure to various aspects of environmental engineering.

10. Cross-Programme Modules: Cross-programme modules enable students to broaden their knowledge base by taking courses from other master's programs, enhancing their multidisciplinary thinking and communication skills.

11. Master's Thesis: The program culminates with a Master's thesis, which involves independent research or design projects focused on environmental challenges. Students receive guidance from supervisory committees throughout the thesis process.

- Link: https://www.tudelft.nl/en/education/programmes/masters/environmental-engineering/msc-environmental-engineering

Name of program: Transport, Infrastructure and Logistics

- University: Delft University of Technology
- Type: Master Program
- Description: The MSc programme in Transport, Infrastructure and Logistics (TIL) is a two-year comprehensive programme that provides graduates with a comprehensive view of the field of transport, infrastructure, and logistics. TIL graduates have up-to-date knowledge of transport policy making and spatial planning design of transport systems, supply chains and infrastructure networks the operation, management and control of these systems. They know how to design new road, rail, air and water transportation services for passengers and/or freight; to efficiently manage transportation networks; and to design and control complex supply chains. These skills

are invaluable for the design, development, and maintenance of cost-effective, efficient systems for moving passengers and freight.

- Duration: 2 years
- Location: on-site classes
- Fees: 4844 EUR (for Dutch and EU students) 42075 EUR (Non-EU/EFTA students (incl UK))
- Teaching delivery methods:

1. Joint Courses: The program begins with a series of joint courses, including fundamentals and TIL seminars. These courses likely include traditional lectures, where instructors convey foundational knowledge related to traffic, transport, infrastructure, and logistics. Students gain essential theoretical knowledge during this stage.

2. Specializations: After completing the joint courses, students have the option to choose one of four specializations. Each specialization may involve a mix of lectures, workshops, and practical projects tailored to the specific area of focus. These specialized courses deepen students' expertise in their chosen field.

3. Recommended Electives: The program offers a broad list of recommended electives that students can choose from to complement their specialization. Electives provide flexibility and allow students to explore topics of interest or acquire additional skills. These courses may include lectures, discussions, and practical exercises.

4. Interdisciplinary Learning: Students in the TIL program have the opportunity to engage in interdisciplinary learning. They can interact with faculty and peers from different faculties and departments within the university. This interdisciplinary approach encourages diverse perspectives and collaboration.

5. Design Projects: The program includes an interdisciplinary design project where students work collaboratively to address real-world challenges in traffic, infrastructure, and logistics. These projects involve problem-solving, teamwork, and practical application of knowledge.

6. Master's Thesis: The final stage of the program focuses on the Master's thesis project. Students conduct independent research or design projects related to their chosen specialization. They receive guidance and supervision as they work on their theses.

7. Practical Application: Many courses likely incorporate practical application of knowledge through hands-on projects, simulations, and case studies. This helps students bridge the gap between theory and practice.

8. Seminars and Discussions: TIL seminars and discussions may involve interactive sessions where students actively engage with course material, share ideas, and participate in debates related to traffic, transport, infrastructure, and logistics.

- Link: https://www.tudelft.nl/en/education/programmes/masters/transport-infrastructure-and-logistics/msc-transport-infrastructure-and-logistics

These five master's programs offer distinct approaches to addressing various challenges in the fields of Transport, Shipping and Logistics. The KTH Royal Institute of Technology's "Transport, Mobility, and Innovation" program stands out with its two-year duration, blending classroom learning with hands-on projects and a focus on urban mobility and innovation. However, one potential gap is the need for more interdisciplinary collaboration to address complex urban challenges comprehensively. The "Management of Logistics and Innovation" program at the University of Gävle provides a one-year intensive curriculum, emphasizing sustainable supply chain management and innovation. While it incorporates traditional lectures and case studies, the program could benefit from more practical exposure and international

perspectives, bridging the gap between theory and real-world application. The University of Hertfordshire's "Sustainable Planning and Transport" program offers a holistic approach to addressing sustainability challenges in urban planning. Its integrated teaching approach combines debates, case studies, group work, and essays, providing students with a comprehensive skill set. However, the program could further enhance its international dimension and foster innovation and entrepreneurship in sustainable planning. Delft University of Technology's "Environmental Engineering" program spans two years and emphasizes practical exercises, group projects, and case studies to tackle environmental challenges. The program excels in its interdisciplinary focus but could incorporate more international experiences and digital skills training to stay ahead in the evolving field of environmental engineering. The same university's "Transport, Infrastructure, and Logistics" program offers a comprehensive view of the transport and logistics sectors. It covers policy making, design, management, and supply chains. However, there is room for more interdisciplinary collaboration and practical industry exposure to prepare students for real-world challenges.

Based on the identified gaps of the above master programs there are key areas that a new program could cover:

Interdisciplinary Integration: The program should emphasize interdisciplinary collaboration, ensuring that students can approach complex challenges from multiple perspectives, similar to the "Transport, Mobility, and Innovation" program.

- Practical Exposure: Incorporate practical experiences, internships, and industry projects to connect theory with real-world application, as seen in the "Management of Logistics and Innovation" program.

- International Perspective: Integrate international experiences, case studies, and projects to prepare students for global challenges, similar to what the "Environmental Engineering" program could enhance.

- Sustainability Focus: Emphasize sustainability in planning, logistics, and environmental engineering, drawing inspiration from the "Sustainable Planning and Transport" program.

- Innovation and Entrepreneurship: Foster innovation and entrepreneurship skills, following the model of the "Transport, Mobility, and Innovation" program.

- Digital Competencies: Integrate digital skills training to address the evolving needs of the transportation and logistics industries, similar to the needs identified in the "Environmental Engineering" and "Transport, Infrastructure, and Logistics" programs.

4.2 Online courses

Title: Designing Climate-Neutral Buildings and Transport

- University: Delft University of Technology
- Type: Online course
- Description: Familiarize yourself with decarbonization measures in the building and transport sectors. Learn about trends in energy usage, carbon intensity, and potential of available alternatives to limit greenhouse gas (GHG) emissions.
- Duration: 4weeks 4-5hours per week/ Self-paced progress
- Location: online

- Fees: Free (or 140EUR with certificate)
- Teaching delivery methods:

1. Lectures: The course includes traditional lectures where instructors present key concepts and information related to greenhouse gas (GHG) emissions. Lectures serve as a foundational source of knowledge.
2. Interviews with Experts: To provide real-world insights and practical perspectives, the course includes interviews with experts in the field. These interviews offer students the opportunity to learn from professionals with hands-on experience in GHG emissions.
3. Exercises: Various exercises are used to demonstrate how to apply the knowledge acquired during the course. These exercises likely involve practical problem-solving, data analysis, and simulations related to GHG emissions. They help students practice what they have learned.
4. Real-Life Examples: The course incorporates real-life examples to illustrate concepts and theories related to GHG emissions. These examples allow students to see how GHG emissions are measured and managed in practice.
5. Readings: Relevant readings are provided to supplement the course material. Students are expected to engage with these readings to deepen their understanding of GHG emissions and related topics.
6. Discussion Forums: Discussion forums are used to facilitate student interaction and engagement. They provide a platform for students to discuss course content, share insights, ask questions, and explore specific areas of interest. Discussion forums promote active learning and peer-to-peer interaction.

- Link: https://www.edx.org/learn/environmental-science/delft-university-of-technology-b-designing-climate-neutral-buildings-and-transport?index=product&queryID=5805c49334e7e39a456729bcf2a9e5af&position=1&results_level=first-level-results&term=Transport+climate+change&objectID=course-26d55525-bedf-4177-bb6a-25f2198da81a&campaign=Designing+Climate-Neutral+Buildings+and+Transport&source=edX&product_category=course&placement_url=https%3A%2F%2Fwww.edx.org%2Fsearch

Title: CISL -Sustainable Supply Chain Management

- University: University of Cambridge
- Type: Online course
- Description: this online course is designed for professionals looking to support their organization in future-proofing their supply chain strategies to allow them to continue adding value as global sustainability evolves. It's beneficial for members of management who want to understand how to incorporate agile and resilient mechanisms into their supply chains to benefit their organizations, whether they are new to logistics and supply chain management or simply interested in updating their skills. This course is also highly relevant for sustainability specialists, strategic professionals, and consultants. Professionals in similar positions, such as operations managers and those with certifications in freight logistics, who are looking to shift career focus to supply chain management, will gain a thorough understanding of their future career path.
- Duration: 8 weeks 7-10 hours per week/ Instructor-led on a course schedule
- Location: online

- Fees: Free (or 140EUR with certificate)
- Teaching delivery methods: Not mentioned.
- Link: https://www.edx.org/executive-education/university-of-cambridge-sustainable-supply-chain-management?index=product&queryID=6cb6ae29e79787006d2f65a534400748&position=1&results_level=first-level-results&term=Logistics+climate+change&objectID=course-5519d303-bf88-425a-88fa-a94fb5de8d5f&campaign=Sustainable+Supply+Chain+Management&source=2u&product_category=executive-education&placement_url=https%3A%2F%2Fwww.edx.org%2Fsearch

Title: Leveraging Urban Mobility Disruptions to Create Better Cities

- University: Massachusetts Institute of Technology
- Type: Online course
- Description: In 8 sessions, this course explores a wide variety of topics that relate to emerging new mobility systems and learn how new mobility can be leveraged to address and promote equity, improve health outcomes, and increase accessibility. The course material is designed to have a global impact by taking advantage of an established network of academic partners and practitioners, each bringing relevant expertise and representing distinct empirical settings. The international nature of this course will allow you to gain multiple social perspectives and familiarity with transportation challenges and solutions from different parts of the world. Guided by the Shared Mobility Principles for Livable Cities and taught by transportation professors from Europe, Asia, Latin America, Africa, and the United States, the course provides insights into urban mobility challenges and opportunities and how the emerging new mobility paradigm can be effectively leveraged to create better, more equitable cities.
- Duration: 10 weeks 2-6 hours per week/ Instructor-led on a course schedule
- Location: online
- Fees: Free (or 93EUR with certificate)
- Teaching delivery methods:
1. Content Exploration: The course spans 8 sessions and explores a wide range of topics related to emerging new mobility systems. Students will engage with diverse subject matter that covers various aspects of urban mobility, including land use, business models, pricing, policy, technology, and data.
2. Global Perspective: The course is designed to have a global impact and leverages an established network of academic partners and practitioners from different parts of the world. This international nature allows students to gain multiple social perspectives and insights into transportation challenges and solutions worldwide.
3. Instructor Expertise: The course is taught by transportation professors from different regions, including Europe, Asia, Latin America, Africa, and the United States. These instructors bring their expertise and represent distinct empirical settings, enhancing the breadth of knowledge shared in the course.
4. Guest Interviews: The course features interviews with prominent individuals such as entrepreneurs, city planners, community development experts, and mobility justice

advocates. These interviews provide additional real-world insights and perspectives on urban mobility.

5. Course Topics: The course covers a wide range of topics related to urban mobility, equity, health, accessibility, and the environment. Students will explore these subjects through a series of sessions.

6. Application to Real-World Challenges: The course emphasizes the practical application of knowledge to address urban mobility challenges and opportunities, including how the emerging new mobility paradigm can contribute to creating more equitable cities.

7. Reflection on Current Events: The course also addresses how the transportation field is responding to the global COVID-19 pandemic, ensuring that students stay informed about the latest developments and challenges in the field.

- Link: https://www.edx.org/learn/engineering/massachusetts-institute-of-technology-leveraging-urban-mobility-disruptions-to-create-better-cities?index=product&queryID=49ba412b0298ef4c032405c7aa649d5f&position=1&results_level=first-level-results&term=shipping+climate+change&objectID=course-2727a5e2-52de-49cd-8cd2-fd1fb832d04c&campaign=Leveraging+Urban+Mobility+Disruptions+to+Create+Better+Cities&source=edX&product_category=course&placement_url=https%3A%2F%2Fwww.edx.org%2Fsearch

Title: Transformative Living Labs in Urban Climate Action and Transportation Planning

- University: Massachusetts Institute of Technology
- Type: Online course
- Description: "Transformative Living Labs in Mobility" introduces living laboratory model of achieving sustainable urban mobility systems. The goal of the course is to explore the ways that multiple stakeholders and agencies organize and investigate living labs to find solutions for urban mobility. Mobility planning plays a key role in building more sustainable cities and providing equitable access to economic opportunities, education, healthcare, and social activities. The living lab concept can be a helpful tool to achieve these goals. This co-development process forms coalitions that enable transformative change, addresses climate change, and supports inclusive, sustainable urban development. Urban change makers can use the living labs approach to highlight the benefits of innovations and interventions and test the validity in collaboration with authorities, academia, civil society, private sector, and end-users.
- Duration: 6 weeks 8-10 hours per week/ Instructor-led on a course schedule
- Location: online
- Fees: Free (or 48EUR with certificate)
- Teaching delivery methods: Not mentioned.
- Link: https://www.edx.org/learn/environmental-science/massachusetts-institute-of-technology-transformative-living-labs-in-mobility?index=product&queryID=93d202c7a1cb2c1f9244d4d7bd5c2127&position=10&results_level=second-level-results&term=shipping+climate+change&objectID=course-c628b4fa-2f66-4f44-b24b-97210ae774c5&campaign=Transformative+Living+Labs+in+Urban+Climate+Action+and+Transportation+Planning&source=edX&product_category=course&placement_url=https%3A%2F%2Fwww.edx.org%2Fsearch

Title: Climate Change for Decision-Makers: Challenges, Transformations, Strategies

- University: University of Cambridge
- Type: Online course
- Description: This research-informed and practice-infused course focuses on three main aspects of climate change and its societal implications: metrics, technology, and governance. Explore the interconnections between the issues raised by climate change and understand how it affects your organisation; gaining the expertise to develop your own position or strategy to solve these issues within your context.This course will provide decision-makers with the ability to develop a 360-degree view of climate change and the implications for society. You will gain the confidence to find new innovative pathways to address climate change and understand its broader collective political and legal implications.
- Duration: 6 weeks 6-8 hours per week/ Tutor guided
- Location: online

- Fees: 2350EUR with Certificate of Achievement
- Teaching delivery methods:
1. Interactive Learning: The course emphasizes interactive learning, allowing students to actively engage with the course content and apply what they are learning to their own context. This approach promotes a hands-on and practical learning experience.
2. Diverse Teaching Methods: The course uses diverse teaching methods to enhance learning outcomes. These methods may include University of Cambridge academic-led videos, quizzes, and group work. This variety of approaches caters to different learning styles and preferences.
3. Optional Live Sessions: The course offers optional live sessions, typically lasting one hour, with University of Cambridge academics and tutors. These sessions provide opportunities for students to deepen their understanding of the week's material through activities such as Q&A sessions, short lectures, or breakout activities. Importantly, these sessions are recorded and made available for students to access later, offering flexibility in learning.
4. Guided Critical Thinking: Students are guided in critical thinking through a reflective workbook. This tool helps students collect, structure, and summarize information and thoughts as they progress through the course. It encourages students to think critically about the course material and their own learning.
5. Access to Course Tutor: Throughout the online learning experience, students have access to a course tutor who facilitates learning and provides support and guidance. Interaction with the tutor can occur through various media, including live sessions, discussion forums, email, or canvas messaging. This interaction ensures that students receive personalized assistance and clarification on course content.
- Link: https://advanceonline.cam.ac.uk/courses/climate-change-for-decision-makers-challenges-transformations-strategies/?utm_medium=cpc&utm_source=google&utm_campaign=4_A_CCD_Geo1_%7BB%7D&gad=1&gclid=Cj0KCQjw4bipBhCyARIsAFsieCxXRUeDLp_tWQPYp2SWFGrfJYfd54XGWY2P_SPAWy4F2jvUcLyrl4AaAgxVEALw_wcB

Among the courses, "Designing Climate-Neutral Buildings and Transport" stands out for its diverse teaching methods, which include lectures, interviews with experts, practical exercises, real-life examples, readings, and discussion forums. This comprehensive approach ensures that students receive a well-rounded education on greenhouse gas (GHG) emissions in the building and transport sectors. Designing Climate-Neutral Buildings and Transport" offers a self-paced, 4-week course with 4-5 hours per week, providing learners with flexibility in managing their time. This self-paced structure caters to a wider audience, including those with busy schedules. In comparison, some courses, such as "Climate Change for Decision-Makers," have a longer duration and higher time commitment, potentially limiting accessibility. The inclusion of discussion forums in the "Designing Climate-Neutral Buildings and Transport" course promotes peer-to-peer interaction, which can enhance the learning experience and foster a sense of community among learners.

After an analysis and comparison of the five reviewed courses in the context of climate change and sustainability education, it becomes evident the limited utilization of advanced teaching methods. While some courses incorporate expert interviews and interactive components, they tend to fall short in fully leveraging technology to simulate real-world scenarios and engage learners in practical problem-solving exercises specific to the transport and logistics sectors. Moreover, when looking specifically at the transport sector's educational landscape, there is a noticeable dearth of comprehensive programs that address the urgent need for decarbonization and climate resilience. The existing courses offer valuable insights into sustainable supply chain management and urban mobility but lack a dedicated focus on the interplay between technology, logistics, and climate action in transportation.

The review, as closely related to the REFOCUS orientation, clearly shows that there is an important gap in terms of available, specialized programs addressing climate change and associated technical, management and policy aspects, targeting niche or broader audiences. REFOCUS is seizing exactly this opportunity to offer educational services for climate change awareness and management, also technical and social topics vis a vis shipping and transport sector needs and requirements and disadvantaged learner groups inclusion.

5   Methodology for co-designing the curriculum

This section delineates a structured methodology for the co-design of a curriculum tailored to address contemporary issues such as sustainability, resilience, digitalization, and green operations within the realms of transport, shipping, and logistics sectors. In the ensuing sections, a detailed workflow is presented in the following diagram (Figure 1), illustrating the sequential and parallel steps essential for an effective and inclusive curriculum development process that also meets the goals of REFOCUS project.

- Initially, the **'Foundation and Planning'** stage establishes a solid groundwork, encapsulating the alignment of objectives, stakeholder identification, needs assessment, and objective setting.

    o The overall curriculum design process should be aligned with the objectives of the REFOCUS project: covering contemporary issues like sustainability, resilience, digitalization, and green operations in the transport, shipping, and logistics sectors.

    o An important component of the first phase in the curriculum co-design process is 'Stakeholder Identification.' A broad spectrum of consultations is initiated at this stage, actively involving a diverse array of stakeholders such as professors, students, and industry experts particularly those involved in transport, shipping, and logistics, as well as environmentalists, NGOs, activists, local authorities or other societal stakeholders, ensuring diverse representation across the whole spectrum of climate change and transport subject matters. A variety of strategies, such as stakeholder surveys and interviews, and focus groups are employed to gain insights. These strategies facilitate the collection of valuable input and feedback regarding the curriculum, deploying modern tools to empower stakeholders to express their unique perspectives and constructive suggestions. By analyzing this collected data, common themes and critical areas that are necessitating enhancement or revision are identified. This engagement process aims to obtain a curriculum that is both reflective of and responsive to the collective needs, expectations of the involved educational and industry communities.

    o For the 'Needs Assessment' surveys, focus groups, or interviews should be conducted to understand current educational needs and gaps in addressing contemporary issues in the sectors of transport, shipping, and logistics.

    o In the first phase is very important to establish curriculum objectives that resonate with the goal of enhancing focus on contemporary challenges and opportunities within the sectors of logistics and maritime transport.

- During the second stage **'Conceptual Development and Preparation'** through collaborative workshops, ideation occurs, and foundational concepts are developed, while concurrently, preliminary research and resource gathering take place to support and enrich the emerging curriculum framework. Specifically:

    o organization of collaborative workshops encourages stakeholders to brainstorm on incorporating contemporary sectoral issues into the curriculum, fostering an environment for innovative idea generation (ideation) focused on sustainability, resilience, digitalization, and green operations.

- o the preliminary research & resource gathering includes the conduction of research and collection of resources focused on the identified contemporary issues, preparing foundational materials for curriculum development.

- In the third stage **'Draft Curriculum Design'** an initial draft curriculum is developed, ensuring that it includes comprehensive coverage of sustainability, resilience, digitalization, and green operations. The preliminary curriculum is aligned with the established objectives and incorporates the insights gathered from various stakeholders. The content, structured to be current and comprehensive, is developed alongside chosen teaching approaches to facilitate effective and student-centered learning experiences. Learning outcomes and teaching methods are clearly indicated. Furthermore, relevant technological tools and resources are selected to enhance delivery and accessibility, ensuring that the curriculum is well-rounded and adaptable to diverse learning needs and environments.

- In the next stage of **'Evaluation and Refinement'** the curriculum undergoes a process of testing, feedback, iteration, and improvement through both stakeholder inputs and practical implementation in a pilot setting.

  - o in this phase it is crucial to obtain and incorporate feedback, emphasizing alignment with the goal of effectively addressing contemporary sectoral issues. The draft should be circulated among stakeholders to gather feedback, in terms of specific comments, suggestions and improvements to be considered. This may require multiple rounds.
  - o small-scale pilot programs or courses should be implemented to test new curriculum elements before implementing them on a larger scale. The gathered feedback from pilot participants is important to make any necessary adjustments.

  The draft curriculum could be compared with similar programs at other institutions or with industry standards to identify best practices, areas for improvement and valuable insights into what works well in other contexts.

- After incorporating feedback and lessons from the pilot, the next stage includes the finalization of the curriculum for broader implementation.

- To ensure that the curriculum stays relevant to the issues like sustainability, resilience, digitalization, and green operations in the transport, shipping, and logistics sectors, **'Continuous Evaluation & Update'** is of great importance. Key components include reviewing learning outcomes to evaluate the effectiveness of current learning outcomes in preparing students for their future careers or academic pursuits, ensuring they evolve to meet contemporary student needs and job market demands.
  Data analytics play a crucial role in this stage, providing critical insights into student performance and course completion rates, which guide necessary curriculum adjustments. A mechanism for continuous feedback is instituted, fostering an ongoing dialogue with stakeholders, allowing the curriculum to be perpetually fine-tuned based on regular assessments of its relevance and practical utility.
  Moreover, technological integration, especially through online platforms, is leveraged for real-time feedback collection from students and faculty, further harnessing the potential of analytics to pinpoint areas ripe for enhancement. This comprehensive

strategy ensures that the curriculum is not only up to date but also effectively facilitating learners' success and readiness for their future endeavors.
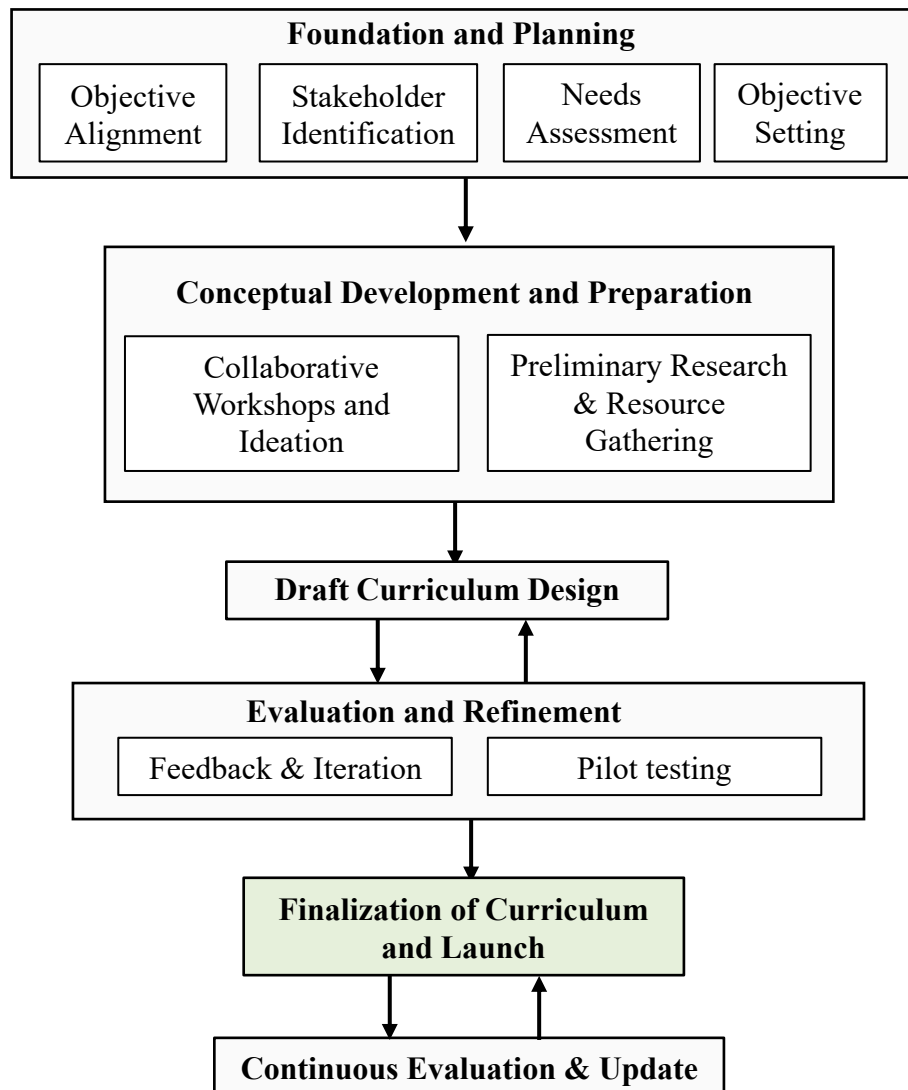

Figure 1: Workflow of curriculum design

Communities of Practice (CoPs) can constitute a central component of and be integrated into the workflow of curriculum co-design to enrich the development process. Within the **'Foundation and Planning'** stage, CoPs contribute by sharing expertise and insights, helping to identify current trends, needs, and gaps in the existing curricula. In the **'Conceptual Development and Preparation'** stage, members of CoPs can actively participate in workshops and discussions, bringing diverse perspectives and innovative ideas to the table, fostering a rich environment for the REFOCUS curriculum enhancement.

As the curriculum draft is being developed, CoPs play a crucial role in reviewing, providing feedback, and suggesting practical improvements, ensuring the curriculum is robust, comprehensive, and aligned with industry needs or field advancements. Moreover, CoPs are instrumental in the **'Continuous Evaluation'** stage, where they engage in ongoing assessments, feedback mechanisms, and iterative improvements, keeping the curriculum dynamic, relevant, and attuned to the evolving needs and trends of the educational landscape. Their continual involvement ensures that the curriculum remains up to date, relevant, and deeply rooted in practical and current expertise, enhancing its overall quality and effectiveness.

6 Conclusions

This report has thoroughly examined and articulated the best teaching practices vis a vis current educational needs, essential for enhancing industry and academia responses to foster climate change awareness, knowledge, and skills development. In particular the pedagogies and models of blended learning, enabled by up-to-date digital learning technology, and a design thinking inspired, co-creation framework for curriculum design, focusing on the transport, shipping, and logistics sectors' context is elaborated. An evaluation was carried out to identify the contemporary requirements, gaps, and areas that require profound improvement and innovation in curriculum design and teaching methodologies.

The active engagement of a diverse stakeholders, including students, faculty, industry experts, and respective Communities of Practice (CoPs), has been identified as central to our approach. Furthermore, stakeholders' unique perspectives and requirements, possibly derived from surveys, interviews, and collaborative workshops, can lay a robust foundation for the co-designing process, to the extent needed. Incorporating a rich variety of insights and expertise, our methodology fosters an environment conducive to innovation, creativity, and relevance, ensuring the curriculum remains aligned with contemporary needs and industry advancements, particularly concerning sustainability, resilience, and digitalization.

Communities of Practice (CoPs) play a pivotal role in enriching the curriculum design process. Stakeholders' continuous involvement, collaboration, and shared expertise have greatly enhanced the projects understanding and approach to ensure the curriculum's relevance, applicability, and alignment with real-world needs and challenges. Through continuous evaluation mechanisms—encompassing review of learning outcomes, data analytics, and technology integration—a dynamic and adaptable curriculum will be co-designed. This iterative approach allows for ongoing enhancements, ensuring that our curriculum will remain responsive to the evolving educational landscape and the nuanced needs of the sectors in focus.

The REFOCUS project, with its comprehensive, up to date methodology, aspires to deliver a curriculum that is not only reflective of current industry standards and needs but also forward-thinking in its approach to education and learning in the realms of transport, shipping, and logistics. In weaving together diverse threads of insights, expertise, and innovation, we aim to craft a curriculum that stands resilient in the face of future challenges and developments.

To this end, the report of T2.3 validated the existence of unexploited and underserved learning needs, identified appropriate teaching methods, teaching technologies, and related educational programs, as well as a refined curriculum development framework that will aid the more specific tasks in WP3 for developing the REFOCUS curriculum, the particular six MOOC courses addressing issues of transport, shipping and logistics and the REFOCUS online life-long educational knowledge sharing hub.

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