STEAMigPOWER

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

2022-1-PT01-KA220-HED-000088221

## A8: Report on the best practices for delivering successful online STEAM courses

WP3: STEAMigPOWER Intensive Program

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## ABSTRACT

THE TARGET OF WP3 is mapping and clustering of strategies and methodologies for STEAM in Europe. Action 8 of this work package however, is related to the adaptation of the developed courses to the online format through exploring best practices for delivering successful online STEAM courses. With this report, it is aimed to evaluate the best practices for delivering online course so as to develop specialized guidelines to deliver the online courses for STEAMigPOWER. This report is about evaluating 25 best practices of the online STEAM courses throughout Europe. The data related to course contents and online features were collected through a rubric prepared by the authors. All the partners of the Project gathered the data on the rubric shared in the project google drive pages. The data was analyzed qualitatively. The results were presented as two parts as General Characteristics of the online course and "Best Practice Point". As a result, the best features of these online courses were evaluated as; a video for introducing the course; user ratings; video lectures synchronized with slides for an interactive learning experience; language alternatives; Integration of multimedia resources (videos, readings, and quizzes) and FAQ sessions.

# 1. INTRODUCTION

Considering the large number of migrants that the European Mediterranean countries are receiving, especially since the migration crisis in 2015, and strongly believing that HEIs should have a fundamental role and responsibility in their socioeconomic integration, the main idea of STEAMigPOWER is to equip migrants that the European Mediterranean countries are receiving, with appropriate tools and skills for a sustainable future. In line with this idea, the project targets to develop STEAMigPOWER Intensive Programs to be delivered migrants, refugees and asylum seekers, focusing on women and pupils in upper secondary school (15 – 18 years old).

So far, till the end of the year 2024, development and delivery of the 5-days on-site STEAMigPOWER Intensive Program (5 STEAM courses on Environment and Fight against Climate Change) were realized in all partner institutions. In line with the proposed program, delivery of the STEAMigPOWER Intensive Program Modules in online format will be realized at the beginning of the year 2025. Before delivering the online format of the Intensive Program Module, a report on best practices for delivering successful online STEAM courses (O1) will be prepared as defined as WP3 A8 in the proposal.

WP 3 of the Project is directly linked to the project's main objectives related to attract and integrate migrants, refugees and asylum seekers into the HE, so that they are able to acquire the necessary educational tools to enter the workforce and to develop knowledge, skills, and values that lead to continued wealth and prosperity for themselves and for the communities they will integrate. Therefore, as a result of WP3, it is targeted to have mapping and clustering of strategies and methodologies for STEAM in Europe, as wells as mapping and clustering of initiatives/courses directed to migrants, refugees and asylum seekers in European HEIs. This result is expected to provide current appraisal of the situation in STEAM courses and other HE activities especially directed to the migrants, refugees and asylum seekers who are arriving in Europe in the last years.

A8 of the WP3, on the other hand, is related to the adaptation of the developed courses to the online format through preparing a report on best practices for delivering successful online STEAM courses which will lead to specialized guidelines to deliver the online courses. This is linked with the main objective of delivering STEAMigPOWER Intensive Program Modules in online format, to be available at the VLE platform, aiming at reaching at least 500,000 migrants, refugees and asylum seekers.

> The goal of this report is mapping and clustering of best practices for delivering successful online STEAM courses

> Indicator: No of STEAM courses online analyzed (at least 25).

Therefore, this report is prepared to list and evaluate 25 best practices of the online STEAM courses throughout Europe for the purpose of;

- delivering successful online STEAM courses,
- delivering guidelines to create and deliver the online STEAM Intensive Program Modules, and
- upload the online modules in the STEAMigPOWER VLE platform.

# 2. METHODOLOGY

## 2.1 DATA COLLECTİON

The data was collected through a rubric prepared as presented below.

Table 1 - Rubric to collect data on online STEAM courses

| Course Title | |
|---|---|
| Course Link | |
| Language | |
| Web site characteristics (useful, informative, etc) | |
| Number of Course Hours | |
| Objective(s) | |
| Course Outline | |
| Syllabus | |
| Learning Outcomes | |
| Practical Activities (video, game, etc) | |
| Course Materials | |
| Visual materials | |
| Certificate of Attandance | |
| Best feature/s of the course website | |
| Remark | |
| Best Practice Point (1-10) | |
| Others | |

The steps followed for Data Collection process were as follows:

Each partner was asked to gather information related to the online implementations of 4 STEAM courses.

The titles of the 4 online STEAM best practices that the partners will propose are preferred to be the same with the one prepared by the partner before.

25 online courses were ready for evaluation at the end.

The table below shows the workload of each partner for gathering the information related to the online STEAM courses.

Table 2 - Work-plan for gathering Best Practices data

| COURSES | PARTNERS | NO of ONLINE STEAM COURSES to be analyzed |
|---|---|---|
| Climate Change | AUTh/Greece | 4 |
| Sustainable Development | UBFS/Spain | 4 |
| Eco Building Construction | UMinho/Portugal | 4 |
| 5 R's | UniPG/Italy | 4 |
| Sustainable, and Renewable Energy | METU/Turkey | 5 |
| Any from the topics above | SEAL/Cyprus | 4 |
| | | 25 |

## 2.2 DATA ANALYSIS

The data analysis was realized through 4 steps:

Table 3 - Data Analysis

| Steps | Description |
|---|---|
| 1st Step | A rubric prepared by METU |
| 2nd Step | Data Collection – ALL partners |
| 3rd Step | Content Analysis of the Data – METU |
| 4th Step | Mapping and Clusterization of the best practices based on the Content Analysis of the collected data -METU |

# 3. RESULTS

## 3.1 BEST PRACTICES FOR DELIVERING SUCCESSFUL ONLINE STEAM COURSES

All the partners of the Project gathered the data on the rubric shared in the project google drive pages. The courses and related links are presented below in Table 4.

Table 4 - Best practices for delivering successful online STEAM courses

| | Course Title | Course Link |
|---|---|---|
| 1 | Sustainability Engineering (Environmental Protection Engineering) | https://opencourses.auth.gr/courses/OCRS420/ |
| 2 | Environmental Policy, Sustainable Development | https://opencourses.auth.gr/courses/OCRS438/ |
| 3 | Environmental Policy, Sustainable Development | https://eclass.hua.gr/courses/GEO131/ |
| 4 | Climate Change Science & Negotiations | https://sdgacademy.org/course/climate-change-science-negotiations/ |
| 5 | The Age of Sustainable Development | https://sdgacademy.org/course/the-age-of-sustainable-development/ |
| 6 | Sustainable Development in the 21st Century | https://sdgacademy.org/course/sustainable-development-in-the-21st-century/ |
| 7 | Measuring Sustainable Development | https://www.edx.org/learn/sustainable-development/sdg-academy-measuring-sustainable-development |
| 8 | Sustainable Development - Ideas and Imaginaries | https://www.coursera.org/learn/sustainable-development-ideas-and-imaginaries |
| 9 | Sustainability and Climate Change | https://www.udemy.com/course/sustainability-and-climate-change/ |
| 10 | MITx: Sustainable Energy | https://www.edx.org/learn/sustainable-energy/massachusetts-in technology-sustainable-energy |
| 11 | HarvardX: Energy Within Environmental Constraints | https://www.edx.org/learn/environmental-science/harvard-university |
| 12 | Renewable Energy Specialization | https://www.coursera.org/specializations/renewable-energy |
| 13 | Beyond the Sustainable Development Goals (SDGs): Addressing Sustainability and Development | https://online.umich.edu/courses/beyond-the-sustainable-development-goals-addressing-sustainability-and-development/ |
| 14 | Exploring Renewable Energy Schemes | https://www.coursera.org/learn/exploring-renewable-energy |
| 15 | Online Digital Storytelling Workshop | https://www.storycenter.org/public-workshops/online-dsw |
| 16 | Powerful Tools for Teaching and Learning: Digital Storytelling | https://www.classcentral.com/course/digitalstorytelling-2170 |
| 17 | Eco Building Design | https://www.learndirect.com/course/eco-building-design |
| 18 | MITx: Sustainable Building Design | https://www.edx.org/learn/sustainable-development/massachusetts-institute-of-technology-sustainable-building-design |
| 19 | Sustainable Construction and Development | https://www.futurelearn.com/courses/sustainable-construction-development |
| 20 | Sustainable Design Practices in Building Design Specialization | https://www.coursera.org/specializations/sustainable-design-practices-in-building-design |

| | | |
|---|---|---|
| 21 | Chemical Technologies for Pollution Control | https://www.unipg.it/internazionale/ects/ |
| 22 | Didactics of chemistry | https://www.unipg.it/en/ects/ects-course |
| 23 | Environmental Chemistry | https://www.unipg.it/en/ects/ects-course |
| 24 | Environmental Pollution and Chemical Risk | https://www.unipg.it/internazionale/ects |
| 25 | Sustainable Energy: Design a Renewable Future | https://www.edx.org/learn/sustainable-energy/delft-university |

## 3.2 MAPPING AND CLUSTERS OF THE BEST PRACTICES

After analyzing all 25 rubrics related to the best practices for online STEAM courses, the following results were derived.

### 3.2.1. GENERAL CHARACTERISTICS OF THE WEB SITES FOR THE BEST PRACTICES FOR DELIVERING ONLINE COURSES

General characteristics of the 25 courses were identified through a content analysis of the 25 online STEAM courses (Table 5).

Table 5 - General Characteristics of the 25 online STEAM courses

| Item | Characteristic |
|---|---|
| Website | Informative<br>Well structured<br>User friendly<br>Pre-requisites recommended<br>bibliography<br>video lectures<br>presentation slides<br>course objectives<br>links to course materials<br>modular structure<br>online certificates |
| Number of Course Hours | YES |
| Objective(s) | YES |
| Course Outline | YES |
| Syllabus | YES |
| Learning Outcomes | YES |
| Practical Activities (video, game, etc) | RARE |
| Course Materials | YES |
| Visual materials | YES |
| Certificate of Attendance | YES |

### 3.2.2. BEST FEATUTES OF THE BEST PRACTICES FOR DELIVERING ONLINE COURSES

After exploring the general characteristics of the courses, the "Best Practice Point" given to each online course were listed with the reported "Best Features" (Table 6).

Table 6 - Best Practice Point and Best Features of the online STEAM Courses

| | Course Title | Best Practice Point | Best Features |
|---|---|---|---|

| | | | |
|---|---|---|---|
| 1 | Sustainability Engineering (Environmental PA. Protection Engineering) | 7 | • Comprehensive course outline with clear prerequisites.<br>• Links to further readings and related materials. |
| 2 | Environmental Policy, Sustainable Development | 7 | • Detailed course outline with keywords.<br>• Bibliography and recommended readings to deepen understanding. |
| 3 | Environmental Policy, Sustainable Development | 9 | • Video lectures synchronized with slides for an interactive learning experience.<br>• Clear and practical evaluation criteria, including hands-on exercises with real climate data. |
| 4 | Climate Change Science & Negotiations | 9 | • Comprehensive, self-paced structure accommodating diverse learners.<br>• Integration of multimedia resources (videos, readings, and quizzes). |
| 5 | The Age of Sustainable Development | 9 | • Accessibility: The course is self-paced.<br>• Informative design: Each course module is well-explained with clear instructions. |
| 6 | Sustainable Development in the 21st Century | 9 | Accessible structure, clear objectives, and free resources |
| 7 | Measuring Sustainable Development | 8 | • While the platform is comprehensive, adding live Q&A sessions or discussion forums could increase engagement.<br>• The course interface is really clear and friendly.<br>• The course allows to access to financial assistance |
| 8 | Sustainable Development - Ideas and Imaginaries | 9 | • Comprehensive structure with diverse learning formats (videos, readings, quizzes).<br>. Instructor insights and expert interviews<br>• Clear progression through the course schedule |
| 9 | Sustainability and Climate Change | 8 | • Ratings of the users<br>• A preview (video) describing course content. |
| 10 | MITx: Sustainable Energy | 9 | • Ratings of the users |
| 11 | HarvardX: Energy Within Environmental Constraints | 8 | • Ratings of the users<br>• FAQ |

| | | | |
|---|---|---|---|
| | | | • There is an "At a glance" part describing the Course Features |
| 12 | Renewable Energy Specialization | 7 | • Ratings of the users<br>• Language alternatives of the courses<br>• Testimonials |
| 13 | Beyond the Sustainable Development Goals (SDGs): Addressing Sustainability and Development | 8 | • flexible learning<br>• engaging case studies from real-world situations<br>• enhancing practical understanding. |
| 14 | Exploring Renewable Energy Schemes | 9 | • flexible learning pace<br>• practical assignments |
| 15 | Online Digital Storytelling Workshop | 8 | • The detailed explanation of the workshop.<br>• Clear registration process with upcoming dates listed. |
| 16 | Powerful Tools for Teaching and Learning: Digital Storytelling | 9 | • Focused on both theoretical and practical aspects of storytelling.<br>• Multi-language support enhances accessibility. |
| 17 | Eco Building Design | 6 | • Continuous assessment |
| 18 | MITx: Sustainable Building Design | 8 | • Instructor-paced<br>• Instructor-led on a course schedule<br>• This learning program is registered with American Institute of Architecture (AIA) CES for continuing professional education. |
| 19 | Sustainable Construction and Development | 9 | • Course certified by the CPD Certification Service as conforming to continuing professional development principles.<br>• User-Friendly and attractive presentation for the user. |
| 20 | Sustainable Design Practices in Building Design Specialization | 9 | • clear layout and detailed course structure.<br>• provides a comprehensive overview of the course<br>• the site includes information on the instructors, prerequisites, and enrollment details, enhancing transparency and accessibility. |
| 21 | Chemical Technologies for Pollution Control | 8 | |

| | | | |
|---|---|---|---|
| 22 | Didactics of chemistry | 9 | |
| 23 | Environmental Chemistry | 8 | |
| 24 | Environmental Pollution and Chemical Risk | 8 | |
| 25 | Sustainable Energy: Design a Renewable Future | 10 | • 1minute video introducing the course |

As is seen in the Table 6, there is only one online course with 10 point, there are 11 online courses with 9 points, 9 with 8 points and 3 with 7 points. The best features of these online courses were evaluated and the best features of the best practices for Delivering Online Courses were summarized (Table 7).

Table 7 - Summary of the Best Features of the Best Practices for Delivering Online Courses


### 3.2.3. SAMPLE BEST PRACTICES

The following is the best online practice that got the highest point as shown in the Table 6.
Sustainable Energy: Design a Renewable Future
https://www.edx.org/learn/sustainable-energy/delft-university-of-technology-sustainable-energy-design-a-renewable-future


thermodynamics) and mathematical skills, such as integration and differentiation, are preferred.

Conservation, Energy Technology, Renewable Energy

## What you'll learn

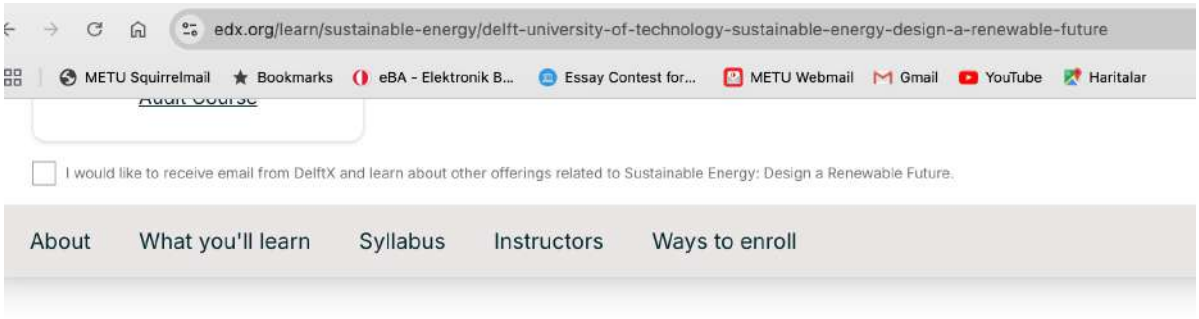
- Assess energy use and the potential for energy reduction for transport, industry and buildings
- Calculate the potential attribution of different sources of renewable energy like wind, solar and biomass and how to integrate them in an energy system

Show more

## Syllabus

**Week 1:** Definition of Energy Use
The use of energy in transport, building and manufacturing.

**Week 2:** Generation of Renewable Energy



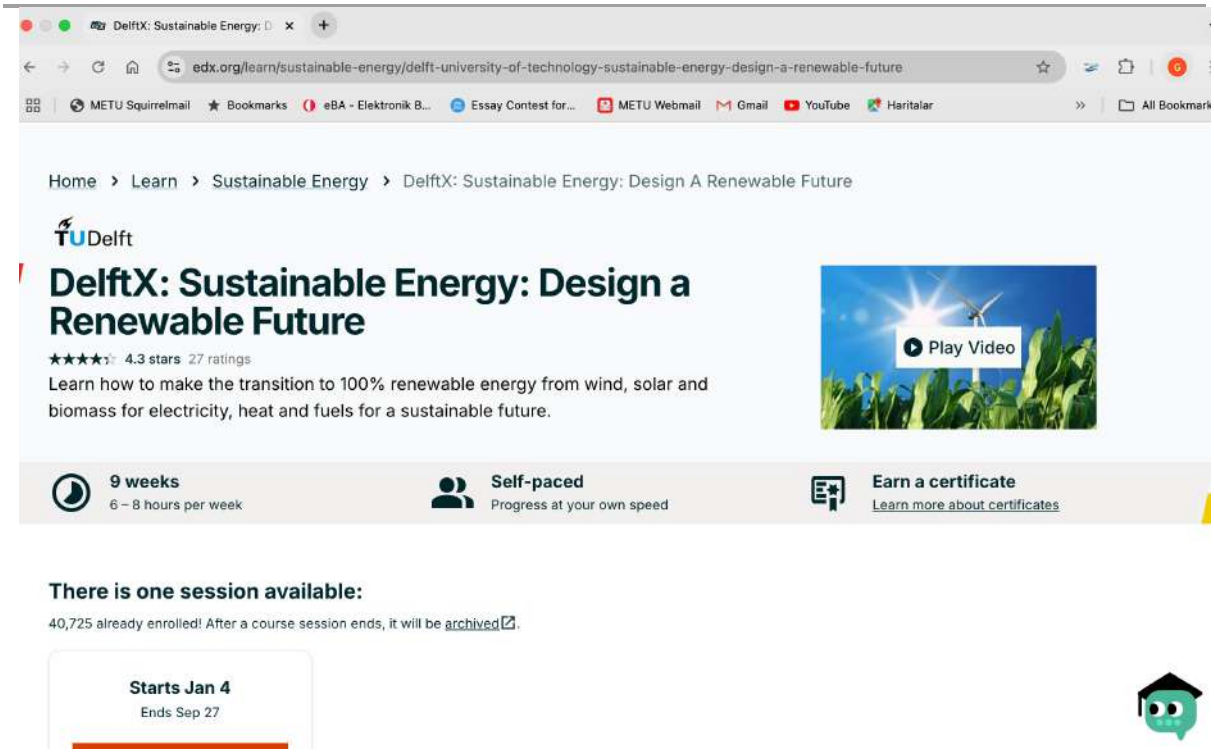

# About this course

A transition to sustainable energy is needed for our climate and welfare. In this engineering course, you will learn how to assess the potential for energy reduction and the potential of renewable energy sources like wind, solar and biomass. You'll learn how to integrate these sources in an energy system, like an electricity network

Show more

## At a glance

- **Institution:** DelftX
- **Subject:** Engineering
- **Level:** Intermediate
- **Prerequisites:** Knowledge of high-school level of physics (mechanics,
- **Language:** English
- **Video Transcript:** اَلْعَرَبِيَّةُ, Deutsch, English, Español, Français, हिन्दी, Bahasa Indonesia, Português, Kiswahili, తెలుగు, Türkçe, 中文
- **Associated skills:** Energy


DelftX: Sustainable Energy: D
edx.org/learn/sustainable-energy/delft-university-of-technology-sustainable-energy-design-a-renewable-future
METU Squirrelmail
Bookmarks
eBA - Elektronik B...
Essay Contest for...
METU Webmail
Gmail
YouTube
Haritalar
All Bookmark
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DelftX: Sustainable Energy: Design a Renewable Future
4.3 stars 27 ratings
Learn how to make the transition to 100% renewable energy from wind, solar and biomass for electricity, heat and fuels for a sustainable future.
Play Video
9 weeks
6 – 8 hours per week
Self-paced
Progress at your own speed
Earn a certificate
Learn more about certificates
There is one session available:
40,725 already enrolled! After a course session ends, it will be archived.
Starts Jan 4
Ends Sep 27

## 4. STEAMIGPOWER VLE PLATFORM

As the above-mentioned general features and best features of the Best Practices for Delivering Online Courses were gathered together, the following proposal for the **STEAMigPOWER VLE Platform** was obtained.

| The Course | What you will learn | Syllabus | Course Material |
|---|---|---|---|
| | Video introducing the program/Project/course | | |
| | | AI | |
| | | Courses<br>1<br>2<br>3<br>4<br>5 | |

# 5. EVALUATION OF ONLINE CERTIFICATE COURSES

Evaluating online courses is important for especially better understand the course's performance, as well to **determine the overall degree** to which course meets the learning objectives.

Also, evaluating the online course will allow the instructor to **identify strengths and weaknesses of the course.** With online course evaluations, it is possible to reduce dropout rates.

Therefore, online course evaluation is crucial to maintaining the high standards and developing the course according to student needs.

### What to measure in online course evaluation

It is vital to understand what to measure first, for evaluating the course efficiently.

There are several methods to ensure a comprehensive assessment of student learning and performance. Here are some effective strategies:

#### *Tracking course completion rates*

Course completion is a very useful metric; it is essential for showing the number of students who actually completed the course successfully. This rate indicates the following factors:

- that the course was engaging and digestible, and
- that students found it valuable to continuously dedicate time to the end.

If the course completion rate is low, it clearly shows that learners are not engaged with the course and are most likely struggling with many parts of the content or delivery style.

#### *Tracking assignment scores*

Make sure to also assess assignment scores, as this is a metric that will help you evaluate the efficiency of the course when it comes to student learning. It will help you identify how well students digested the provided material and what areas they are having difficulties in.

Assignment scores should be tracked across different types of assignments, from tests and quizzes to surveys and questionnaires.

#### *Measuring student progress*

Keep an eye on student progress through the course, especially if it is self-paced. To track student progress use metrics such as grades, assignment completion rates, class participation rate, and course completion rates. For instance, by tracking metrics such as class participation and grades you can see how students improve over time understanding the effectiveness of your learning program. These metrics will help you evaluate the effectiveness of the course in terms of workload.

Remember the importance of monitoring students' interaction and engagement levels. Engaged learners are a clear indicator of a well-rounded course. However, if the engagement and interaction levels are low, then some work definitely needs to be done.

To measure student engagement and interaction levels, you can check how many students have completed assignments, tests, or games within the course. Also, measure how many students engaged in discussions and forums.

#### *Keeping an eye on student retention rates*

Finally, keep an eye on retention rates. If the same student returns for another course, that means your course succeeded in delivering and exceeding students' expectations. However, if your retention rates are low, it indicates that you need some in-depth evaluation and identification of areas for improvement.

As far as we are clear on what you need to measure, it is time to jump into the best practices and, soon enough, best tools to efficiently evaluate each of these metrics.

### *Student Self Evaluation*

Have students reflect on their own learning and progress. This can be done through self-assessment forms or reflective essays. Following is a sample template for student self-evaluation.

| | |
|---|---|
| What went well? | |
| What didn't go well? | |
| What did I learn? | |
| What still puzzles me? | |

According to Benigno and Trentin (2000), on the other hand, the key elements to be evaluated for an online course are:

- the participants' individual characteristics (initial competence, expectations, learning, etc).
- the learning environment, in terms of its various components, whether they be local (learning **center**, home, etc), virtual (the network), or social.
- the participation dimension (quantitative analysis of the messages exchanged in the computer conference).
- qualitative analysis of messages in terms of content and contribution to collaborative work.
- Analysis of communication (interaction dynamics, the relationship between the actions of tutors and experts, teaching and/or operational strategies adopted by tutors and experts, etc).
- learning material used (books, articles, software, etc.).
- communication technology (ease of use, effectiveness for online collaboration).

On the basis of these points, authors proposed how and when to carry out evaluation and is summarized below. Each assessment goal in the below table is coupled with the corresponding mode of operation for evaluation.

| | |
|---|---|
| submission of entry questionnaire | • pre-knowledge and any previous experience in the topic area participants might bring to the course;<br>• reason for enrolling and expectations;<br>• each participant's learning environment;<br>• ICT know-how |
| monitoring of exercises | verify the outcome of exercises undertaken |
| monitoring of computer conferences | verify participation in discussions and contribution to collaborative activities |
| request for brief progress reports | bring to tutors' attention any useful information for calibrating or reinforcing parts of the course, etc |
| request for group production | verify effectiveness of collaborative work |
| request for individual essays | at the end of course, modules verify the extent of content acquisition |
| request for final project | verify the capacity to apply all the knowledge imparted within the course |
| submission of a final questionnaire | request for views on:<br>• interest in course contents;<br>• educational approach adopted; |

| | |
|---|---|
| | • correspondence between expectations and results achieved;<br>• learning material used;<br>• organization of activities;<br>• individual students' participation modalities (logistics);<br>• technical aspects related to networking and use of the suggested technologies;<br>• performance of both tutors and area experts in their various roles |
| **observation of placement phase** | verify the capacity to transfer knowledge and skills acquired in the course within one's own professional field |

Therefore, considering the structure, targets and content of the STEAMigPOWER VLE Platform, the best method for evaluating the course and student progress is decided to be the ***Student Self-Assessment Report***.

# 6. CONCLUDING REMARKS

The activity A8 of the WP3 is related to the adaptation of the developed courses to the online format through preparing a report on best practices for delivering successful online STEAM courses which will lead to specialized guidelines to deliver the online courses. This is linked with the main objective of delivering STEAMigPOWER Intensive Program Modules in online format, to be available at the VLE platform, aiming at reaching migrants, refugees and asylum seekers.

With this report, it is targeted to explore the best practices of the online STEAM in various Higher Education institutions as well as different platforms of education. In parallel to this target 25 online STEAM course related to the 5 courses of this project were explored, the web sites were analyzed according to the rubric developed for this purpose. The characteristics of the web sites were listed, mapped, analyzed.

It was interesting to find out that, most of the web sites of the online courses were similar with several distinguished characteristics. Therefore, the characteristics of the web sites were categorized as A. General Characteristics B. Best Characteristics. STEAMigPOWER VLE Platform, therefore, is proposed to include these characteristics in line with its target and content.

The results obtained from this exploration is very useful for categorizing characteristics of the online STEAM course offered from HEIs and education platforms of different countries and exploring that the web sites for delivering STEAM courses have similar properties with several ones with distinguished – more friendly and innovative features. This result is very valuable for constructing STEAMigPOWER VLE with the best of the best characteristics of the available online course platforms.

As a conclusion, with WP3/A8, we had a chance to develop the best way to deliver and assess our online courses to migrants, refugees and asylum seekers.

## 7. REFERENCES

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https://www.evolmind.com/en/blog/best-process-for-evaluating-elearning/#elementor-toc__heading-anchor-13

https://uteach.io/articles/evaluate-online-courses#:~:text=To%20evaluate%20an%20online%20course,goals%20and%20content%20were%20correlated