



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

### D4.4 Evaluation of ASSET educational proposition - v1

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## Executive Summary

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This deliverable reports the results of the evaluation activities in all tasks of WP4 up to M18 of the project i.e. up to October 2020. WP4 is generally involved with the piloting and delivery of educational programmes developed under the ASSET platform. ASSET delivers the developed educational programmes to the targeted actors across EU universities, companies from the energy sector, and EU societies. The evaluation aims to collect feedback for refining ASSET offerings which will be used to define concrete ASSET educational offers as well as sustainability and scalability plans. This deliverable corresponds to the evaluation process during the first 6 months of the delivery activities, starting from the second year of the project where the delivery activities started.

The monitoring tools including surveys for MOOC quality and delivery assessment and face-to-face classes that were developed in D2.4, are used for the evaluation activities. These surveys consider the student evaluation only. Therefore, to include feedback from teachers, new surveys and questionnaires are also reported in this deliverable. The evaluation concept and evaluation criteria including qualitative as well as quantitative assessments are detailed in this deliverable. Self-assessment and peer-assessment methods are applied for effective evaluation at all levels of preparation, piloting, and delivery. Moreover, assessment surveys are also used to analyse the satisfaction of instructors and participants with the quality of the delivery.

The results from the assessment are analysed in detail for each course and MOOC. Based on the feedback from various analytics tools including EMMA, and Vimeo, the recommendation for the next round of delivery, i.e. for the next 6 months of delivery is derived.

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## List of Acronyms

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Abbreviation / acronym	Description
MOOC	Massive Open Online Course
RIE	Research, Innovation, and Education
KSC	Knowledge Skills and Competencies
IPR	Intellectual Property Rights
SSH	Social Sciences and Humanities
AAU	Aalborg University
KPIs	Key Performance Indicators
OER	Open Educational Resources
LLL	Life Long Learning



# 1. Introduction

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## 1.1. Purpose & Scope

The purpose of this deliverable is to report the results of the evaluation activities in all tasks of WP4 up to M18 of the project i.e. up to October 2020. WP4 is generally involved with the piloting and delivery of educational programmes developed under the ASSET platform. ASSET delivers the developed educational programmes to the targeted actors across EU universities, companies from the energy sector, and EU societies. Since ASSET educational offerings are highly novel, therefore, evaluation is mandatory for defining concrete and realistic sustainability plans. Within the current scope of the deliverable, the evaluation aims to collect feedback for refining ASSET offerings and to define plans for the future scalability of ASSET educational offers.

According to the project timeline, the first year is dedicated to the need identification, an ecosystem built up, and educational programme preparation, while most of the second year is devoted to the pilot delivery and evaluation of ASSET educational services. The piloting and delivery activities are further distributed in two phases. The first phase corresponds to the period from May 2020 to October 2020, while the second phase corresponds to the period from November 2020 to April 2021. This deliverable (D4.4) corresponds to the evaluation process during the first phase, i.e. first six months of the delivery activities, starting from the second year of the project. The evaluation results in this deliverable will serve as a baseline for the improvement of intended delivery activities in the second phase, and the evaluation of the second phase of delivery activities will be reported in an updated version of this deliverable, i.e. D4.5, by the end of the project.

The monitoring tools for the assessment of the quality and delivery of MOOCs and face-to-face courses reported in D2.4 are used for the evaluation activities. These surveys focus on the evaluation from the student perspective only. The feedback from the students provides an overview of the end user's perspective and may be regarded as one of the key indicators for the validation. However, the preparation of the educational offer itself, the tools facilitating the preparation phase, the delivery platform, and its user-friendliness also need to be assessed for the concrete sustainability of the offers. Therefore, for effective evaluation, the teacher's perspective on various aspects of programme preparation and delivery also needs to be taken into consideration. In order to include this aspect, new surveys and questionnaires for teacher assessment are prepared and included in this deliverable. To have inclusive feedback, the assessment strategy is designed such that it involves the participation and perspective of the course-delivering instructor as well as the view and feedback from the fellow instructors in the consortium.

In particular, the evaluation concept and criteria at **three hierarchical levels, i.e. a) individual level, b) course level, and c) programme level** are detailed in the deliverable. At all these levels, a mixed-method approach with a set of qualitative and quantitative questionnaires is employed to look into various aspects of the preparation and delivery. Moreover, statistical data from the delivery platform is integrated to reinforce the findings from the assessment. At the individual level, self-assessment and peer-assessment methods are applied for the assessment of various aspects including preparation, platform support, features integration piloting, and delivery. At the course level, directly reported students' feedback, as well as the participation and engagement of the students, is assessed. At the programme level, a holistic overview of the overall offering and its key attributes are evaluated. The combined analysis from students' feedback, teachers' feedback, analytics, and statistical data serve as the baseline for the evaluation of the overall ASSET educational proposition.

The results from the assessment are analysed in detail for each course and MOOC. The key results highlighting teachers' satisfaction, students' participation and engagement, their willingness to continue using ASSET educational proposition, and trends for the adoption of ASSET educational proposition across Europe and worldwide are discussed in detail. Each course is monitored and analysed, and individual feedbacks to the corresponding instructors is provided for the enhancement of the quality of contents, engagement, and delivery. Based on the evaluation results of the

educational offer level assessment, the recommendations for the next round of delivery, i.e. for the second phase of delivery are derived.

## 1.2. Structure of the Deliverable

The deliverable report is organized into five sections as the main chapters. Section 1 introduces the document.

Section 2 defines the **hierarchy of evaluation**, categorizing in three layers. This section also details the criteria of evaluation and the way that various layers and multi-facet aspects of ASSET educational proposition are evaluated. Then, a detailed course level assessment is made, and key findings from this assessment are detailed.

Section 3 provides a complete **overview of educational level assessment**. This section discusses the evaluation of the platform used for the delivery of MOOCs and its various feature and their conduciveness for the effective engagement of the course. This section also presents the learning analytics and assessment results per offering and discusses the feedback loop that is necessary for highlighting both the positive aspects as well as shortcomings observed during the first round of delivery.

Based on the feedback section, Section 4 presents the **overall lesson learned** from phase one of the delivery activities and outlines the key recommendations or the second phase of the delivery.

Finally, Section 5 concludes the deliverable.

## 1.3. Relationships with other WPs and Tasks

As highlighted earlier, this deliverable reports the results of the evaluation activities for the piloting and delivery of educational programmes developed under the ASSET platform for the first phase of delivery. Each task of WP4 targets the delivery of a different mode of offering including MOOCs (Task 4.1), classroom-based and blended short programmes (Task 4.2), interdisciplinary courses (Task 4.3), and course on-demand (Task 4.4). However, in the first round of delivery, the focus is on the MOOCs, classroom-based short programmes, while interdisciplinary, and on-demand courses are already under preparation. Therefore, this deliverable directly links with Task 4.1 and Task 4.2. Moreover, customization of the EMMA platform as a core part of T4.1, which enabled the tracking, logging, and engagement services is also used extensively for the evaluation and is, therefore, directly linked with this deliverable. Since all the programmes that have been delivered within the current phase are being prepared in WP3, therefore this deliverable has an indirect dependence on WP3, particularly with Task 3.1 'Learning graphs and modules design for energy transition programmes' and Task 3.2 'Learning content preparation'. Moreover, the monitoring and evaluation tools prepared in WP2, under Task 2.4 'Monitoring Tools' have been employed for course-level assessment. These tools including questionnaires have been reported in D2.4, so the deliverable has direct involvement with Tasks 2.4 and D2.4 as well.

## 2. Course Level Assessment

### 2.1. Assessment criteria used in the pilot phase

The ASSET educational offer is holistic and hybrid in its nature. Its multi-facet aspects and formats required an assessment strategy at different levels:

- **Individual:** how teachers designed the course, how they took advantage of the learning graph approach, how they react over their workflow and coordinate lesson production and team, how much they are satisfied with the platform used, its functionalities, and the assistance offered. This dimension allows the teacher also to reflect on course instructional design, the outcomes achieved, and the effort to put in place to reach goals that are more ambitious.
- **Course:** how many learners follow a course, how many got a certificate of participation, how many completed the course?
- **Whole program:** besides the KPIs to be reached such as the total number of students involved, the total number of visits, etc., the whole program can be assessed looking also at some qualitative indicators such as how many visits came from countries different from the ones involved in the project, how many students the ASSET project was able to reach in the energy sectors, how many in the field such as SSH

The assessment methodology consists of a mixed-method approach with a set of qualitative and quantitative questionnaires complemented with learning analytics and platform statistics. These tools are connected with the system of indicators (KPIs) mentioned in section 1.3 of the DOA [1] and developed according to D2.4 Monitoring tools [2]. Table 1 reports the number of respondents to questionnaires according to the mentioned KPIs and their status:

KPI	Target	Total numbers		Status
<b>6.1. Number of responses to ASSET questionnaires received from professors/tutors</b>	30	Self-Assessment (9 MOOCs, 4 Other Courses, 7 Seminars). Peer Assessment (9 MOOCs, 5 Other Courses)	34	Achieved
<b>6.2. Number of responses to ASSET questionnaires received from students/learners</b>	400	197 Questionnaire for face to face courses and seminars, 83 MOOC Registration Questionnaire, 18 MOOC expectation Questionnaire, 9 Mini-survey for Quality Monitoring	307	Not achieved yet but highly likely to be achieved by the end of the project
<b>6.5. The percentage of completion rate - Target (against an average value of 4-5% observed today)</b>	>20%	Higher than the average value, but lower than the expected rate.	5,36	Not achieved yet, actions needed.

**Table 1: Status of the number of respondents to questionnaires and MOOC completion**

Self-assessment and peer-assessment tools have been developed to address the call for feedback at the individual and course levels. Moreover, in the following sections, the tools designed for course self-assessment and peer-assessment are reported, each one with a short explanation and data interpretation.

## 2.2. Self-Assessment

This evaluation section concerns the qualitative self-assessment of courses run during the first Pilot Phase. It consists of a set of questions aiming at analysing the MOOC quality according to several perspectives, as in the following list:

- The course development
- The course deployment
- The course running
- The platform' experience

Seven MOOCs and several seminars have been self-assessed by their teachers after six months from the launch of the program. Teachers received a call to action, a submission calendar, and simple instructions about how to use the online survey designed by UNINA and available on Survey Monkey. In this session, the raw forms are briefly presented in order to explain the rationale of each monitoring tool. Respondents have been required to provide at least 50 words per question to their answers highlighting both positive and negative aspects. For a brief overview, at the end of this session, there are two examples of self--assessment of MOOCs.

### 2.2.1. Self-Assessment form for MOOC development

This tool intended to solicit a reflection process in teachers by inquiring about the level of involvement required by them in developing the course and detecting their strategy in coordinating activities. A couple of examples of MOOC development are reported.

#### Questions

1. Please, can you specify the name of your course?
2. Please specify the mode of delivery of your course (e.g. MOOC, class-based, etc.)
3. How many people were involved in designing/adapting the course content?
4. How many hours per week do they spend on this task? What specific task do they do (e.g. write a blog entry, recommend further reading or video, monitor assignment results on the dashboard)?
5. Did you provide overall feedback to the group about how the course was going? If so, what form did this take? (Video, mail, etc.?) How often did you do this?
6. Have you or your co-teachers followed a course on EMMA?

### 2.2.2. Self-Assessment form for MOOC deployment

This form aims at understanding the level of comfort of teachers with the deployment plan set in D4.2 [3] and his/her proactivity in student recruitment. This experience, however, was affected by the Covid-19 lockdown adding, for example, frustration for a tighter work plan. Aware of difficulties created by lockdown, UNINA strengthened its effort in assisting teachers but a certain pressure to keep the deadline was not evitable. A couple of examples of MOOC deployment are reported in Table 2, and 3 below.

#### Questions

1. Were you able to cope with the timeframe set by the project management team for editing video-lessons?
2. How participants were recruited?
3. Are you happy with the assistance received by the team involved in course deployment? If not, what were your expectations?

### 2.2.3. Self-Assessment form for MOOC running

The following form intends to assess the satisfaction of teachers and users against the platform functionalities and the course running. Through student comments, teachers become the main 'antenna' to capture the mood of their students even in an online classroom. On the other side, the

EMMA platform staff at UNINA has the pulse of the situation thanks to its analytics system and can inform the individual teacher about the trend of his/her course so to create a feedback loop. An example of such a strategy is reported in section 3.3 where the most relevant data are available to generate a feedback loop offering directions for course improvement.

### Questions

1. Can you identify a baseline regarding user-satisfaction of the platform used for delivery of the course (please specify it)?
2. Can you identify a baseline regarding user-satisfaction concerning your course?
3. Are you happy with your course? What do you think can be improved?
4. How did you use the feedback received from analytics?
5. Did you take the chance to interact with learners? How was it?
6. Did your course receive the attention of unexpected users (e.g. from other countries, faculties, etc.)?

COURSE DEVELOPMENT	
Please specify the mode of delivery of your course (e.g. MOOC, class-based, etc.)	MOOC
How many people were involved in designing/adapting the course content?	Three professors and a research fellow by the University of Naples "Federico II" have been involved to design all the contents and lessons. Also, an ExCo Delegate for Italy in the IEA Technical Collaboration Programme was engaged.
How many hours per week do they spend on this task? What specific task do they do (e.g. write a blog entry, recommend further reading or video, monitor assignment results on the dashboard)?	The number of hours per week that we spent on the project was slightly higher than expected in the preliminary phase of the project.
Did you provide overall feedback to the group about how the course was going? If so, what form did this take? (Video, mail, etc.?) How often did you do this?	There were regular meetings and some information was informally transferred to the other project members.
Have you or your co-teachers followed a course on EMMA?	Yes.
COURSE DEPLOYMENT	
Were you able to cope with the timeframe set by the project management team for editing video-lessons?	Due to the Covid-19 emergency, there was a two-month shift, but we observed the lessons schedule time.
How participants were recruited?	Through the course sponsoring on the social network platforms.
Are you happy with the assistance received by the team involved in course deployment? If not, what were your expectations?	Yes, I am satisfied

COURSE RUNNING	
How many teachers/facilitators/tutors have been involved in running the course?	Four teachers by the University of Naples "Federico II" have been involved to design all the course contents and a facilitator was engaged too.
Can you identify a baseline regarding user-satisfaction of the platform used for delivery (please specify it)	The course recently started, but students seem to be satisfied with the platform used.
Can you identify a baseline regarding user-satisfaction concerning your course?	The course recently started, but students seem to be satisfied with my course.
Are you happy with your course? what do you think can be improved?	I am satisfied with my course. In the future, I will use the conversion tool to answer questions and use my blog on the platform inviting students to follow all the lessons.
Did you take the chance to interact with learners? How was it?	No. There are currently few learners following the course.
How did you use the feedback received from analytics?	Analytics was used to understand the type of students to be involved.
Did your course receive the attention of unexpected users (i.e. from other countries, faculties, etc.)	Yes, they come from Europe, Brazil, and South Africa.

Table 2: Example of self-assessment: Electrical Heat Pumps in Energy Transition Framework (MOOC)

COURSE DEVELOPMENT	
Please specify the mode of delivery of your course (e.g. MOOC, class-based, etc.)	Class-based (distance learning for this semester due to Covid-19)
How many people were involved in designing/adapting the course content?	Only one the Professor teaching the course
How many hours per week do they spend on this task? What specific task do they do (e.g. write a blog entry, recommend further reading or video, monitor assignment results on the dashboard)?	4 hours (2 hours teaching and 2 hours preparing and enhancing the course adding and recommending further reading or video, monitor assignment results on the dashboard, semester project of each student evaluation, etc.).
Did you provide overall feedback to the group about how the course was going? If so, what form did this take? (Video, mail, etc.?) How often did you do this?	Yes, once officially through the anonymous survey from the Quality Monitoring Unit of the University and every 2 weeks during the last 5 minutes of the presentations to discuss the course and receive feedback from the students.
Have you or your co-teachers followed a course on EMMA?	Yes

COURSE DEPLOYMENT	
<b>Were you able to cope with the timeframe set by the project management team for editing video-lessons?</b>	YES, it was quite easy as the course lasts a semester and I have used material that I have to collect and create. Furthermore, I use in the course videos, images and another free material already existing is the web allowing me to enhance easily and fast the course.
<b>How participants have been recruited?</b>	Through the official e-class page of the course and announcements from the university about the courses. This course is the official course of the 4th semester of the Department of Electrical and Electronics Engineering at the University of West Attica Greece.
<b>Are you happy with the assistance received by the team involved in course deployment? If not, what were your expectations?</b>	Yes
COURSE RUNNING	
<b>How many teachers/facilitators/tutors have been involved in running the course?</b>	Only me
<b>Can you identify a baseline regarding user-satisfaction of the platform used for delivery (please specify it)</b>	The platform used this semester was MS-Teams for e learning and e-class from uploading the material. These 2 platforms were the official ones of the University and the one-parameter used to identify the satisfaction was the number of participants.
<b>Can you identify a baseline regarding user-satisfaction concerning your course?</b>	Following the participants' comments on the evaluation and during the course I believe that the high number of participants on MS-Teams (average participation exceeded 80% of those who participate in the final exams) it seems that can be a good indicator.
<b>Are you happy with your course? what do you think can be improved?</b>	Even though I may be happy with my course, I believe that it can, and it must be improved. The reason is simple the technological development is very fast and the interactions of the energy, environment are becoming more and more complex, and at the same time, too many actions towards reducing the impact on the environment from the use of energy are developing. I have used it in order to improve the weak points of the course. The basic one was that the course should be longer and bigger.



<b>How did you use the feedback received from analytics?</b>	I have used it in order to improve the weak point of the course. The basic one was that the course should be longer and bigger.
<b>Did you take the chance to interact with learners? How was it?</b>	Yes, I had this chance. It is always important and crucial for the successful implementation of the course in a University
<b>Did your course receive the attention of unexpected users (i.e. from other countries, faculties, etc.)</b>	YES. I have students from other Universities under the ERASMUS + and ERASMUS+ ICM collaborations that have taken my course. This year I have students from Ukraine, Russia, Georgia, Portugal, due to Covid-19.

**Table 3: Example of self-assessment: Energy and Environment (class-based course)**

#### **2.2.4. Quantitative Self-Assessment of experience with the platform**

This is a questionnaire aiming at quantifying how much the platform fits the expectations of teachers/tutors rating from "strongly agree" to "strongly disagree" (Likert scale), his/her reaction to the EMMA look & feel, the course effectiveness, the student behaviour. It also allows us to understand if they have explored the EMMA interactive feature and used extensively. Questions have been organized in three clusters and are completed by an open-end question on the estimated number of students.

##### **The platform look & feel**

1. I like the general look and feel of the platform, including colours, font, etc.
2. The basic logic and architecture of the platform are functional.
3. The basic logic and architecture of the platform are sufficiently flexible.
4. The authoring environment is easy to navigate.
5. It was easy to train staff to use EMMA.
6. It was straightforward to transfer my course onto EMMA.
7. My course fits/rides comfortably on EMMA.
8. The personal blogs, conversation, and wall offer me the range of communication tasks I need to run my course successfully.

##### **The course effectiveness**

1. I/my co-teachers make full use of all the EMMA features in my course.
2. I/my teachers encourage learners to compare specific content in courses offered by other partners.
3. I/my teachers encourage learners to compare different approaches to similar subjects by recommended specific study units in a variety of courses on EMMA.
4. I encourage my students to follow the MOOC from start to finish.
5. I/my teachers encourage participation in conversation from learners from other countries and language groups.

##### **The student's behaviour**

1. Students are very interested in the topic
2. Students have no idea of the social implication of energy transition
3. Students are interested in additional CFU/ECTS
4. The course has been designed taking in mind the ASSET objectives
5. Teaching an Energy Transition class is challenging



## Open-Ended Response

1. Please specify the number of students and the course length in hours.

Please rate from "strongly agree" to "strongly disagree" your reaction to the EMMA platform for providing your MOOC courses.	Strongly agree	Agree	Neutral	Disagree	Strongly disagree
I like the general look and feel, including colours, font	36,8%	47,4%	15,79%		
Please specify the mode of delivery of your course (e.g. MOOC, class-based, etc.)	31,6%	57,9%	10,53%		
The basic logic and architecture of the platform is sufficiently flexible	26,3%	52,6%	21,05%		
The authoring environment is easy to navigate	31,6%	52,6%	10,53%	5%	
It was easy to train staff to use EMMA	52,6%	26,3%	15,79%	5%	
It was straightforward to transfer my course onto EMMA	15,8%	47,4%	31,58%	5%	
My course fits/rides comfortably on EMMA	15,8%	75,0%	36,84%		
The personal blogs, conversation and wall offer me the range of communication tasks I need to run my course successfully	15,8%	36,8%	42,11%	5%	
I/my co-teachers make full use of all the EMMA features in my course		47,4%	42,11%	11%	
I/my teachers encourage learners to compare specific content in courses offered by other partners	21,1%	21,1%	47,37%	11%	
I/my teachers encourage learners to compare different approaches to similar subjects by recommended specific study units in a variety of courses on EMMA	26,3%	31,6%	31,58%	11%	
I encourage my students to follow the MOOC from start to finish	52,6%	31,6%	10,53%	5%	
I/my teachers encourage participation in conversation from learners from other countries and language groups	21,1%	47,4%	15,79%	16%	

**Table 4: Reaction to the platform Services**

In Table 4 you can see how positive was the reaction of the teachers to the EMMA platform look and feel (84,2% strongly agree + agree) with the majority of respondents showing appreciation for how the course fits the platforms (90,8%) and for the whole assistance received by the UNINA staff (78,9%). While they encouraged students to complete the course (84,2%), they were even less proactive in encouraging students to compare contents on similar topics (58,37%).

### 2.2.5. Self-Assessment of non-MOOC format

The same logic has been used to assess non-MOOC format courses. Also, in this case, a set of closed questions with predefined answers Likert Scale based have been submitted to teachers in order to collect feedback. However, this offer has been created and provided for different situations. In some cases, it was possible to have class-based courses or seminars, in other they took the form of webinars, in other they took the form of blended classes depending on the Covid-19 context.

1. Students are very interested in the topic
2. Students have no idea of the social implication of energy transition
3. Students are interested in additional CFU/ECTS
4. The course has been designed taking in minds the ASSET objectives
5. Teaching an Energy Transition class is challenging
6. Please specify the number of students and the course length in hours

Please rate from "strongly agree" to "strongly disagree" your reaction to non-MOOC format courses. (Please select one option for each row.)	Strongly agree	Agree	Neutral	Disagree	Strongly disagree
Students are very interested in the topic	26,32%	42,11%	31,58%		
Students have no idea of the social implication of energy transition	15,79%	31,58%	36,84%	15,79%	
Students are interested in additional CFU/ECTS	21,05%	31,58%	36,84%	10,53%	
The course has been designed taking in mind the ASSET objectives	36,84%	52,63%	10,53%		
Teaching an Energy Transition class is challenging	47,37%	36,84%	15,79%		

**Table 5: Self-assessment of non-MOOC format**

The self-assessment of non-MOOC format concerns webinars, seminars, and face-to-face classes. Table 5 is quite clear about the level of difficulty of teaching in the Energy Transition. It is considered challenging by over 80% of respondents, and students are considered as very interested in the topic by 68%. However, students appear not well aware of the social implications of the energy transition (47%).

### 2.3. Peer-Assessment

The peer review of a course run during the pilot phase has been tasks assigned to those MOOC providers who were not involved during the pilot phase, to let them learn from the pilot and reflect on the own/others approaches. Also, for the peer review, we have adopted a mixed method with both qualitative and quantitative aspects.

For the qualitative questionnaire, reviewers had to explain how the course looks like from an external perspective highlighting both positive and negative aspects. Being the scientific content under the sole responsibility of teachers, they are not called to review the MOOC from a scientific perspective. Peers have been assigned to a MOOC by AAU, each one received a deadline and a list of questions to be answered. Each review has been delivered to the MOOC responsible teacher in order to provide them with an external but expert overview of their course.

For the qualitative part, information has been collected according to three dimensions of analysis:

- Course design
- Course material
- Course activities

### 2.3.1. Peer-Assessment form for Course Design

The peer instructors keeping the following questions and aspects in mind have evaluated the course design.

#### Questions

1. Is there a clear pedagogical approach, and if so, what is it?
2. Are the syllabus and material logically structured and coherent (are terms explained, do sections follow each other?)
3. Are the learning outcomes clear and achievable?
4. Are active verbs used for the easily measurable learning outcomes?
5. Are the activities consistent with the platform's functionality (i.e., discussion forum, feedback mechanisms)?

### 2.3.2. Peer-Assessment form for Course Material

The course material has been evaluated by the peer instructors keeping the following questions and aspects in the mind.

#### Questions

1. Are there any elements of multimedia (interactive materials, audio, and video) included? If so, what are they? How do they look like?
2. Are all materials open (are there any technological access issues)?
3. Do the external links work, if any?

### 2.3.3. Peer-Assessment form for Course Activities

The course material has been evaluated by the peer instructors keeping the following questions and aspects in the mind.

#### Questions

1. Are sections given clear timeframes?
2. Are there any communicative activities, if so, what are these?
3. Are there any collaborative activities, if so, what are these?
4. Are there any assessment/assignment elements, and if so, what are they?
5. Are there any comments you wish to make about this course?

For a brief overview, the following are a couple of examples of a peer-review as shown in Table 6 and Table 7:

COURSE DESIGN	
Is there a clear pedagogical approach, and if so, what is it?	The pedagogical approach is mostly a traditional teacher-centered approach, with lecture-based lessons led by the instructor that present the theoretical concepts behind the taught topics. Theoretical lessons are complemented with some laboratory sessions that help students in having a more concrete idea of the practical implications associated with some of the learning aspects.
Are the syllabus and material logically structured and coherent (are terms explained, do sections follow each other?)	The material and the sequence of learning outcomes follow a clear and logical structure that starts with introductory materials and step-by-step moves to a more in-depth and detailed presentation of the technical aspects. Terms and new concepts are introduced and duly explained. The logical structure of the course allows having a clear understanding of the learning path and having a clear idea of the overall progress.

<b>Are the learning outcomes clear and achievable?</b>	The learning outcomes are concise, clear and they reflect the learning results achievable via the provided material. Maybe one of the learning outcomes could be split into two because it has a large amount of learning material associated with it.
<b>Are active verbs used for the easily measurable learning outcomes?</b>	The learning outcomes are always described via active verbs that properly represent the skill that students acquire via the associated learning material. Some of the learning outcomes (and the associated verbs) sound quite easily measurable, while some other (e.g. "describe", "explain") probably require some more detailed verification approach to effectively evaluate and measure them (but this also depends on the particular subject of the learning module).
<b>Are the activities consistent with the platform's functionality (i.e., discussion forum, feedback mechanisms)?</b>	The course is already provided with videos as complementary learning material for each unit, thus allowing the possibility to offer it as a MOOC. Apart from this, the current structure of the learning material mostly follows a traditional face-to-face teaching approach. Nevertheless, the impression is that a series of additional activities (questions, feedback mechanisms) can be added straightforwardly to the existing material. Moreover, each unit of learning material also contains a reference to additional readings that can be used as a starting point for forum discussions.
<b>COURSE MATERIAL</b>	
<b>Are there any elements of multimedia (interactive materials, audio, video) included? if so, what are they? How do they look like?</b>	The course is provided with videos (and English audio) for each unit of the learning material, thus allowing it to offer it as a MOOC. The videos are of good quality, with good audio and quite easy to follow. Overall, the videos look very professional and well prepared.
<b>Are all materials open (are there any technological access issues)?</b>	Some external links are provided as references or as additional readings within the learning material. All these links correctly work.
<b>Do the external links work, if any?</b>	Links are provided in the different sections as external resources or study material. All the provided links work correctly.
<b>COURSE ACTIVITIES</b>	
<b>Are sections given clear timeframes?</b>	The timeframe for the overall course is the same as typical semester University courses, but no clear timeframes are explicitly indicated for the different sections.
<b>Are there any communicative activities, if so, what are these?</b>	In its current form, no specific communicative activities are explicitly indicated

<b>Are there any collaborative activities, if so, what are these?</b>	In its current form, no specific collaborative activities are explicitly indicated, even if they could be potentially performed in the lessons with case study analysis and during the laboratory sessions.
<b>Are there any assessment/assignment elements, and if so, what are they?</b>	In the course structure, a case study activity is included, which concerns the dimensioning of a hydrogen production system. This (or similar tasks) could be probably delivered also as an assignment to students.
<b>Are there any comments you wish to make about this course?</b>	The current version of the course reflects a traditional face-to-face course, but it seems to be possible to easily integrate additional features into the MOOC-based version.

**Table 6: Example of Qualitative Peer-assessment: Hydrogen as an Energy Vector (MOOC)**

The peer-reviewers show a general appreciation for how the MOOCs, materials, and assignments have been designed, organized, and run. However, they claim also limited usage of collaboration and of interactive activities, which could give more appeal to the courses. However, the quantitative analysis shows results very clear in this respect.

The quantitative peer-review analysis, instead, has been conducted with a short set of questions with predefined answers on a Likert Scale (Table. 7) to have the possibility to summarize the assessment of the most relevant features for a MOOC along the following six dimensions:

- The use of multimedia
- The degree of communication
- The degree of collaboration
- Amount of reflection
- Learning pathway
- Learner autonomy use

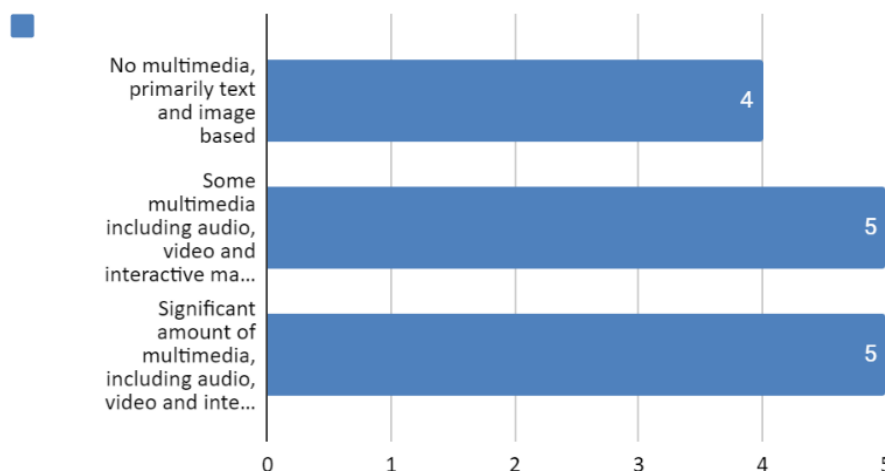
PEER ASSESSMENT (QUANTITATIVE)					
<b>Please insert a signpost (X) into corresponding cells.</b>		<b>x</b>		<b>x</b>	<b>x</b>
<b>Use of multimedia</b>	No multimedia, primarily text, and image-based		Some multimedia including audio, video, and interactive materials		A significant amount of multimedia, including audio, video, and interactive materials
<b>Degree of communication</b>	Little or no communication included either between students or with tutors		Some communication, for example, some use of discussion forum		Significant communication across a variety of channels (forums, socials, blogs, webinars, etc.)

<b>Degree of collaboration</b>	Little or no collaboration encouraged		Some collaboration		A significant amount of collaboration, and/or working in groups	
<b>Amount of reflection</b>	Little or no reflection encouraged		Some reflection encouraged		A significant amount of reflection encouraged throughout the course	
<b>Learning pathway</b>	No learning pathway provided		Some guidance provided, but a degree of student choice on the order of completing the materials and activities		A clearly articulated learning pathway is evident	
<b>Formal learning</b>	No link to formal learning		There is the option to link the course to a formal learning opportunity		The course is an integral part of a formal learning opportunity	
<b>Learner autonomy Use</b>	No learner autonomy		Some level of learner autonomy, for example in terms of choice of which materials and activities to complete in which order		Significant learner autonomy, with the opportunity for learners to personalize their courses and create their PLE	

**Table 7: Components of Quantitative Peer-Review Analysis Questionnaire**

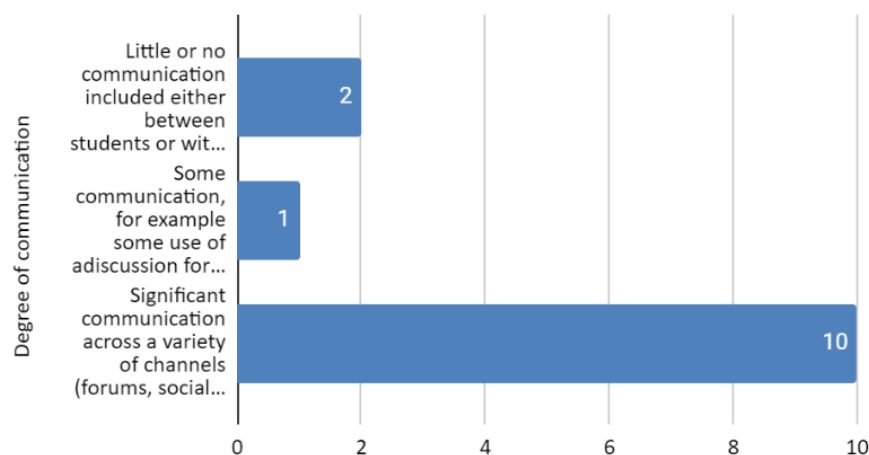
The results are generally positive. However, as has already anticipated, while the use of multimedia and communication in online courses is taken for granted, some cases would take advantage of increasing the degree of multimedia use and communication (Figures 1 and 2).

### Use of multimedia



**Figure 1: Peer-review: Use of multimedia**

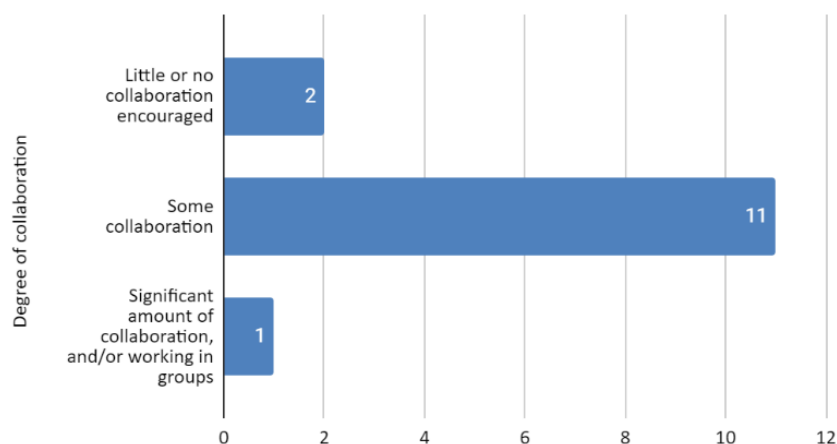
### Degree of communication



**Figure 2: Peer-review: Degree of Communication**

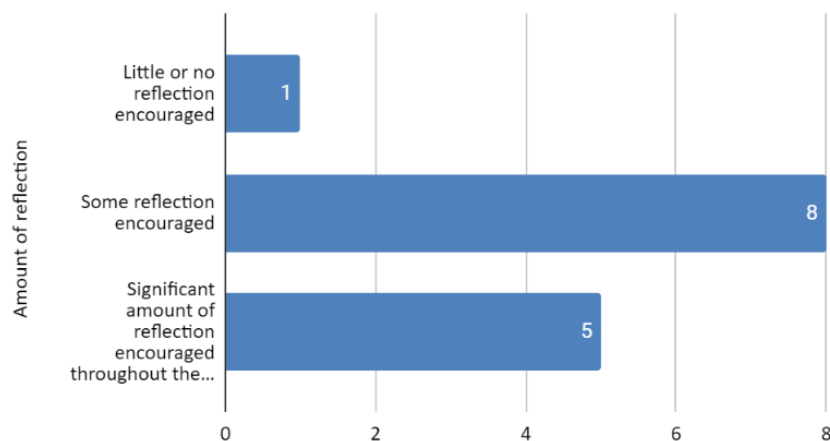
The basic structure of a MOOC is then in place, while the most advanced pedagogy based on collaboration, reflection and giving the sense of direction with a strategy to scaffolding the course needs to be developed and used more (Figures 3, 4, and 5).

### Degree of collaboration



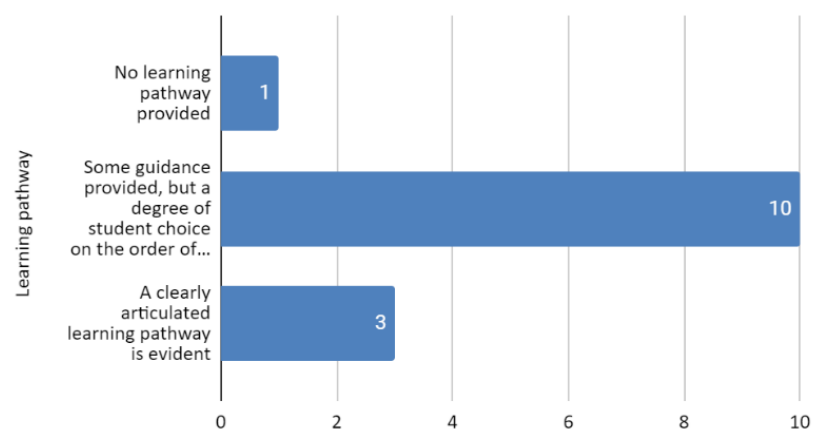
**Figure 3: Peer-review: Degree of collaboration**

### Amount of reflection



**Figure 4: Peer-review: the amount of reflection**

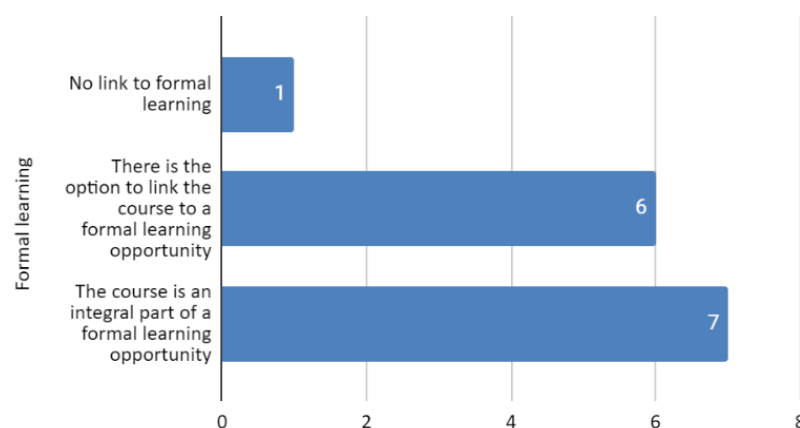
### Learning pathway



**Figure 5: Peer-review: Learning pathway**

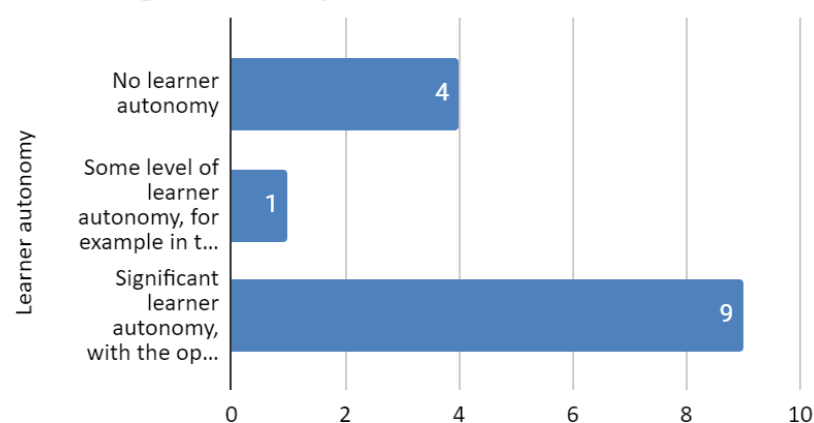
Finally, to comment fig. 6, 7, and 8, courses have been projected keeping in mind a learner with a greater degree of autonomy, needing only some instructional design and guidance but able to find out his way. However, these were also designed to become mostly an integral part of formal learning or to be linked to a formal course, thus revealing a projective behaviour according to ASSET's value proposition.

### Formal learning



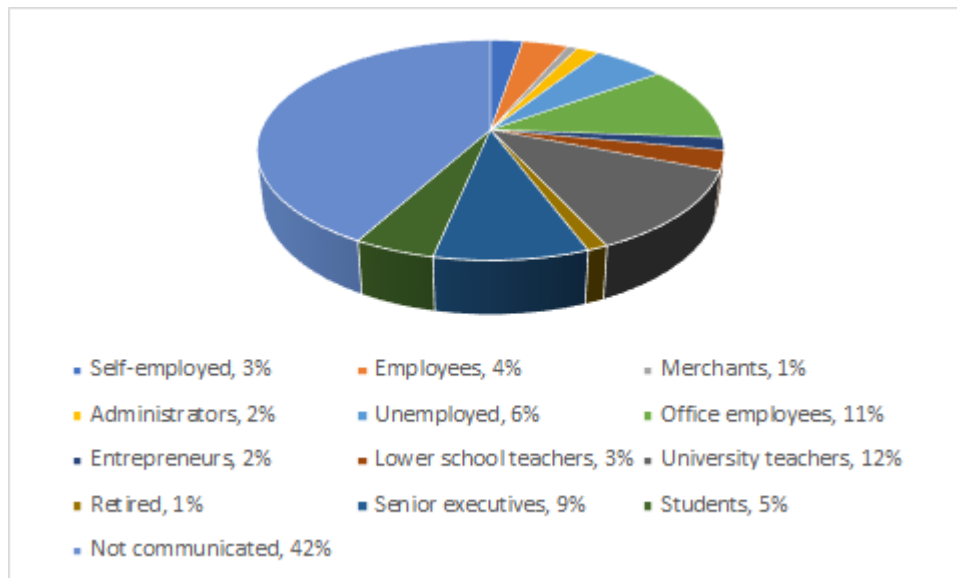
**Figure 6: Peer-review: Formal Learning**

### Learning autonomy



**Figure 7: Peer-review: Learner Autonomy Use**





**Figure 8: MOOC users by professions**

### 3. Educational Offer Level Assessment

The ASSET educational offer during the Pilot phase has recruited 823 students enrolled in MOOCs offered through the EMMA platform. Of these, 7,8% followed the course but only 5,36% of them have got a certificate, reaching the completion rate. The figure does not include the non-MOOC format (i.e. webinars, class-based and blended course) which are counted separately.

These results are not exciting, but they were somehow expected. During the first Covid-19 period, an enormous offer of online teaching came out from several educational and cultural institutions as well as from platforms such as Edx and Coursera offering free certificates for all. We have seen an increase in online academic courses and a wide offer of webinars in the field of Energy Transition and Sustainable Development held by newspapers, associations, research institutions, and public agencies. Therefore, we faced some sort of saturation phenomenon.

The impact of Covid-19 had an impact also on the availability of learners, mainly from university, to spend almost the whole day online in their university teaching. In other words, when all forms of education became digital, the ASSET online offer partially lost its attractiveness. This is testified by webinars organized by partners as the integration of their academic offer. This shorter format was a successful one. As an example, UNINA organized a set of three open webinars involving different partners, external experts, and professionals, and promoted as a Facebook event reaching an average number of 180 participants, with hits of 220. While the University of Aachen, Germany (RWTH) piloted a class-based blended course with 22 participants. Various findings and results from various assessment strategies are presented in the following sessions.

#### 3.1. Learning Analytics for MOOCs

The EMMA platform incorporates comprehensive user tracking tools, designed to record user actions on the platform. The analytics aims to trace the way learning resources are used and the engagement patterns that can be identified based on interactions in the system. In total, 823 students registered for ASSET courses. The data collected shows that users who have not gone beyond registration are the vast majority. These students probably enrolled believing they could get a certificate effortlessly and when they realized they had to take the tests they decided not to continue. The quantitative data on learners who have gone beyond just registration are encouraging. While 59% of them did not complete 80% of the followed course, on the other hand, many people completed 100% of the courses showing interest and involvement. Obviously, **41% of the students obtained the certificate**.

About the employment of the users, the subscription form gave us some relevant information. Excluding the users who have not disclosed their employment but that - probably- are students, the vast majority of users are university teachers, office employees, and executives who represent 32% of users. The students who declared their activity are 5% and self-employed is 3% while the rest of the categories are residual. A particularly interesting data is related to the unemployed who represent 6% of users. This is a very important target for the ASSET project which has as own objective the diffusion of new skills too.

##### 3.1.1. Feedback Loop

A feedback was provided to MOOC offering teachers in the form a PowerPoint presentation with the most relevant data concerning their course to let them know the pattern of use. In case, if the analytics show that there is a need to offer more support to learners, corrective actions were taken accordingly. Learning analytics, in other words, are offered to create a feedback loop. Following is the case of one of the most popular MOOCs<sup>1</sup>.

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<sup>1</sup> For this MOOC, analytics of video visualization are not available because UPV used its own channel for video lessons.

### 3.1.2. A case for feedback loop: Hydrogen as Energy Vector

The data came from the Google analytics and EMMA platform and were collected from June 3 to August 26, 2020. In the first section of the PowerPoint, are the data from Google Analytics concerning the visitors and the views. The MOOC has been visited 525 times: 54, 29% are Returning Visitors against 45,71 % of New Visitors as shown in Figure 9.

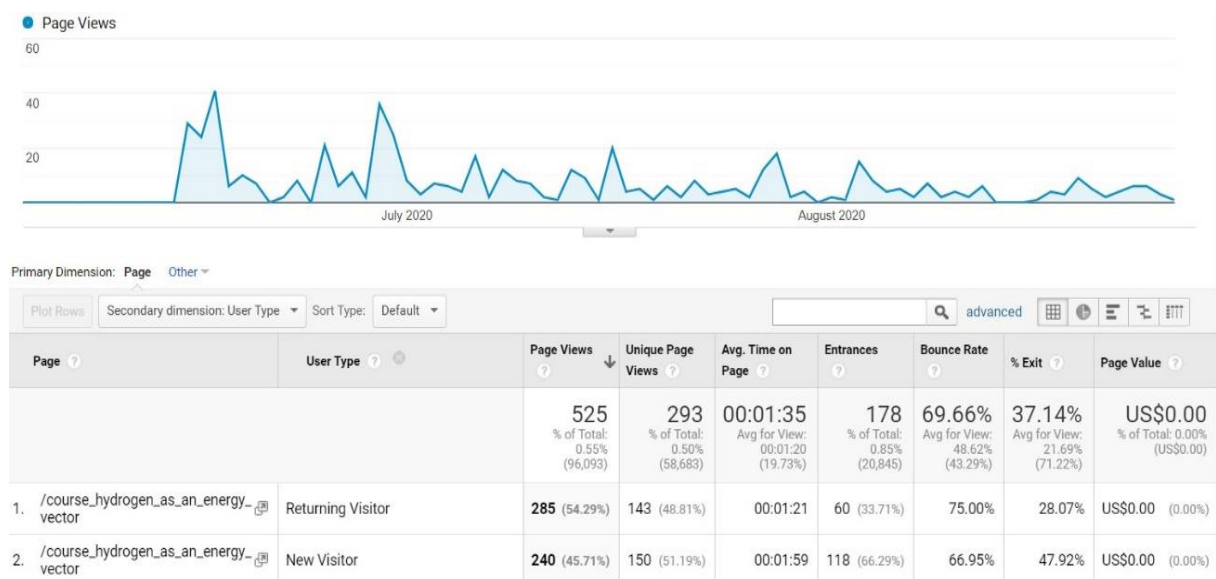


Figure 9: Pageviews and number of visitors from Google Analytics

The MOOC received visits from several countries, mainly from Europe: 32,38% from Spain, 10,29% from the United Kingdom, and 7,81 % from Italy. Visits came mainly from Europe (63,81%), but also the Americas (19,81) and Asia (10,48). Figures 10 to 12 concerns course users, views, and average time spent by unique visitors on the course page. The course's introduction had 426 unique visitors, which visited the page 1719 times (page views). MOOCs attract lots of interest, but the number of students decreased. Of course, data have a descending trend also because - after the introduction - only enrolled people can have access the lessons.











Paese	Visualizzazioni di pagina	Visualizzazioni di pagina
	525 % del totale: 0,55% (96.093)	525 % del totale: 0,55% (96.093)
1.  Spain	170	32,38%
2.  United Kingdom	54	10,29%
3.  Italy	41	7,81%
4.  United States	34	6,48%
5.  India	32	6,10%
6.  Colombia	28	5,33%
7.  Australia	25	4,76%
8.  Canada	20	3,81%
9.  Portugal	11	2,10%
10.  Chile	10	1,90%

Figure 10: Countries reaching the course page. Google Analytics

Continente	Visualizzazioni di pagina	Visualizzazioni di pagina
	525 % del totale: 0,55% (96.093)	525 % del totale: 0,55% (96.093)
1. Europe	335	63,81%
2. Americas	104	19,81%
3. Asia	55	10,48%
4. Oceania	26	4,95%
5. Africa	5	0,95%

Figure 11: Course page visits per geographical area. Google Analytics

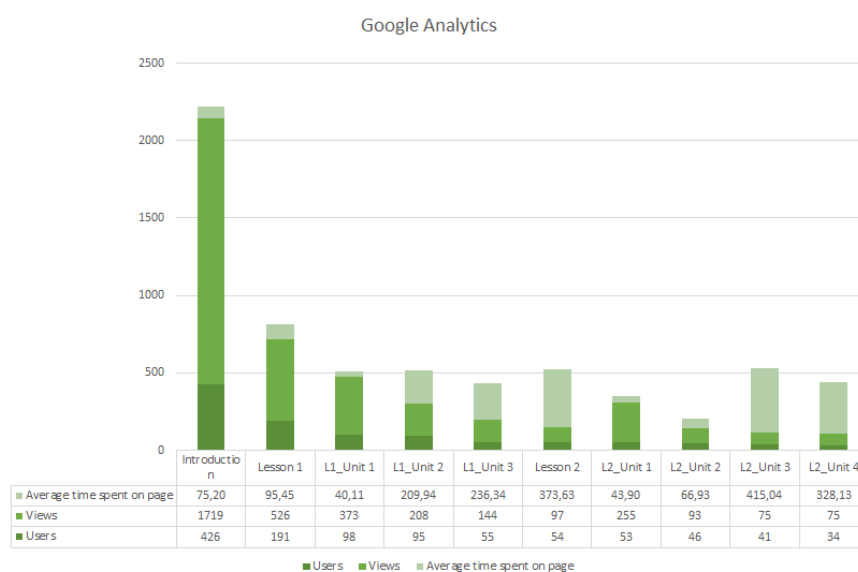


Figure 12: Number of views per course page. Google Analytics

In the second section are the data from the EMMA platform and for Hydrogen as Energy Vector. 121 learners enrolled in the course, but few un-enrols can be registered during the course lifetime (Figures 13, 14).

## Hydrogen as Energy Vector

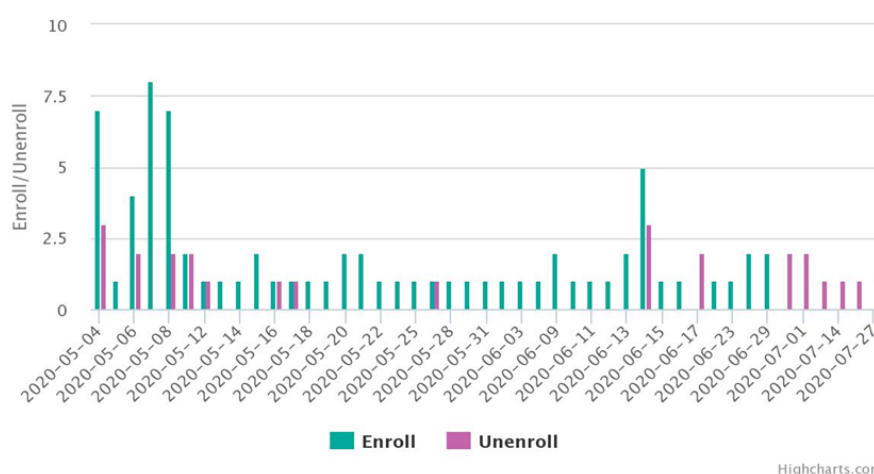
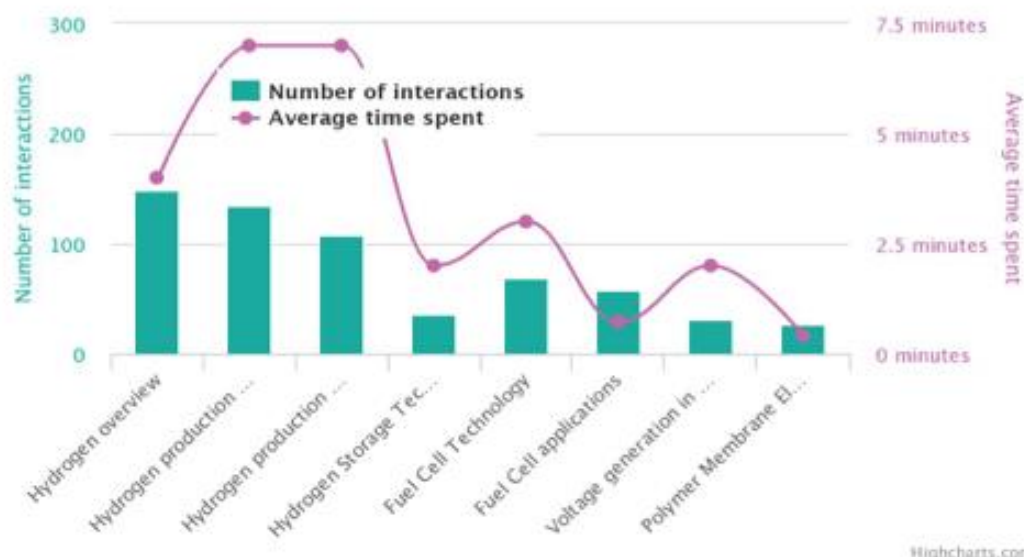
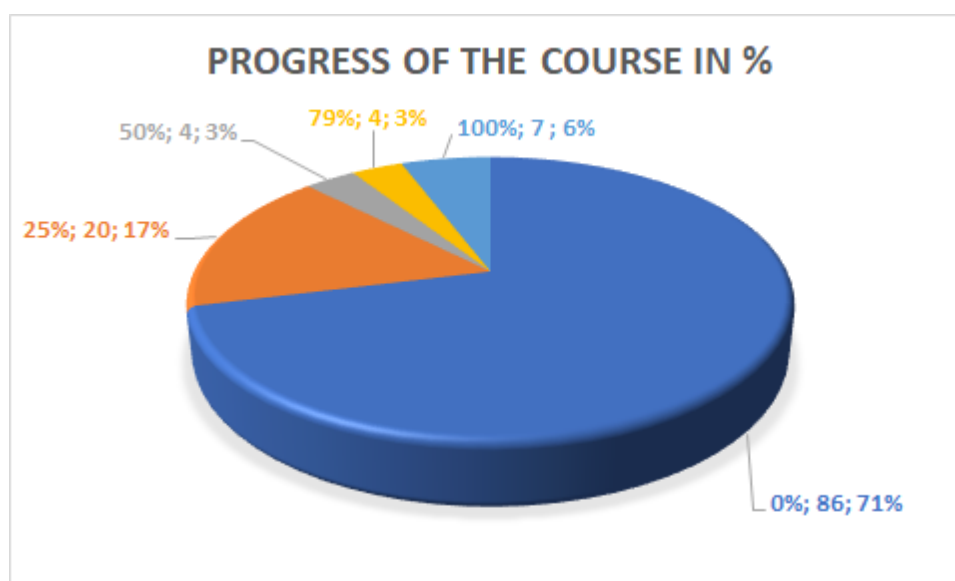


Figure 13: Number of enrolled persons into course. EMMA Learning Analytics



**Figure 14: Number of interaction and Average time spent from EMMA platform**

In Figure 15 are the data of the number of interactions and the average time spent. The MOOC started quite well, but the number of interactions had a descending trend after the third lesson. In the second chart (fig. 15), the course progress in percentage is reported: 86 students on 121 enrolled did not attend the course. This happens quite often in MOOCs, but teachers can still try to engage students by offering thoughts, personal messages, etc. or using EMMA's interactive features.



**Figure 15: Progress of the course in % from EMMA platform**

### 3.2. Google Analytics for MOOCs

From 1<sup>st</sup> of April to 1<sup>st</sup> of October, 7128 unique visitors visited the online ASSET offer, with over 23953 pages visited, and an average time spent on the page of 01:44 minutes. Excluding the partner-countries from Europe, users came mainly from the US, India, Brazil, Canada, Australia, Mexico, Russia, the Philippines, and Pakistan (Figure. 16). The ASSET offer on the EMMA platform objectively had worldwide visibility.

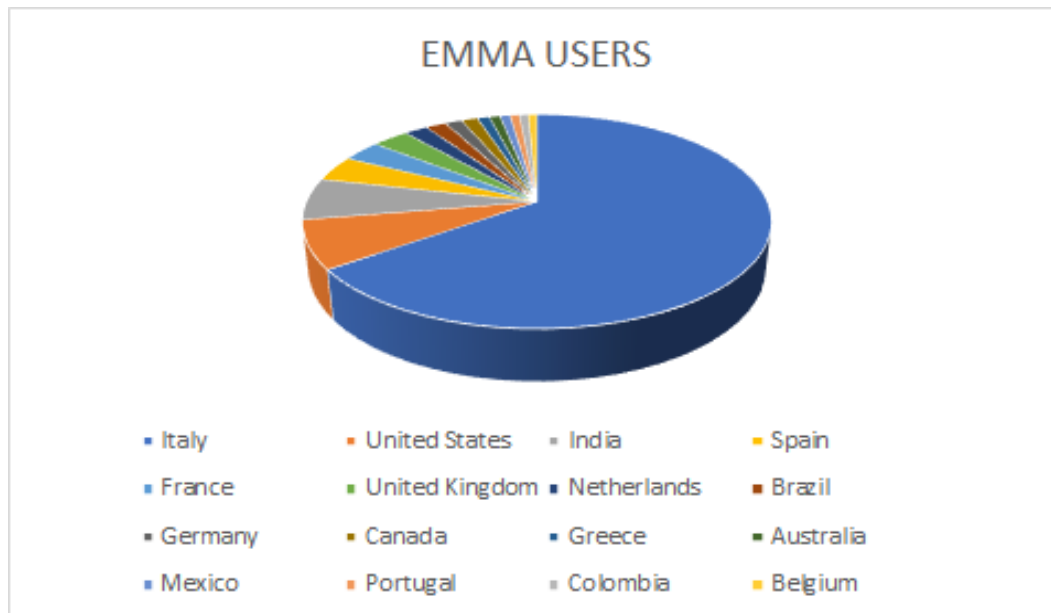


Figure 16: EMMA users per country

### 3.3. Learner expectations and evaluation for MOOCs

From a constituency perspective, all learners enrolled in a MOOC, and those that decided not to complete the whole path proposed by an ASSET MOOC, are invited to express their expectation, their opinions on the program, as well as on MOOC quality and platform usage. The questionnaires propose questions with a multiple choice of pre-coded reasons but answering was not compulsory. For this reason, the answer rate is quite low. A specific tool has been set for face-to-face course where – mainly due to the teacher presence – the answer rate is definitively higher. The questionnaires set are in D2.4 [2], while in this document; the most relevant results are reported.

#### 3.3.1. User profile

Students enrolled in an ASSET MOOC because they have been invited or informed by university teachers (66%) or solicited by social media campaign (11%). Among the whole cohort of subscribers (823), 86 persons responded to the registration questionnaire. The 54,6% of them are (not surprisingly) male and 45,3% female. Interesting is the distribution per age showing that the most numerous group (29,07) falls in the age class (25-34), but 27,9 are equally distributed in age-class 15-24 and 45-64, while the less numerous (15,12) falls in the class 35-44. These data show a specific interest in young generations according to their educational path and in elder people according to their employment needs. In fact, 50% have already a university degree while 24,4%, are still students, the remaining have a diploma (11,6), a master's degree (4,6), or a Ph.D. (9,30). The job position of respondents is quite consistent with the ASSET target groups, as you can see: they identify themselves in two main groups, one of Research & Education (52,5) and that of Companies from the energy sector (17,5), while a group of individuals not identifiable with a specific cluster counts about 18,7%. Energy citizens, policy bodies as well as societal actors are very little represented, with 11,2 altogether. Again, this is not a surprise as the MOOCs for the citizens are not yet offered.

Obviously, the most represented category is one of the students (30,2), but teachers (10,47), and researchers (5,8), middle managers, and unemployed (4,6), office workers (13,9) and professionals (4,6) are represented as well, as shown in Figure 17. They have a specific interest in renewable energy (66,2) and sustainability (52,5), in climate change and energy efficiency (42,5), and environmental aspects (48,7), while the 33,7% are interested in social aspects of the energy transition as shown in Figure 18.

## Job Position

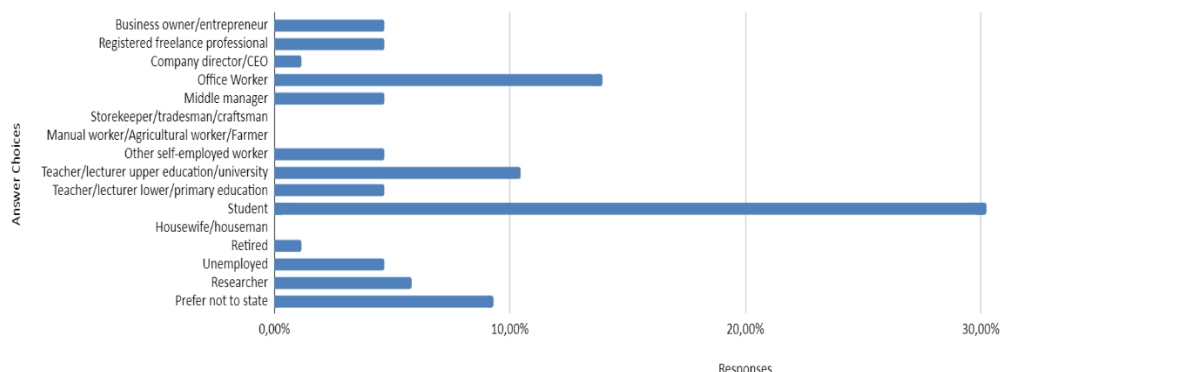


Figure 17: Survey respondents by job position

## Which are your specific fields of interest related to the energy transition process

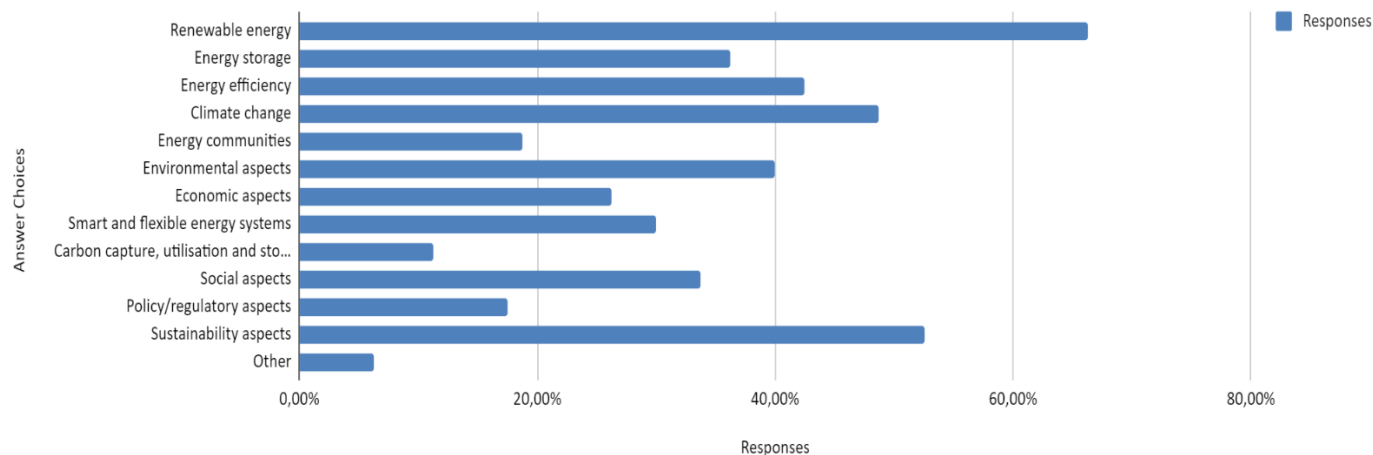
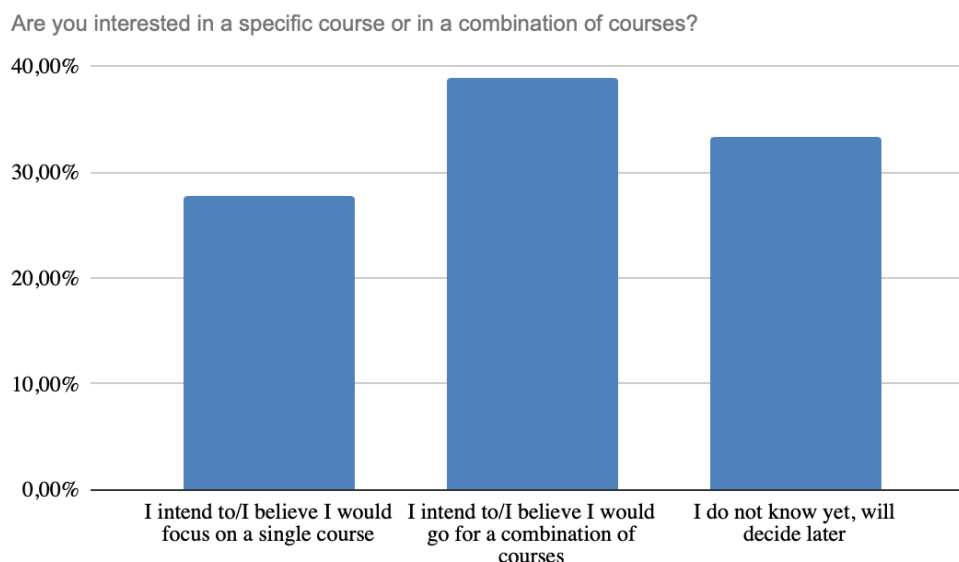


Figure 18: Fields of Interest. Questions with multiple answer options

## 3.3.2. User's expectation

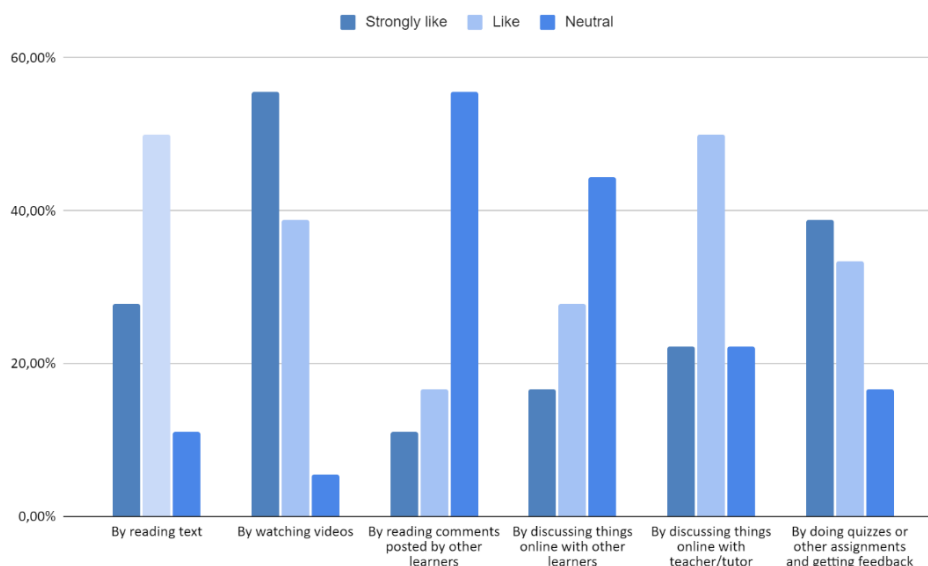
During the lessons of all the ASSET MOOCs, enrolled learners were invited to answer to a second questionnaire in order to detect their expectations. Due to the Covid-19 restriction, most students followed the course from home (94,4%), while only some from the university (27.8%) or workplace. The focus on used devices shown that for the world of online training, the mobile phone represents a residual, albeit growing, technology, leaving the primacy to the laptop (72,2%).

The answer rate, however, is quite low since answering was not compulsory (18 questionnaires filled correctly). Surprisingly, 50% of this small cohort was new to MOOCs and its pedagogical format, while the remaining part was satisfied with their previous experience. The reason why the learners have enrolled in an ASSET MOOC was, for the 27,9%, to get an idea or a first knowledge (5,56) in energy transition and to gain advanced knowledge in the topic, the remaining part was interested in the MOOC format in itself (11%), and to acquire a certificate or new skills (11%). For this reason, most of them are looking for a combination of MOOCs as shown in Figure 19.



**Figure 19: Are you interested in a specific course or in a combination of courses?**

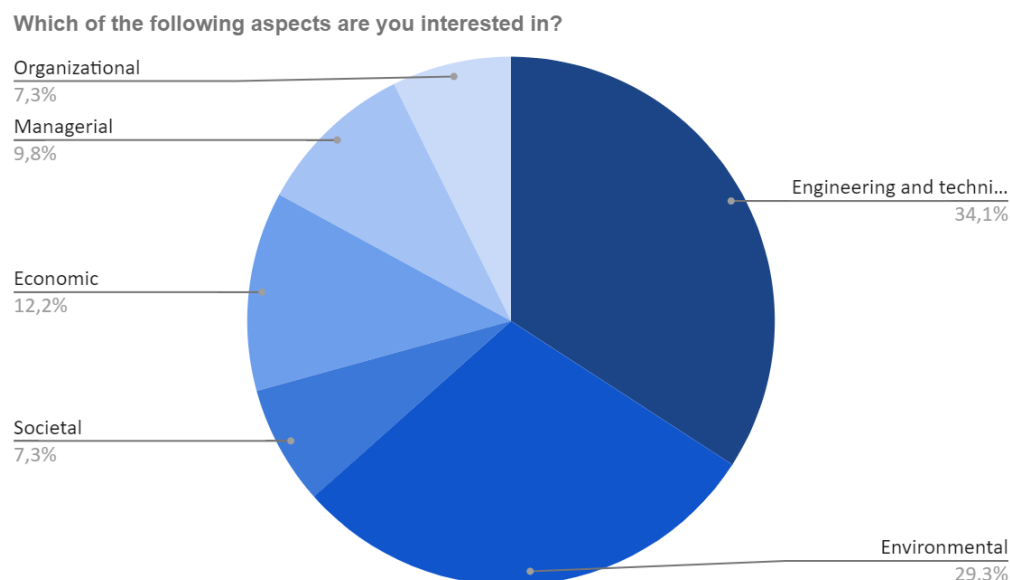
Indeed, they seem to prefer a hybrid approach where traditional and innovative modes of learning are considered, keeping central the teacher role. In fact, in Figure 20 to the question of how they would like to learn on Energy Transition the rate of the agreement becomes lower when peer discussions and comments are concerned. Respondents expressed a preference for learning the basics of the energy transition just as if the courses were face-to-face courses, filling out quizzes, and receiving feedback from teachers. In this respect, they seem to be focused more on the topic as a learning objective to reach also because they have a full-time temporary job in the field.



**Figure 20: How you would like to learn on Energy Transition?**

In most cases, users had interests in engineering and technical, as well as, environmental aspects of the energy transition. Societal aspects are actually less preferred coming after economic, managerial, and organizational ones. Accordingly, 41% of respondents come from the engineering, manufacturing, and construction sector, in many cases they work as shown in Figure 21. For the sake of clarity, since the sample is very small these results are quite questionable. Hopefully, in the second run of MOOCs, more answers will be added.



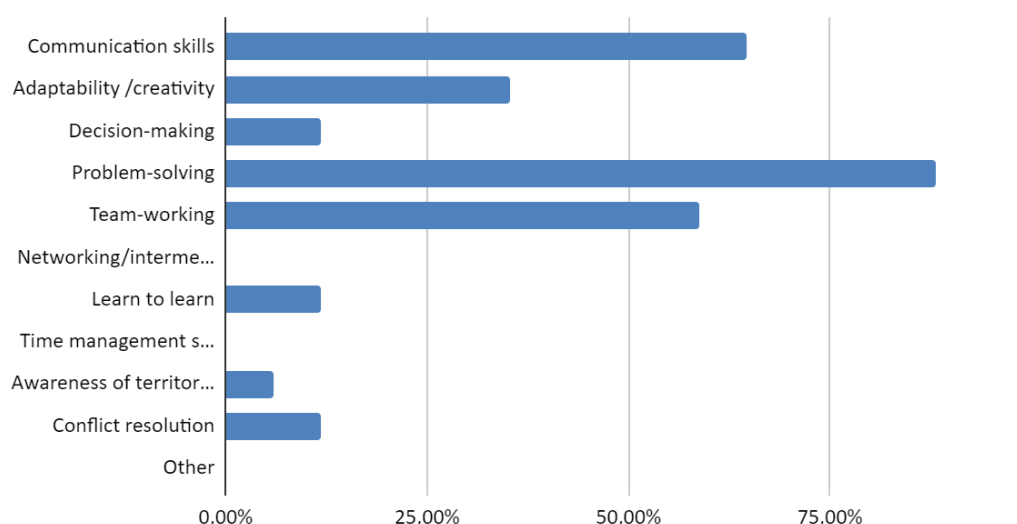


**Figure 21: Which of the following aspects are you interested in?**

Considering the sector in which learners are directly involved (public administrations, a private company, trade union, etc.), they expect to acquire first of all a certification, but also language, management, and digital skills, but also logistics seem to have some preferences. In fact, they consider their knowledge in the field 'Neither high nor low' (52.9%) against the 6% who consider themselves quite experts as shown in Figure 22.

About what concerns the world of soft skills they seem to have a clear idea, in fact, they have chosen problem-solving as first choice, communication, and team-working. Some creativity and adaptability to contexts requiring a resilience approach are also appreciated.

Considering the sector in which you are directly involved (public administrations, a private company, trade union, etc.), what soft ski...



**Figure 22: Soft skills expected to acquire**

### 3.4. Learners expectation and evaluation for face-to-face courses

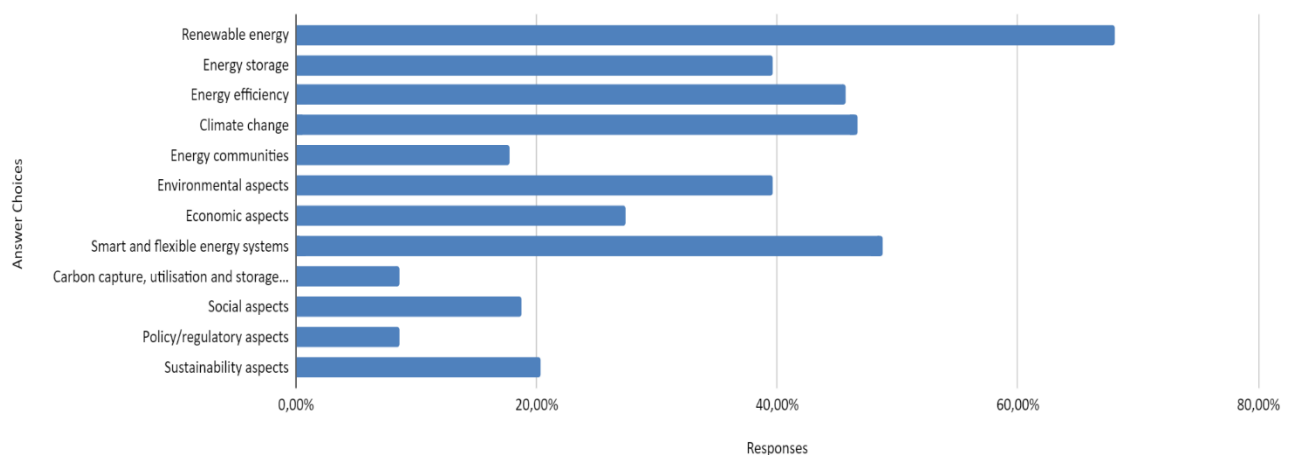
Students who followed the class-based courses (mainly in engineering or computer science) or a set of webinars offered by the ASSET project compiled the questionnaire on face-to-face courses. The total number of respondents has been 197 but, for the completeness of the answers, it was chosen to take into analysis 176 questionnaires. Regarding gender, the sample under examination showed a clear prevalence of men (69.54%). This data seems to clearly demonstrate that the areas related to education in engineering are still preferred by male students. Over 95% of the interviewees are aged between 15 and 34 years. Obviously young people are generally more predisposed to increasing their skills.

Users from Mediterranean countries filled almost all the questionnaires. 81.22% in Greece, 14.21 in Italy, only 3.5% in Germany. The questionnaires filled in by users from other countries are a residual share and have low statistical significance. Obviously, the figure is strongly affected by the ability of the ASSET partners to distribute the questionnaire during the face-to-face lessons.

Regarding the education level, the questionnaire highlighted a clear majority of graduates (82.74%) while only a minority has a master's degree (14.21%) or a Ph.D. (3.05%). The data seem to show a greater predisposition to follow ASSET courses among those who have not yet greatly increased their skills. Furthermore, it is evident that the partners of the ASSET project are mostly universities and therefore graduates were a privileged target.

Data shows also those specific fields of the energy transition considered most interesting. For the users of the ASSET courses, they were renewable energy, energy storage, energy efficiency, climate change, smart and flexible energy systems as shown in Figure 23. Aspects linked to the energy communities and the social aspects of the energy transition do not yet arouse the deserved interest. This could represent a risk affecting the transition in the long-term period.

Specific fields of interest related to the energy transition

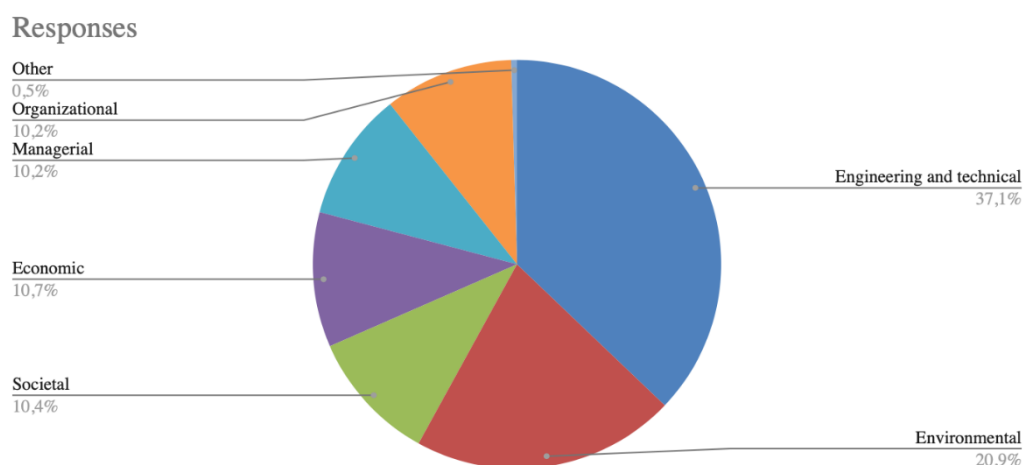


**Figure 23: Specific field of interest related to energy transition process**

Respondents would like to learn on Energy Transition preferably by watching the video and by discussing it with the teacher and tutor. The least appreciated didactic tool seems to be reading learners' comments or doing assignments. The data were collected using the Likert scale (-2, -1, 0, +1, +2), and the results obtained are in the following Table 8.

How you would like to learn on Energy Transition					
	Strongly dislike	Dislike	Neutral	Like	Strongly like
By reading text	3,55%	7,61%	41,12%	35,53%	12,18%
By watching videos	0,51%	2,54%	10,66%	38,58%	47,72%
By reading comments posted by other learners	3,55%	14,21%	42,64%	31,47%	8,12%
By discussing things online with other learners	0,51%	9,64%	31,98%	40,61%	17,26%
By discussing things online with teacher/tutor	0,51%	2,03%	16,24%	46,70%	34,52%
By doing quizzes or other assignments and getting feedback	1,52%	7,61%	23,86%	43,65%	23,35%

**Table 8: How you would like to learn on Energy Transition**



**Figure 24: Aspects of interests**

Figure. 24 highlights how engineering and technical as well as environmental aspects are those mainly associated with the energy transition. The other spheres seem to be residual. However, in this graph societal aspects are higher, this is mainly due to the presence of social sciences course students in our sample. They have been actively involved in the ASSET project.

What has just been said seems to be confirmed by the answers to the question "Which of the following ASSET Courses would be interesting for you?" In fact, the most "interesting" courses were once again those relating to technical and engineering issues (Figure 25). A holistic vision of the energy transition is something necessary but also to be built in the common understanding.

These students consider their own knowledge into the field 'neither high nor low' (53,2) and 'fairly low' (22,5) against 19,6% which consider it 'fairly high' or 'extremely high' (2,9). Of course, this explains why they are really focused on their learning objective directly linked to their master's degree of Ph.D. courses as shown in Table 9.

Which of the following course would be interesting for you to follow?

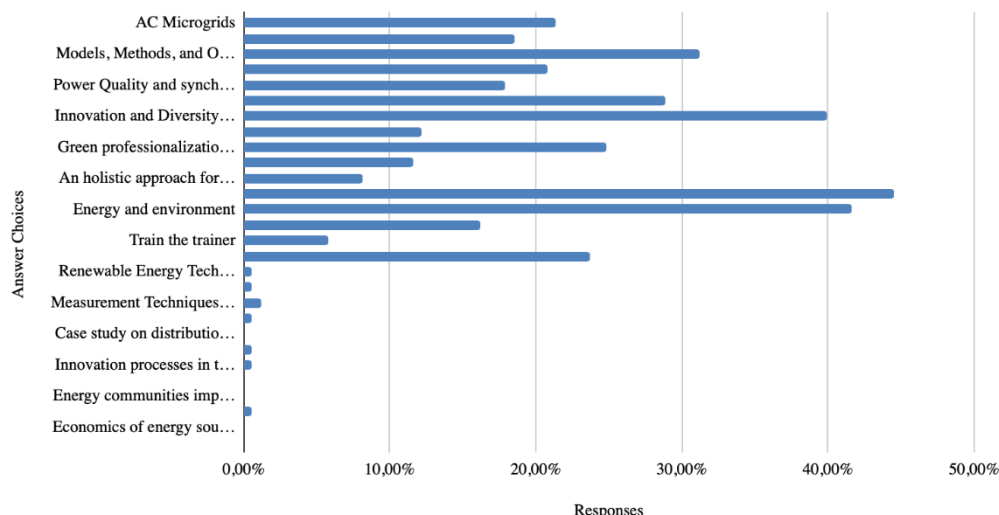


Figure 25: Users interest in Energy transition courses

	Extremely high	Fairly high	Neither high nor low	Fairly low	Extremely low	Total
1	2,89%	19,65%	53,18%	22,54%	1,73%	100% 173

Table 9: How would you consider your knowledge in the Energy Transition field?

The Likert Scale was also used to measure some specific characteristics of courses followed by students in the face-to-face mode as shown in Table 10, so to have a broad evaluation of the face to face offer. The results are quite encouraging, as it is possible to see in the following table. Courses are considered engaging, comprehensive, multidisciplinary, flexible, useful, integrative, and preparing for in-depth education. However, they seem to be not exhaustive compared to the student's expectations.

	Completely agree	Fairly agree	Neither agree nor disagree	Disagree	Fairly disagree	Completely disagree
It's engaging	22.54%	52.60%	19.08%	4.05%	1.16%	0.58%
It's comprehensive	18.50%	45.09%	30.64%	3.47%	1.73%	0.58%
It's exhaustive	6.36%	15.61%	31.21%	20.81%	13.87%	12.14%
It offers a multidisciplinary perspective	21.39%	46.24%	24.28%	6.36%	1.16%	0.58%
It offers flexibility in learning paths	23.70%	49.13%	20.81%	4.05%	1.73%	0.58%
It's innovative	29.48%	41.62%	20.81%	4.62%	2.89%	0.58%
It's useful	38.15%	48.55%	8.67%	2.31%	1.16%	1.16%
It's complementary to acquired knowledge	19.65%	50.29%	24.86%	2.31%	1.73%	1.16%
It's preparatory for an in-depth education	17.92%	49.13%	26.01%	4.62%	1.73%	0.58%

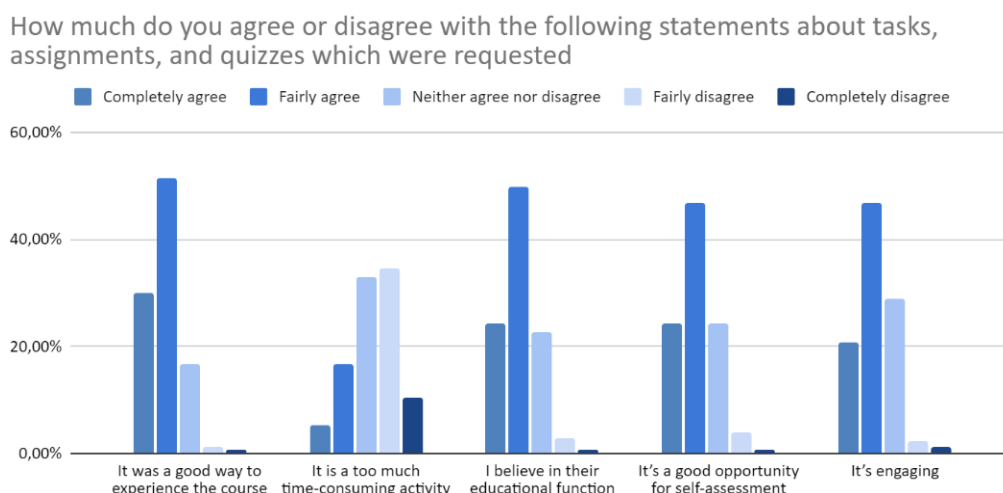
Table 10: How would you consider your knowledge in the Energy Transition field?

Question number 13 is a series of claims concerning the courses followed and the respondents had to agree or disagree with certain statements. **The 53,18% said they enjoyed the experience and 45.09% said the course was well organized.** Interesting, however, is that 46,24% of the respondents found the course "Truly formative" and 42,2% the courses helped them to complement their previous knowledge in the field.

During the lessons, to deepen the topics studied, students were provided with various teaching materials that the respondents judged updated (36,42%), of right quality (54,34%), and matching the expectations (53, 76%).

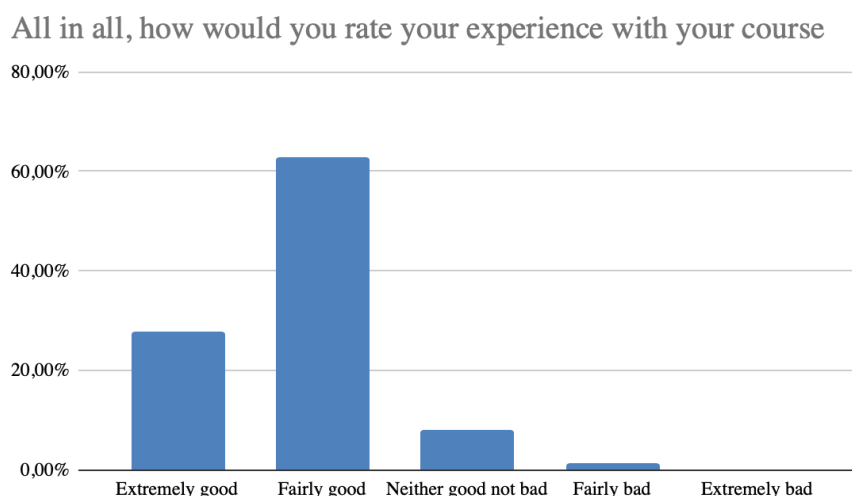
First of all, the number of tasks assigned is perceived just the right amount for the 75,72% of respondents. A series of statements on the function of quizzes and assignments were evaluated (adopting Likert Scale) as shown in Figure 26. In this case, the respondents agreed that it was a good way to experience the course (51.45%). They believe in their educational function (49.71%) and it's a good opportunity for self-assessment (46.82%) and engaging (46.82%).

The answers probably mean that the student feels the need to rework the knowledge acquired through quizzes and homework because they see their educational importance to be involved in the lesson. Also, these give the students the opportunity both to self-assess and to receive feedback from the teacher.



**Figure 26: Agree or disagree about tasks, assignments, and quizzes**

Finally, as we can see in Figure 27, the respondents assessed their experience with the program as fairly or extremely good. It emerges that the courses are of high quality according to their expectation.



**Figure 27: Feedback on the course experience**

Respondents were also asked which course of the ASSET offer they would like to follow, and it is possible to see some consistency with the demand made previously on the fields of interest. In fact, as you can see from the graph, the courses with the highest percentages are those concerning energy and the environment, the professions in the sector, and engineering innovations.

Since the ASSET project also offers MOOCs, it was useful to ask what the expectations for MOOCs on the energy transition were. From the answers, it emerges both a correlation with the previous question because the 25,16% answered to want courses more focused on technical issues. There is also a need to learn the basics of energy transition because 15,48% expect more introductory-level courses as shown in Figure 28.

To corroborate the positive assessment of the courses **is 66.45% who said they learned a lot during the courses and 55.48% said liked it, while 50,3% said they would propose it to a friend.**

From the general results emerges the evaluation of a positive experience with the courses both for quality and for materials, assignments, and it is clear that in particular the technical courses are highly appreciated.

Is there a course within the current ASSET program which you would like to enroll into, in the near future?

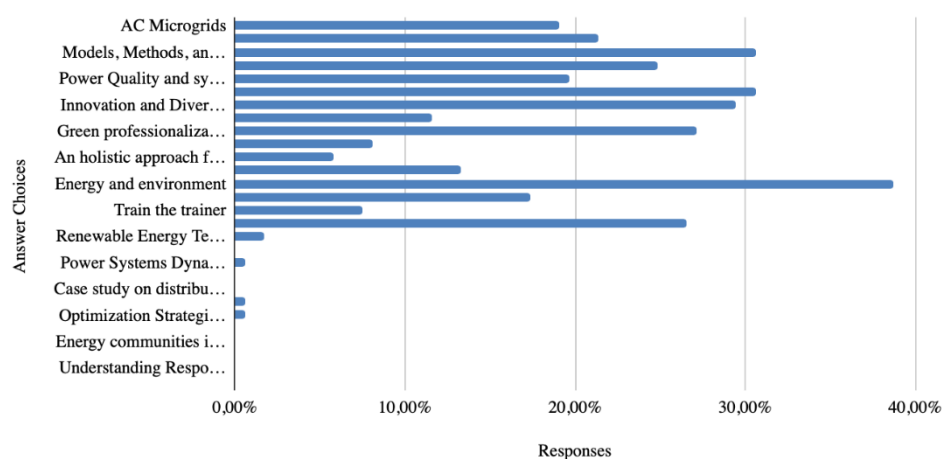


Figure 28: Courses to follow in the near future

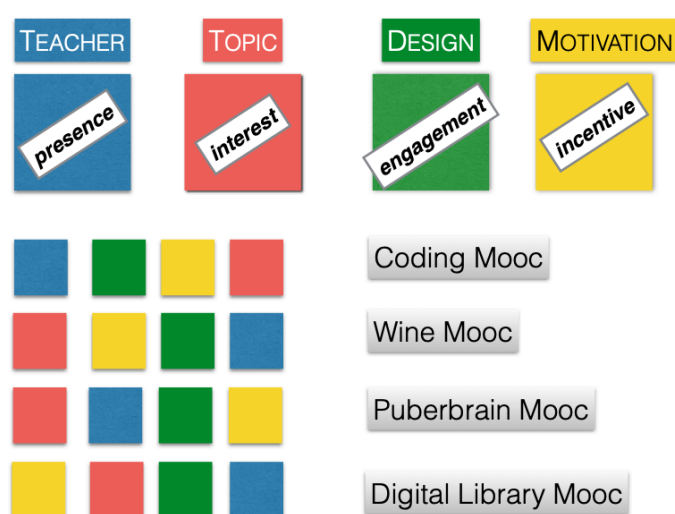
## 4. Recommendations for the second phase

The lessons learned from the first phase of delivery and piloting activities are further highlighted in this chapter to use them as a feedback loop for improving the delivery in the second phase and all the upcoming rounds of the delivery activities. As such, we focus here **on points to improve** considering that, the successful aspects have been highlighted in section 3. A set of recommendations is therefore laid to make sure that the weakness observed in the first round are largely avoided for the second phase, while all the positive aspects are further strengthened to enhance the effectiveness of the delivery. Since the platforms for the delivery of various modes of the programmes, e.g. class-based courses, Seminars, and MOOCs are different in their nature; a separate set of recommendations for each mode of delivery is also presented. The prevailing situation of COVID-19 largely affected the delivery of face-to-face courses and in most cases; courses have been delivered in a blended mode, using online mediums. Therefore, guidelines for effective engagement of class participants in online synchronous and asynchronous modes of delivery have been laid out to ensure an effective delivery even if that situation continues. The interdisciplinary and on-demand courses are not included in the first round of delivery; as they will be prepared during the second phase. The mixed-method approach consisting of both quantitative and qualitative assessment from self and peer reviews will be extended for interdisciplinary and on-demand courses and a guideline is outlined in the chapter. Moreover, the recommendations for the improved process of evaluation are also outlined for the effective assessment and validation of the ASSET education proposition.

### 4.1. Recommendations for MOOCs

The first phase of delivery has been completed and despite the reasonable enrolment, the completion rate is observed to be low as discussed in the above chapter. The interaction of students with the course platform and the total time spent on the platform with the material are the key analytics that allows monitoring and timely action for student engagement. Therefore, the instructors must regularly maintain an overview of EMMA analytics.

The pedagogy and success of MOOCs are not a standardized practice or specific formula but a combination of factors. The success factor is a TEACHING MIX (Figure 29) where all components are relevant, but the order of importance varies. Moreover, the EMMA platform accommodates a variety of instructional design. The appeal of any MOOC seems to depend as much on the topic, teacher engagement/presence, user motivation, and MOOC design.



These components should not to be considered as **enabling factors** (ie. to put in place at beginning of learning process), but as the main components of succeed Moocs (measured at the end of the learning process). In fact there are MOOCS starting on very interesting topics that after an initial hype decreased in numbers.

This means that we need to clearly distinguish the objectives from the effects, and that **there is not a unique recipe for success**.

Figure 29: Teaching Mix Model (De Rosa, Ferrari, Kerr 2017)

#### **4.1.1. MOOC Topic**

Obviously, the topic is a factor on which it is impossible to implement further actions. Once you have chosen a topic of interest, all you can do is measure its real appeal. However, do not forget to give your course a comprehensive and inspiring title, the same for lessons and units to highlight, since the very beginning, core concepts and objectives. Explain your topic but try to challenge your students offering food for thoughts, maps, infographics, questions to think about, or to discuss somewhere, both on the platform or in the social classroom. Try to add interactive features to your content if possible (using H5P technologies available on EMMA) or to diversify your material by introducing open educational resources (OER). Sometimes, be funny, creative, surprising.

#### **4.1.2. MOOC Design**

It's absolutely necessary to plan your MOOC's pedagogical side. It's like a blueprint for your course and the success of student learning depends on the correctly chosen instructional design. The MOOC should be relatively short, our experience suggests that longer MOOCs result in high dropout rates and low learner satisfaction. **Four to eight weeks** is the recommended length of a MOOC. The course must be clearly articulated in terms of anticipated learning hours per week. Some analysts say that a MOOC should have a clear and logical learning pathway and a structure which have core and extension activities. The content is the king, and it should be coherent and logically structured, with a clear beginning, middle, and end. All the materials must be accessible (variable fonts), all the links working. Keep text simple and to a minimum. Ensure that each week is organized in the same way so that it is easy for the participants to orient themselves and include transcripts for videos and audio to let students understand different accents or pronunciation.

#### **4.1.3. MOOC Teacher**

The questionnaires proposed during the ASSET courses confirmed some convictions gained through years of experience with EMMA. Teachers have a decisive role not only in the MOOC creation phase. The central role of teachers is precisely to be present during the course, engaging and involving learners, making calls to actions, asking them if there are any doubts or concerns. It is important to provide tutor support, try to focus on activities rather than content, and encourage reflective or dialogic learning. A suggestion is keeping participants motivated and on track by providing a weekly email update, summarizing the key points covered, and signposting to the following week's activities. You can use the blog feature in EMMA to stay in contact with your students. For any post, they will receive an email notification. Another way to be present as a teacher is by providing a discussion thread on the conversation tool to enable participants to introduce their experience of the subject to date. In the end, try to announce each lesson a week beforehand on social media and teacher blog and on Conversation of the lesson itself – "Coming next week".

#### **4.1.4. User Motivation**

The motivation of a learner to follow a course can depend on a topic or a series of actions that the teacher can implement. First, to motivate them learn to follow the courses it could be useful to adopt some incentives. Some of the incentives can be educational credits or use courses as exam material. It is important to connect the course to the social classroom. It can be a devoted page on Facebook, Twitter, Instagram, Wikies, etc. so that students can move themselves in a seamless environment where they can keep ongoing discussions generated in EMMA, involve more people, promote the course, etc. To motivate learners to follow the courses, but also to make the ASSET offer known, you could prepare a snappy, appealing phrase for each unit of every lesson in advance so they can be sent out on EMMA and other social networks or invite your students and colleagues to promote the course or publish the video-introduction of your MOOC on your social media pages as a form of course promotion.

For the second phase of delivery starting from the course promotion until the end of the course, the following key recommendations can also be observed for effective delivery.



- **Invite your students and colleagues to promote the course**

The success of the MOOCs mainly depends upon the engagement of the participants, their involvement with the course topics and instructor, as well as the seriousness of the purpose. The quality enrolment not only allows one to maintain their self-interest in the course but also effectively engages the instructors and peers through discussions, question-answer sessions, and feedback, thereby maintaining a balanced delivery environment. Therefore, it is highly recommended to invite your colleagues and university students to participate in the course.

- **Publish the video-introduction of your MOOC on your social media pages as a form of course promotion**

To attract the participants, social media platforms can be the key drivers and it can be a very good practice to promote the introductory videos on various social platforms including Facebook, Twitter, and other professional networking platforms, e.g. LinkedIn, etc.

- **Enter an invitation to follow ASSET's free educational offer on your department page**

The departmental page at the university's website, as well as various accounts and linked platforms can be effectively utilized for the promotion of the courses. ASSET's free educational offers and particularly the courses offered by the relevant department may be promoted using departmental newsletter and events calendar.

- **Invite professional associations or energy companies to take advantage of the free education opportunity**

Along with the university students, professionals and life-long learning (LLL) participants from professional associations or energy companies must be invited to create a diverse ecosystem conducive for learning.

- **Use your personal blog on EMMA**

The personal blog on EMMA can be used to send messages, to invite students to react to some concepts/stimuli/questions you asked during the lessons, to tell them something new about you.

- **Check out conversation tools**

The conversation tools available at EMMA must be checked out on the regular basis to answer questions or engage the students. These questions also act as a stimulus for learning to other course participants, thereby tends to enhance the overall learning experience.

- **Teacher Assistant**

Some of the students who have already taken the MOOCs in the first round of the delivery and are familiar with the MOOC flow, structure, and dynamics can be assigned as a teacher assistant. These teacher assistants can help involve other students so that they can support each other, and mutually learn from each other's experience.

## **4.2. Recommendations for class-based courses, short programmes, and Seminars**

The prevailing situation of Covid-19 majorly affected the dynamics of delivery for the class-based courses, short programmes, and seminars. Initially, most of them were planned either face-to-face or in some cases with a blended approach consisting of both face-to-face and online mediums. Due to the pandemic situation, however, most of them shifted to either completely online or blended mode of delivery, which allowed the instructor to realize the importance of online teaching, various tools, and platforms for feedback, engagement, and involvement strategies for effective delivery. Based on the experience of the instructors, from the feedback collected in the form of a questionnaire and its analysis, a set of recommendations are presented for a more fruitful delivery in the second phase of the ASSET project.

- **Emphasis on student-centred learning through engagement**

Effectively transform the conventional teacher-centred approach majorly adopted in the face-to-face mode of delivery into student-centred learning encouraging students to participate and create bottom-up knowledge. Therefore, for all the delivery activities of the second phase, an emphasis needs to be placed on the enhanced student engagement, various tools, and strategies for achieving this enhanced learning experience are also discussed in the subsequent points.

- **Flexibility in teaching**

Teaching activities can be flexibly managed in the blended mode of delivery, rather than using the fixed face-to-face class-based modalities, where teaching hours, classroom availability, and teacher availability are largely fixed, the blending mode allows flexibility in hours, availability, through both, synchronous and asynchronous teaching. Similarly, a co-teaching approach may also be adopted for a reinforced learning experience with multiple teachers of different expertise.

- **Flexibility in assessment**

Conventionally, summative assignments are used for assessment; however, a variety of assessment techniques may allow instructors to effectively evaluate the progress as well as the participation of the course. Formative assignments allow student engagement, and active participation in the class, therefore, is highly recommended for the class-based short programmes in the second phase of the delivery.

- **Online teaching tools**

The use of a variety of online teaching tools is highly recommended, given both instructors and participants are familiar and comfortable with the tools used. For instance, google forms, video annotating software, online pallets, etc. can be used for effective student engagement and active participation. The overall set of recommendations for online teaching and learning and key components of recommendations are further highlighted in Figure 30.

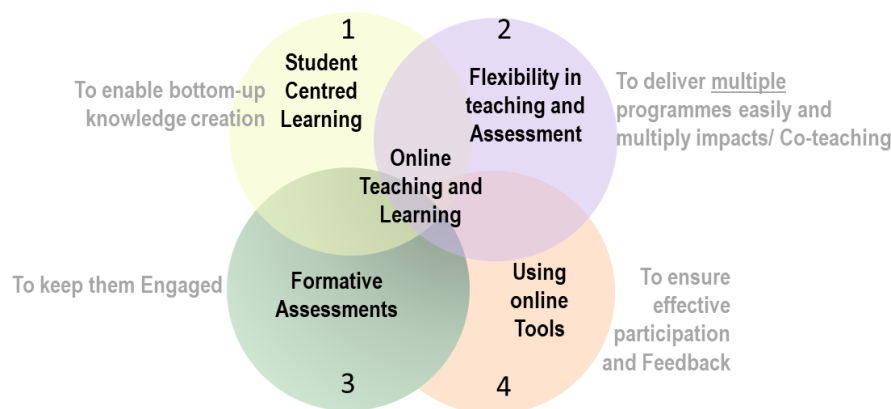


Figure 30: Recommendations for class-based courses, short programmes and seminars.

### 4.3. Evaluation of Interdisciplinary and on-demand courses

As discussed in chapter 2 of the deliverable a mixed-method employing qualitative and quantitative approach involving peer and self-assessment is used for the evaluation of MOOCs and class-based courses. In the second phase of the delivery, a similar approach needs to be extended for the evaluation of interdisciplinary courses. In both cases, self-assessment will be carried out by the programme-preparing instructor, while peer-assessment will be done by the university and industry participants inside and outside the consortium. Particularly, the on-demand courses need to be evaluated by the industry participants specifying the requirements or the on-demand courses. Therefore, peer evaluation will be extended to external industry partners for effective validation of the ASSET educational proposition.

#### 4.4. Assignments for self and peer review assessment

For the evaluation of the first round of the delivery activities, peer and self-assessment was carried out such that each instructor who prepares the course to evaluate the course content, conduciveness of the delivery platform, the usability of engagement tools, and delivery activities. Similarly, the instructors and partner institutes within the consortium having a similar set of expertise, and technical knowledge were assigned for the evaluation of similar feature, but from a neutral perspective. In the first round of the delivery, these assignments were made after the major portion of the course work had been delivered. This way peer-instructors were able to evaluate the content available on the repository and with the learning graph tool, and for MOOCs they were able to track the material and engagement on the EMMA platform. Though evaluation had been very effective and useful, however, the timely actions based on the feedback of peer evaluation are missing as peer instructors did not enrol in the courses during their delivery phase. To have more effective participation and evaluation from other peer instructors, they have been assigned peer-assessments from the start of the second round of the delivery. This allows peer instructors to follow a) the progress of the course in real-time, b) track the activities, and c) provide timely feedback for improvement. The assessment assignments for MOOCs and short programmes for the second round of the delivery are highlighted in Table 4.2 as shown below.

No.	Course Topic	Category	Offering Institute	Responsible for Self-Assessment	Responsible for Peer-Assessment
1	Power systems dynamics	Course	RWTH	Antonello Monti	AAU
2	Implementation of automation functions for monitoring and control	Course	RWTH	Ferdinanda Ponci	AAU
3	Case study on distribution grid operation	Course	RWTH	Ferdinanda Ponci	AAU
4	Multi-terminal DC grids	Course	RWTH	Ferdinanda Ponci	AAU
5	Power Quality in Microgrids	Course	AAU	Alexander Micallef	RWTH
6	AC Microgrids	Course	AAU	Juan C. Vasquez	RWTH
7	DC Microgrids	Course	AAU	Josep M. Guerrero	RWTH
8	Maritime Microgrids	Course	AAU	Josep M. Guerrero	RWTH
9	Optimization Strategies and Energy Management Systems	Course	AAU	Eleonora Riva Sanseverino	RWTH
10	Energy Efficient and Ecological Design of Products and Equipment	Course	UWA	Constantinos S. Psomopoulos	LS
11	Innovation processes in the smart energy sector	Seminar	OTEA	Katerina Dima	No Peer-review
12	Energy communities implementation in Industrial Parks	Seminar	UWA	Constantinos S. Psomopoulos	No Peer-review
13	Behavioural change as a powerful drive to minimize energy	Seminar	LS/ENEA	Antonio Disi / Rino Romani	No Peer-review

	consumption while providing the same level of energy service				
14	Economics of energy sources and the optimal integration of renewable energies and energy conservation measures	Seminar	LS	Walter Cariani	No Peer-review
15	Innovation and Diversity in Engineering	MOOC	RWTH	Antonello Monti	UWA
16	A holistic approach for Energy Transition: territory, networks, and sustainability	MOOC	UNINA	Anna Maria Zaccaria	UPV
17	Corporate Communication and Corporate Social Responsibility	MOOC	UNINA	Ivano Scotti	UWA
18	Electric heat pumps in the energy transition framework	MOOC	UNINA	Alfonso William Mauro	UPV
19	Energy and Environment	MOOC	UWA	Constantinos S. Psomopoulos	UNINA
20	Energy Efficient and Ecological Design of Products and Equipment	MOOC	UWA	Constantinos S. Psomopoulos	RWTH
21	Green professionalization and ethics	MOOC	UNINA	Dario Minervini	UWA
22	New Materials for solar cells applications	MOOC	UWA	Theodore Ganetsos	AAU
23	Train the Trainer	MOOC	OTEA	Nikos Agiotis	UNINA
24	Power Quality Challenges and Solutions for Microgrids	MOOC	AAU	Alexander Micallef	RWTH
25	An Introduction to AC Microgrids for Energy Control and Management	MOOC	AAU	Juan C. Vasquez	RWTH
26	An Introduction to DC Microgrids for Energy Control and Management	MOOC	AAU	Josep M. Guerrero	UPV
27	Maritime Microgrids- A Sustainable Solution for Green Sea Transportation	MOOC	AAU	Josep M. Guerrero	UWA
28	Optimization Strategies and Energy Management Systems	MOOC	AAU	Eleonora Riva Sanseverino	UWA
29	Challenges and solutions in Future Power Networks	MOOC	RWTH	Ferdinanda Ponci	UPV
30	Behavioural change as a powerful drive to minimize energy consumption while providing the same level of energy service	MOOC	LS/ENEA	Antonio Disi / Rino Romani	No Peer-review

**Table 11: Assignment for self and peer review assessment for the evaluation of the second phase of the delivery activities**

## 5. Conclusions

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This deliverable presents the outcomes for the evaluation of the ASSET educational programmes for the first phase of the delivery activities. The assessment strategy including different layers of evaluation and assessment criteria for each layer has been detailed in the deliverable. Different layers of evaluation mainly include individual, course level, and educational offer level assessments. Self-assessment and peer-assessment methods are applied for effective evaluation at all levels of preparation, piloting, and delivery. The assessment surveys are also used to analyse the satisfaction of instructors and participants with the quality of the delivery. The findings of the evaluation are presented for the validation of the ASSET educational proposition. These show that:

- ASSET offerings have been considered in principle good or extremely good.
- ASSET offerings have reached a large numbers of target groups also from extra-European countries.
- ASSET offering has reached high visibility in Italy and partner countries.
- ASSET teachers have been trained to a new pedagogical evidence-based method so to be able to better engage students in non-pilot phase.
- ASSET monitoring tools have been tested in real situation and their tuning is progressive.
- ASSET mission has been shared with Social Science students that have translated it in communication activities becoming energy activists.

Although in general, we consider the 1st piloting phase successful, we have defined in chapter 4 the points where we need to focus as well as recommendations to improve the delivery in the second phase of the delivery. The overall evaluation document serves as a baseline to collect feedback and refine ASSET educational offerings. Future offerings based on the recommendations laid out in this deliverable will contribute to the quality enhancement and sustainability of the ASSET educational offers.

## 6. References

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