A holistic and Scalable Solution for research, innovation and Education in Energy Transition

D4.3 Educational Programmes Development

Work Package	WP4 Programs delivery and piloting
Author (s)	Louisa Bouta, Stavroula Bertzouani (OTEA), C. Psomopoulos, T. Ganetsos, N. Leligou (UNIWA), Marco Pau, F. Ponci, Ana De La Varga (RWTH)
Quality Reviewer(s)	Nadia Politou, Sara Diez (ATOS), Sara Golessi, Davide Zanoni (ENOSTRA)
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0.1	24/8/2020	Louisa Bouta (OTEA)	Document structure
0.2	18/9/2020	Louisa Bouta (OTEA)	Chapter 1 content, Integration of chapter 2 and 3 inputs from UNIWA
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Executive Summary

This deliverable is the outcome of task 4.3 which focuses on interdisciplinary programme creation and delivery up to M18. It thus describes the structures and materials designed and developed exploiting the ASSET learning graph concept towards preparing and delivering the interdisciplinary courses defined in D4.2[3]. Additionally, evaluation of the level of support for interdisciplinary course creation from both ASSET team members and experts outside the consortium is provided and shown to be positive. Finally, it specifies additional steps to be made in the next months towards communicating our approach and cause the proliferation of interdisciplinary courses in universities and vocational training organisations. (Further information to the rest of the educational programmes -existing by M12- are provided in D3.2 [1]).

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List of Acronyms

Abbreviation / acronym	Description
IPR	Intellectual Property Rights
KSC	Knowledge Skills and Competencies
MOOC	Massive Open Online Course
RIE	Research, Innovation and Education
RRI	Responsible Research and Innovation
SSH	Social Sciences and Humanities

1. Introduction

1.1 Purpose & Scope

This deliverable includes the structures and learning materials for all educational programmes created by the ASSET partners under task 4.3 which is titled “Interdisciplinary programme creation and delivery”.

In this task, short programmes of any type (MOOC, blended or face-to-face) responding to the needs identified in WP2 are created:

- Firstly, by professors from the consortium exploiting the learning graph models to combine learning materials using the relevant online-ASSET tool.
- Second, professors outside the consortium team are invited to experience the ease of interdisciplinary course creation in a dedicated event. The short programmes are delivered to the departments and universities of the ASSET partners and ecosystem.

In this deliverable, we present the short programmes created by professors from the ASSET consortium. Additional interdisciplinary courses are anticipated to be created from professors outside the consortium from M18-M24 in the framework of dedicated events (and will thus be included in the deliverable of WP4 that will be delivered in M24).

1.2 Structure of the Deliverable

This report is organized into six main chapters:

- Section 1 provides the introduction to the document;
- Section 2 presents the implementation of the deployment concept outlined in D4.2[2] and the approach towards developing and delivering the selected interdisciplinary courses;
- Section 3 presents the structures and learning materials of the five interdisciplinary courses created by professors in ASSET;
- Section 4 presents the outcomes of our efforts to define, propose and initiate interdisciplinary PhD and Master thesis as well as post-graduate programmes;
- Section 5 provides the experiences and lessons learnt from the above procedures;
- Section 6 concludes the deliverable.

1.3 Relationships with other WPs and Tasks

This deliverable builds on:

a) The learning graph model and tool developed in WP3;
b) The learning structures and materials developed in WP3;
c) The KSC needs of the market specified in WP2;
d) The deployment plan defined in task 4.2[3].

2. Interdisciplinary programme deployment concept and delivery

2.1 Introduction

In D4.2[3]**Error! Reference source not found.**, we distinguished between two different cases:

- The case where professors/trainers are interested in enriching their current educational programmes injecting seeds from other disciplines. The first four courses from the following table belong to this category.
- The case where a completely new interdisciplinary educational programme is created. The fifth course falls in this category.

The list of the courses along with the updated time plan are shown in the table.

	Course title	Creator	Involved Disciplines	Re-using learning materials included in D3.2	Target audience	Delivery
1	Software Defined Networks	UNIWA, P. Karkazis	ICT and Innovation processes in the energy sector	YES	Postgraduate UNIWA students	Spring 2020
2	Mobile app development	UNIWA, N. Leligou	ICT and Innovation and Diversity in engineering	YES	Undergraduate UNIWA students	Winter 2020
3	New Materials for solar cell applications	UNIWA, T. Ganetsos	Material and Responsible Research	YES	Undergraduate and post graduate UNIWA students, Students from Democritean University of Thrace	Winter 2020
4	Energy Efficient and Ecological Design of Products and Equipment	UNIWA, C.S. Psomopoulos	Ecological and Energy Efficient approach and Corporate communication and responsibility	YES	Undergraduate and post graduate UNIWA students	Winter 2020
5	Understanding Responsibility in the Energy Transition	RWTH, F. Ponci and A. De La Varga	Electrical Engineering & SSH	NO	Undergraduate/ postgraduate students	Design only

Table 1: Interdisciplinary programmes

2.2 Interdisciplinary Educational Programme 1: Software Defined Networks

In the educational programme currently offered at UNIWA, at the department of information and computer engineering titled “Software Defined Networks”, two learning outcomes from the ASSET programme “Innovation processes in the energy sector” were included in the spring 2020. The selected learning outcomes were:

- Understand Innovation Processes
- Familiarise with Growth Mindset

For this purpose, UNIWA and OTEA professors met and co-developed one lecture (in the form of slides) that were delivered to the students by UNIWA professor. It is reminded that due to COVID-19 pandemic, it was not feasible to organize more extensive teaching on the issue.

The introduction of the relevant learning outcomes as declared in the official e-class space of the course is shown below as well as the inclusion of the relevant materials in the documents used for this course.

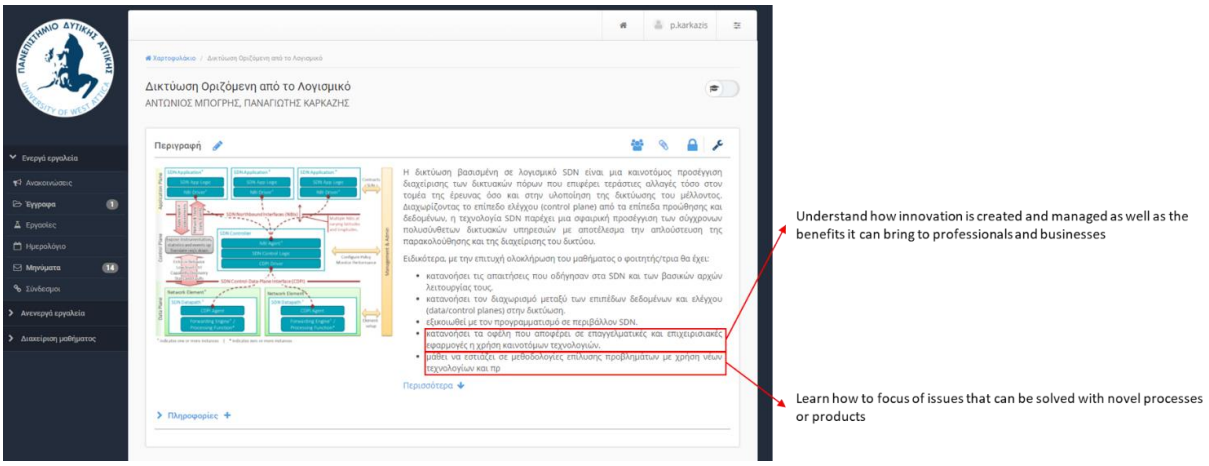

Figure 1: The (updated) learning outcomes of the course taught by Prof. Karkazis on Software Defined networking

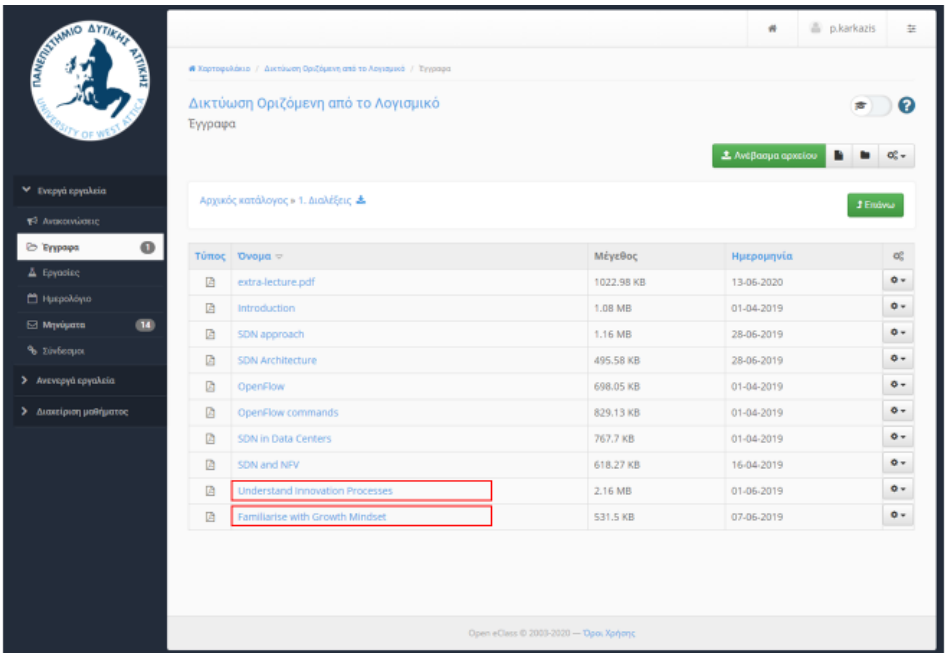

Figure 2: The learning materials produced in ASSET (in red boxes) included in the materials of the course on Software Defined Networking

2.3 Interdisciplinary Educational Programme 2: Mobile app development

This course is delivered in the 9th semester of the Industrial Design and Production Engineering Department of University of West Attica. It can be considered as level 7 as it corresponds to master-level. In the educational programme titled “mobile app development”, two learning outcomes from the ASSET programme “Innovation and Diversity in engineering” will be included:

- Explain and compare different gender and diversity approaches;
- Discuss the context between diversity and innovation.

To do so, the learning materials already in place come for the part of pure mobile app development from the university of West Attica and for the part of “Innovation and Diversity in engineering” from the currently available materials from RWTH. To better prepare the course, the two tutors met (late September) to organize the course and a lecture-workshop co-organised through MS Teams is planned for late November.

2.4 Interdisciplinary Educational Programme 3: New Materials for solar cell applications

In the educational programme currently offered at UNIWA, titled “New Materials for solar cell applications”, after thorough examination, it was decided to add two (instead of one, initially defined in D4.2[3]) learning outcomes from the short programme on Understanding responsibility in research and Innovation:

- Examine the concept of responsibility in research and innovation
- Discuss the social impact of research and innovation

The professor of the two courses will meet to check how the integration of the materials will be enhanced in November. Additionally, interest to use the materials of this interdisciplinary course has been witnessed from professors outside ASSET consortium and more specifically, from the National Technical University of Athens and from the Democritean University of Thrace.

2.5 Interdisciplinary Educational Programme 4: Energy Efficient and Ecological Design of Products and Equipment

In the educational programme currently offered at UNIWA, titled “Energy Efficient and Ecological Design of Products and Equipment”, to the post graduate students, instead of delivering materials relevant to Understanding Responsibility In Research and Innovation as initially planned, prof. Psomopoulos according to the feedback he received from the industry, decided to offer bonus to the students enrolling and successfully finishing the ASSET MOOC course titled: Corporate Communication and Corporate Social Responsibility.

The results from the students’ perspective will be examined in January 2021.

2.6 Interdisciplinary educational programme 5: Electrical Engineering & SSH - Understanding Responsibility in the Energy Transition

RWTH structured a new interdisciplinary short programme, merging aspects of electrical engineering and social sciences and humanities, which will be delivered as a seminar. This seminar explores the concept of responsibility in research and innovation processes taking place in the energy transition area. A researcher is expected to extend boundaries of knowledge, produce new insights into a specific issue or push forward a technological development that could realize the energy transition. But what does it mean to do responsible research in this sector?

Several questions will be discussed in an interactive manner and in an interdisciplinary context: in what way is it (or not) the researcher’s responsibility to respond to social needs, values and demands? Should any researcher consider ethics, public engagement, science education, etc. in his/her work? How could one maximize the social impact of the research results? Responsible Research and

Innovation (RRI) aims to bridge the gap between science and society and foster sustainable innovation. In this workshop, students will develop different approaches to promote responsible research in the energy sector. They will reflect on responsibility issues during the innovation process, work out creative solutions to build greater trust in the science through research and discuss case studies considering the perspectives of different stakeholders. On completion of this workshop students will be able to:

- understand the responsibility in doing research related to the energy transition;
- familiarize with a toolkit of resources and guidelines to implement more social responsibility;
- apply different concepts of RRI to increase the social impact of their research;
- discuss specific energy related examples of good practice;
- find inspirational ways of increasing the dialogue with the society.

The seminar will be delivered at the Human Technology Centre of the RWTH Aachen University for a group of up to 20 PhD Students, Postdoc researchers, Young Research Group Leaders, and possibly research and science managers or partners from industrial R&D departments. The students will come from different disciplines and programmes across the RWTH Aachen. It can also be offered to a more international audience with participants from the IDEA League[1] Universities or the ENHANCE[2] Universities Alliance in some of the exchange activities among the alliances. The course will be imparted by lecturers both from the department of Electrical Engineering and from the Human Technology Centre (Social Sciences and Humanities) in order to guarantee the interdisciplinary character. The variety of perspectives will also be reinforced with the course methodology, alternating the presentation of theoretical concepts and literature from the social sciences, technical descriptions adapted to a broader audience, case studies and a variety of co-creation and debating tools. The course will be implemented based on the guided interaction among participants, in order to better understand different dilemmas in energy transition processes and the perspectives of different societal actors.

2.7 Other activities and further plans

In order to be able to assess whether ASSET tools facilitate the creation of interdisciplinary programmes we have performed and planned a set of activities as follows:

- A workshop in the framework of ITS conference (June 2020) where we asked the attendees to evaluate whether the ASSET tools help in this direction
- Another similar workshop in Spain by UPV in October 15th, 2020.
- Short workshops with people from academia to evaluate and discuss with them about the creation of interdisciplinary course. Currently we plan to talk with:
  - Representatives of a Master programme on Smart grids offered by the National Kapodestrian University of Athens
  - Representative of a Master programme on Informatics offered by the Hellenic Open University;
  - Representative of a Master programme on smart grids from the University of West Attica.
- The 2nd train the trainers workshop which will give emphasis on teaching trainers of technological topics so that they provide seeds of other disciplines (mostly SSH and economics) so that other disciplines permeate into technological objectives.

[1] https://idealeague.org/
[2] https://enhance.webs.upv.es/

3. Interdisciplinary courses structures and materials

In this section we describe the structures and materials of the five interdisciplinary courses outlined above. The additional materials which come from a different discipline are highlighted in purple.

3.1 Interdisciplinary programme 1: Software Defined Networking

Topic	Learning outcomes	Learning Materials
Software Defined Networking	Possess knowledge of SDN basic concepts	Slide set in Greek
	Understand the concepts of NFV architectures	Slide set in Greek
	Deeply understand the distinction between the data and control planes	Slide set and online exercise
	Analyse the operation of OpenFlow protocol and programme networking SDN devices	Slide set in Greek
	Understand the architecture of the SDN controller	Articles from the literature and slide-set in pdf
	Combine design methodologies of advanced networking systems to achieve specific QoS	Project
	Understand how innovation is created and managed as well as the benefits it can bring to professionals and businesses	Slides will be used to cover the following topics. • innovation and entrepreneurship - definitions • where does innovation come from? • the adoption lifecycle
	Learn how to focus of issues that can be solved with novel processes or products	Assignment: Your dream company in the energy sector and disruptive innovation

3.2 Interdisciplinary programme 2: Mobile app development

Topic	Learning outcomes	Learning Materials
Conceive and specify a mobile app	Be able to study a specific market sector, analyse the mobile apps available in the market and define a new application of interest	Lecture slides in Pdf format from the professor Exercise: Reports from the students

Topic	Learning outcomes	Learning Materials
Explain and compare different gender and diversity approaches	Introduction of gender approaches Introduction of diversity approaches	Learning Material 1: Video lecture: Gender and diversity approaches Learning Material 3: Video lecture: Innovation and diversity
Discuss the context between diversity and innovation	Understand how diversity affects innovations	Learning Material 4: Text work And workshop during a lecture
Collect user requirements	Learn the methodologies for user requirement collection	Lecture slides in Pdf format from the professor
Design the mobile application	Definition of the specification of the application based on user requirements and specification of the appropriate tools to use throughout the development	Lecture slides in Pdf format from the professor Exercise: Reports from the students
Implement a mobile application	Learn to use the appropriate languages and tools to develop a mobile application (e.g. Android studio)	Lecture slides in Pdf format from the professor Hands on in the lab
Test with the users the mobile application	Learn how to recruit users for testing, organize test sessions and formally collect feedback	Lecture slides in Pdf format from the professor Actual events Questionnaires
Conceive and specify a mobile app	Be able to study a specific market sector, analyse the mobile apps available in the market and define a new application of interest	Lecture slides in Pdf format from the professor Exercise: Reports from the students
Explain and compare different gender and diversity approaches	Introduction of gender approaches Introduction of diversity approaches	Learning Material 1: Video lecture: Gender and diversity approaches Learning Material 3: Video lecture: Innovation and diversity

3.3 Interdisciplinary programme 3: New Materials for solar cell applications

The structure of the course is shown in the following table. The learning materials are available in the links included reported in D3.2.

Topic	Learning outcomes	Learning Materials
New Materials for solar cells applications	Recall the history of Solar Cells	Learning material 1 Learning material 2 Learning material 12
	Identify the importance of Solar Energy	Learning material 2 Learning material 3 Learning material 12
	Define the Power generation from solar cells	Learning material 2 Learning material 4 Learning material 12
	Describe Solar cells technology	Learning material 5 Learning material 12
	Recall the operation of solar cells	Learning material 4 Learning material 5 Learning material 12
	Describe the Production of solar cells	Learning material 5 Learning material 6 Learning material 12
	List thin films solar cells	Learning material 6 Learning material 7 Learning material 12
	Describe the polymer solar cells	Learning material 6 Learning material 8 Learning material 12
	Define Methodology and Importance of materials characterization	Learning material 9 Learning material 12
	List the Characterization techniques	Learning material 9 Learning material 10 Learning material 12
	Define implement Solar Energy Spectrum and the Necessity of Band Gap Tuning	Learning material 11 Learning material 12
	Recognize the relationship of the profession of Industrial Design and Production Engineering and the	All Learning Material

Topic	Learning outcomes	Learning Materials
	renewable resources of energy and their interdependence.	
	Examine the concept of responsibility in research and innovation	From the course: Understanding Responsibility in Research and Innovation: • Learning material 1: lecture by instructor - slides • Learning material 2: interactive discussions (partly based on video material) • Learning Material 4: selected papers
	Discuss the social impact of research and innovation	From the course: Understanding Responsibility in Research and Innovation: • Learning Material 1: lectures by the instructor – slides • Learning Material 2: interactive discussions (partly based on video material) • Learning Material 4: selected papers
	Ability to apply that knowledge in his/her business life.	All Learning Material

3.4 Interdisciplinary programme 4: Ecological and Energy Efficient approach and thinking

The structure is as follows. The additional learning outcomes are mainly acquainted through attendance of the MOOC titled “Corporate Communication and Corporate Social Responsibility” which triggers relevant discussion in the classroom.

Topic	Learning outcomes	Learning Materials
Energy Efficient and Ecological Design of Products and Equipment	Analyse the EU Energy Efficiency, EcoLabel, EcoDesign, RoHS and WEEE Directives.	Learning Material 1 Learning Material 10
	Identify the Economics of Energy Efficient Design and EcoDesign of products and systems.	Learning Material 1 Learning Material 2 Learning Material 3 Learning Material 10

Topic	Learning outcomes	Learning Materials
	Identify the Consumer Orientation - Innovation through Eco-Design and Energy-efficient Design, based on the total life cycle analysis approach.	Learning Material 1 Learning Material 2 Learning Material 3 Learning Material 10
	Combine methods for developing and adopting strategies for Eco and Energy-efficient design of products and systems through analysis of all phases in their life and reverse engineering approaches.	Learning Material 4 Learning Material 5 Learning Material 6 Learning Material 7 Learning Material 8 Learning Material 9 Learning Material 10
	Analyse different components and methods for reducing the impact of a product or equipment in the environment during the different phases of its life cycle.	Learning Material 4 Learning Material 5 Learning Material 6 Learning Material 7 Learning Material 8 Learning Material 9 Learning Material 10
	Combine the Concepts and Methodologies and Basic Tools for the Energy-efficient and Eco-Design of Products.	Learning Material 6 Learning Material 7 Learning Material 8 Learning Material 9 Learning Material 10
	Ability to perform Life Cycle Analysis and Life Cycle Costing Analysis during the design of a product and the calculation of the Total Cost of Ownership	Learning Material 6 Learning Material 7 Learning Material 8 Learning Material 9 Learning Material 10
	Ability to use the principles of ecological design (Eco-Design) and environmental legislation regulations that define the design, operation and the end of life cycle of electrical equipment and installations, in his/her professional activity.	Learning Material 1 Learning Material 2 Learning Material 3 Learning Material 10

Topic	Learning outcomes	Learning Materials
	Acquiring the basic knowledge on the relationship between corporate communication, organizational features and social values.	Seminar slides and selected paper(s), reading – learning material 1-3.
	Understanding the role of consumption and the consumer in contemporary society and business communication, as well as acquiring the basic knowledge in the definition of the communication plan with particular attention to energy companies.	Seminar slides and selected paper(s), reading – learning material 4-6.
	Final task. A short document about a communication plan proposed by students.	Learning material 7: Slide with instruction for the final task
	Ability to perform the studies and work and to assess their results considering the sustainable/energy-efficient design parameter.	All Learning Material
	Ability to use the principles and methodologies of energy-efficient and ecological/sustainable design (Eco-Design) in his professional activity.	All Learning Material

3.5 Interdisciplinary programme 5: Understanding Responsibility in the Energy Transition

The structure of the interdisciplinary course foresees a set of learning outcomes that will be achieved via a combination of different types of learning materials, such as slides, presentation of case studies, scientific papers, videos, simulations as well as a number of interactive discussions and engagement activities. Since the designed seminar includes a combination of learning materials coming from different sources, the details of the learning materials are indicated as well in specific tables.

3.5.1 Structure

Topic	Learning outcomes	Learning Materials
Understanding Responsibility in the Energy Transition	Examine the concept of responsibility in research and innovation in the energy transition	Learning Material 1: lecture by instructor: slides Learning Material 2: interactive discussions (partly based on video material) Learning Material 3: card-based engagement exercise Learning Material 4: selected papers

Topic	Learning outcomes	Learning Materials
		Learning Material 5: slides on case studies from the energy research area Learning Material 6: simulations that illustrate the technical aspects of the case study Learning Material 7: card-based engagement exercise (energy cases) Learning Material 10: compilation of relevant literature on CSR
	Assess how to involve stakeholders in an innovation process	Learning Material 1: lectures by instructor: slides Learning Material 2: interactive discussions (partly based on video material) Learning Material 3: card-based engagement exercise Learning Material 7: card-based engagement exercise (energy cases) Learning Material 8: ASSET game word puzzle Learning Material 10: compilation of relevant literature on CSR
	Discuss the social impact of research and innovation	Learning Material 1: lectures by the instructor: slides Learning Material 2: interactive discussions (partly based on video material) Learning Material 4: selected papers Learning Material 10: compilation of relevant literature on CSR
	Propose ways to improve the alignment of research in energy transition with societal needs	Learning Material 1: lecture by instructor: slides Learning Material 5: slides on case studies from the energy research area Learning Material 9: video of expert briefly presenting the case
	Discuss “responsibility” in a case study on energy transition	Learning Material 1: lecture by instructor: slides

Topic	Learning outcomes	Learning Materials
		Learning Material 4: selected papers Learning Material 5: slides on case studies from the energy research area Learning Material 9: video of expert briefly presenting the case Learning Material 10: compilation of relevant literature on CSR

3.5.2. Learning Materials

Learning Material 1	
Short description or summary	Lecture slides "Understanding Responsibility in Energy Transition. Part I". The slides comprise information about basic concepts in the area of responsible research and information, guidelines to discuss the social impact of research, guidelines to work on own research, and a compilation of open-source resources.
Targeted EQF level	7-8
The targeted delivery mode.	Face-to-face
The targeted audiences	PhD/Post-Doc researchers (optional: research and science managers and stakeholders from the industry cooperating with the university in research projects)
Format and/or link to the material	PowerPoint presentation including relevant links to open source material https://rwth-aachen.sciebo.de/s/5yDn6mkF7ckttgD
Author & organisation	Ferdinanda Ponci, Ana de la Varga (RWTH Aachen)
Material Type	Lecture Notes
Level of Completion (%)	100

Learning Material 2	
Short description or summary	Open source videos to initiate different discussion on topics related to the concepts of Responsibility in Research and Innovation
Targeted EQF level	7-8

Learning Material 2	
The targeted delivery mode.	Face-to-face
The targeted audiences	PhD/Post-Doc researchers, research and science managers and stakeholders from the industry cooperating with the university in research projects)
Format and/or link to the material	Links to videos https://www.youtube.com/user/RRITools
Author & organisation	HEIRRI (heirri.eu), RRI-Tools (rri-tools.eu)
Material Type	Homework/Assignment
Level of Completion (%)	100

Learning Material 3	
Short description or summary	Open source card games to initiate different discussion on topics related to the concepts of Responsibility in Research and Innovation
Targeted EQF level	7-8
The targeted delivery mode.	Face-to-face
The targeted audiences	PhD/Post-Doc researchers (optional: research and science managers and stakeholders from the industry cooperating with the university in research projects)
Format and/or link to the material	PowerPoint presentation including links or guidelines to card games https://rwth-aachen.sciebo.de/s/5yDn6mkF7ckttgD
Author & organisation	Ferdinanda Ponci, Ana de la Varga (RWTH Aachen), HEIRRI (heirri.eu)
Material Type	Game
Level of Completion (%)	100

Learning Material 4	
Short description or summary	Compilation of selected papers and relevant literature

Learning Material 4	
Targeted EQF level	7-8
The targeted delivery mode.	Face-to-face
The targeted audiences	PhD/Post-Doc researchers (optional: research and science managers and stakeholders from the industry cooperating with the university in research projects)
Format and/or link to the material	List of selected papers: https://rwth-aachen.sciebo.de/s/5yDn6mkF7ckttgD
Author & organisation	Ana de la Varga (RWTH Aachen)
Material Type	Reading
Level of Completion (%)	100

Learning Material 5	
Short description or summary	Lecture slides “Understanding Responsibility in Energy Transition. Part II”. Lecture notes including case studies and guidelines for interactive discussion in the specific context of the energy transition
Targeted EQF level	7-8
The targeted delivery mode.	Face-to-face
The targeted audiences	PhD/Post-Doc researchers (optional: research and science managers and stakeholders from the industry cooperating with the university in research projects)
Format and/or link to the material	PowerPoint https://rwth-aachen.sciebo.de/s/5yDn6mkF7ckttgD
Author & organisation	Ferdinanda Ponci, Ana de la Varga (RWTH Aachen)
Material Type	Lecture Notes
Level of Completion (%)	100

Learning Material 6	
Short description or summary	Simulations that illustrate the technical aspects of the case study
Targeted EQF level	7-8
The targeted delivery mode.	Face-to-face
The targeted audiences	PhD/Post-Doc researchers (optional: research and science managers and stakeholders from the industry cooperating with the university in research projects)
Format and/or link to the material	MATLAB Link not available yet
Author & organisation	Ferdinanda Ponci (RWTH)
Material Type	Simulation
Level of Completion (%)	70%

Learning Material 7	
Short description or summary	Card-based engagement exercise to initiate different discussion on topics related to the concepts of responsibility and social dilemmas related to energy research
Targeted EQF level	7-8
The targeted delivery mode.	Face-to-face
The targeted audiences	PhD/Post-Doc researchers (optional: research and science managers and stakeholders from the industry cooperating with the university in research projects)
Format and/or link to the material	Guidelines to card games included in presentation slides (Part II) https://rwth-aachen.sciebo.de/s/5yDn6mkF7ckttgD
Author & organisation	Ferdinanda Ponci, Ana de la Varga (RWTH Aachen)
Material Type	Game

Learning Material 7	
Level of Completion (%)	100

Learning Material 8	
Short description or summary	ASSET game word puzzle
Targeted EQF level	7-8
The targeted delivery mode.	Face-to-face
The targeted audiences	PhD/Post-Doc researchers (optional: research and science managers and stakeholders from the industry cooperating with the university in research projects)
Format and/or link to the material	https://energytransition.academy/puzzle
Author & organisation	ASSET
Material Type	Game
Level of Completion (%)	100

Learning Material 9	
Short description or summary	Video of expert briefly presenting the case (optional)
Targeted EQF level	7-8
The targeted delivery mode.	Face-to-face
The targeted audiences	PhD/Post-Doc researchers (optional: research and science managers and stakeholders from the industry cooperating with the university in research projects)
Format and/or link to the material	Video Link not available yet
Author & organisation	RWTH Aachen

Learning Material 9	
Material Type	Diagram/Illustration
Level of Completion (%)	0%

Learning Material 10	
Short description or summary	Compilation of relevant literature from the related course on Corporate Communication and Corporate Social Responsibility (by UNINA)
Targeted EQF level	7-8
The targeted delivery mode.	Face-to-face
The targeted audiences	PhD/Post-Doc researchers (optional: research and science managers and stakeholders from the industry cooperating with the university in research projects)
Format and/or link to the material	Free access pdf 1: "Globalization and postmodern values." Free access pdf 2: "Organizational communication for organizational climate and quality service in Academic libraries." Free access pdf 3: "Corporate Social Responsibility." Free access pdf 4: "Prosumer communities and relationships in smart grids." Free access pdf 5: "Designing a strategic communication plan." Free access pdf 6: "E-Marketing by energy companies."
Author & organisation	Ivano Scotti, University of Naples
Material Type	Reading
Level of Completion (%)	100

4. Experiences and lessons learnt

This chapter is meant to provide the results from assessing whether the creation of interdisciplinary courses was facilitated by the ASSET offerings and more concretely a) the learning graph model and b) the learning graph tool.

4.1 Internal assessment

During the preparation of the aforementioned interdisciplinary courses, ASSET professors defined some interesting conclusions. They mainly come from the first four courses listed in chapter 2 because the fifth one was organised by two professors from different disciplines at the same time from the same university. This means that they had the opportunity to meet easily at their common semester planning.

Lesson learnt #1: Having all the programmes in the same platform and modelled according to the graph model facilitated a) the identification of programmes and authors to "blend" with and b) the examination of the materials so as to minimise the time needed by the professors to collaborate so as to create an inter-disciplinary course.

Lesson learnt # 2: The most interesting modules for interdisciplinary programme creation are those tackling global challenges such as:

- Innovation processes in the energy sector
- Innovation and Diversity in Engineering
- Understanding responsibility in research and innovation
- Corporate Communication and Corporate Social Responsibility

As such and given that during the 2nd train-the-trainers workshops (that will be held in the framework of ASSET), an introduction to such programmes will be provided to the attendees, we (ASSET consortium) anticipate that the likelihood of mixing technological with non-tech disciplines will significantly increase.

Lesson learnt #3: It is not clear even among professors what the difference between interdisciplinary and multi-disciplinary course is. In ASSET, we feel we need to work on this and furthermore to dig into what the industry needs, which we plan to do in the next months.

Lesson learnt # 4: Offering MOOCs at self-paced mode provides the flexibility to the professors of the universities and other organisations to prompt their students enrol to additional courses which has a dual benefit: a) additional knowledge/skills and b) familiarisation with the MOOC process and realisation of additional ways to learn.

Lesson learnt # 5: Due to COVID-19 pandemic, the courses at the universities were given as online lectures in a synchronous mode. This prohibited UNIWA professors from inviting e.g. RWTH to give seminars to the students of UNIWA. UNIWA personnel plans to organise online-lectures having invited professors to participate and organise exercises and workshop to improve student engagement and interest stimulation.

4.2 External Assessment

To provide as objective results and feedback as possible, UNIWA has first organised a workshop in the framework of a conference (namely ITS2020) and then a workshop was organised in UPV in Spain. In both workshops the participants were asked to evaluate the easiness to build an interdisciplinary course enabled by ASSET. In total 54 responses have been collected through online questionnaires from the participants. Their answers to the question "Assuming you are interested in creating an interdisciplinary course, does the learning graph tool make it easier?" is shown in the following figure.

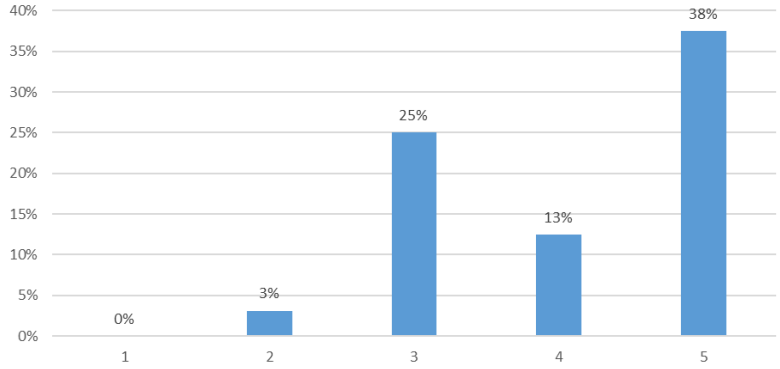

Figure 3: Distribution of answers to the question regarding the support of interdisciplinary course creation received in the two workshops (5 stands for "helps a lot")

Additionally, the 30% of the respondents commented that one of the three top advantages of the learning graph model approach and tool is the efficient support of interdisciplinarity.

We plan to invite tutors outside ASSET team to create interdisciplinary course during one or more events, in the coming months. Our target is to have more than three interdisciplinary courses created by professor/trainers outside consortium.

5. Conclusions

ASSET has delivered tools that facilitate the creation of interdisciplinary programmes and raised awareness among professors of technical subjects regarding the necessity of including in their short programmes elements from other non-technical disciplines.

The ASSET team members have used these tools to create five interdisciplinary courses up until M18 of the project lifetime. We have outlined concrete “lessons learnt” so that the overall proposition of the tools can be improved. We have also specified additional activities to foster interdisciplinary programme creation and dissemination/deployment. The acceleration/facilitation of interdisciplinary programme creation has been positively evaluated by external experts in the framework of a workshop. The next step is mainly the recruitment of professors and course designers outside the ASSET members’ team towards exploring and evaluating ASSET tools including also the 2nd train-the-trainers workshop, which is fully oriented to interdisciplinarity.

6. References

[1] Tarnate, W., et al. (2020), D3.2 ASSET Learning Materials v1, ASSET
[2] De Rosa, R., Papadimitriou, G. (2020), D2.4 Design of monitoring tools, ASSET
[3] De Rosa, R., et al. (2020), D4.2 Educational programmes deployment plan, ASSET