



WP2			
D 2.1		Framework for Learning Goals and Outcomes	
Date: June 2021	Type: Report	Dissemination level: Public	Lead: PoliMi Authors: Irene Olivero



With the support of the  
Erasmus+ Programme  
of the European Union

## **Enhance – One Campus (WP2) – Methodologies for the European Education Pathways (version 1.0)**

Enhanced mobility across our institutions is key to build the European Universities of Technology Alliance, fostering European identity, and enabling *Enhance* students and researchers to work with European society. At the center of this revolution in student mobility stands the development of the **ENHANCE European Education Pathways**, i.e. a system of common Learning Goals and Outcomes, a subject and competence mapping tool that allows students to select courses across all educational offers of the partner institutions, automatic recognition guaranteed.

We envision that, in the long-term, this will allow students to choose learning provisions independent of where they are registered for a degree. Students will be able to select a course at one of the *Enhance* partner institutions, which fits the learning outcomes of their degree, and register for this course under the same conditions as the home students. This will lead to customized, innovative joint learning programmes at the bachelor and master level.

To work towards this long-term ambition, we are following a step-by-step approach, where the goal for the nearest future is to propose a Learning Goals and Outcomes Frameworks. To realize this goal, four pilot programmes: BSc and MSc in Mechanical Engineering; MSc in Computer Science; MSc in Energy Engineering, and MSc in Urban Planning, have been working on different strategies – described below – towards the European Education Pathways.

### 1) A Top-Down Approach.

A working framework has been created, consisting of an Excel tab, subdivided into 3 spreadsheets.

Each spreadsheet is to be filled in with the following relevant information:

- Sheet 1 (Calendar): calendar info (teaching and exam periods) at each institution.
- Sheet 2 (Learning Outcomes): a list of (expected) Learning Outcomes for the degree programme at each institution. Each partner institution is requested to mark how each of the courses planned to be offered within the *Enhance* Alliance contributes to the Learning Outcomes listed in the lines.
- Sheet 3 (Courses Offered): each partner institution is asked to provide specific info about the courses offered for *Enhance* at each institution. Specifically: macro area; course name; name of the university hosting the course; number of the ECTS attained with that course; degree (BSc/MSc) in which the course is offered; year in which the course is provided (I, II, III, etc.);

teaching period (fall/spring); language in which the course is taught; link to the course page; number of Enhance students that can be accepted; teaching mode (remote, online, both); special requirements and additional notes.

This way, looking at the list of Learning Outcomes and at whether, where, and how each course fulfills them, it should be feasible to define how to “enhance” the teaching offers at each institution. The idea is indeed to map the existing (expected) Learning Outcomes for the degree programme at each partner institution to synthesize and cluster them into a common list of (expected) Learning Outcomes shared by all partners for the specific study programme. Afterward, it will be evaluated whether and which of the courses offered by each institution contributes to these common Learning Outcomes. This way, it should be easier to come up with a list of courses that any student at each institution will be able to choose and include in his or her study plan.

This model is the one that has been chosen by the pilot degree programmes of Mechanical Engineering and Energy Engineering.

## 2) A Bottom-Up Approach.

This approach has created a working framework consisting of an Excel tab, subdivided into 3 spreadsheets.

Each spreadsheet is to be filled in with the following relevant information:

- Sheet 1 (Calendar): calendar info (teaching and exam periods) at each institution.
- Sheet 2 (Courses List): a list of courses – with relative web page links – that each institution plans to offer within the *Enhance* Alliance. This sheet also includes a column to be compiled with 5-10 keywords relevant to identify the contents and topics covered by the course at stake and a column to indicate the number of ECTS attained and the number of *Enhance* students that can be accepted in each specific course.
- Sheet 3 (Courses description): each partner institution is asked to provide specific info about the courses offered for *Enhance* at each institution. Specifically: course description; Learning Goals; (expected) Learning Outcomes; requirements/prerequisites to take the course; topics covered; bibliography; number of *Enhance* students that can be accepted; language in which the course is taught; teaching/exam modalities (online, in-presence, both); number of ECTS attained with that course.

The idea is to map the existing teaching offer at each partner institution, i.e. to map the courses made available for the specific degree programme by each partner university. This way, it should be easier to evaluate which courses can be included in the list of courses that any student at each partner institution will be able to select for his or her study plan for the relevant degree programme. Instead of starting from a common, shared list of (expected) Learning Outcomes for the degree programme, the focus is placed directly on the correspondences or differences among the courses offered by each partner university, “enhancing” the teaching offers accordingly.

This model is the one that has been chosen by the pilot degree programmes of Computer Science.

### 3) A Hybrid-Approach

In this approach, a virtual online blackboard has been customized on which each partner institution can comment. On the virtual blackboard, 4 possible thematic clusters have been proposed through a video designed *ad hoc* (the video is available at the following link: <https://sho.co/1ECP>).

Each partner institution has then been asked to evaluate the proposition and pitch in with further ideas about how to “enhancing” it. To this extent, each partner institution has selected relevant courses that characterize or are innovative at that institution, and that can contribute to shaping each proposed thematic cluster. These courses should be chosen keeping in mind the following ultimate purpose: to come up with a course list complementing, integrating, and intensifying the existing teaching offer. Upon agreement, these courses will constitute the joint enhanced teaching offer for *Enhance* students. This hybrid approach is the one that has been chosen by the pilot degree programme of Urban Planning.

Interestingly, and ultimately, this model is aiming to follow two parallel paths:

- a. Selecting and opening to *Enhance* students existing relevant courses. This will be done by reaching an agreement about common (expected) Learning Outcomes, number of intake *Enhance* students, number of ECTS attained with that course, and so on – as foreseen by the Top-Down Approach.
- b. Offering collaborative/elective workshops (maybe under the umbrella project “New European Bauhaus”) that may become the core of original, customized study programmes to be offered for the *Enhance* project. The rationale behind this idea is to: start “warming up” the students with an *Enhance* proposal that can be made available by each partner institution already from the upcoming a.y. of 2021/22; create stronger bonds among the partner institutions; start experimenting with the idea behind the project, its possible challenges or opportunities.

The team working on shaping and discussing the outlined methodologies is constituted as follows: a coordinator Professor and a Research Fellow from PoliMi for each degree programme plus two or three Professors from each involved partner institution responsible for that degree programme at different levels at that institution. All the approaches described have been discussed separately (each degree programme discussed its own) among the partners engaged in the project during the course of 5 meetings. The relevant degree alliance has somewhat approved the suitable approach.

However, a few common challenges and difficulties are being encountered in completing the tasks required by each method. These challenges are listed below:

- a. There are significant differences among partner universities in classes capability, with the consequent problem that several courses offered can host a very slim number of *Enhance* students;
- b. The parties involved are different, being different also the commitment shown by each partner, with consequent difficulties in going towards a similar direction;
- c. Some of the parties involved are reluctant to complete the tasks for they foresee problems with the technical implementation of the teaching offer due to the scarce compatibility of the different IT systems used by each partner university;
- d. From c. follows a possible consequent difficulty or even impossibility of adopting original IT features that would allow better integration and longer usability of the new system.
- e. Scarce (human) resources, time, and future uncertainties (about whether we will have in-presence or remote classes, about when the semesters will start, etc.) represent further challenges in completing the required tasks.

The departments and faculties engaged in the Enhance Alliance are:

For Mechanical Engineering: BSc in Mechanical Engineering, Technical Design, Automation and Mechatronics and MSc in Applied Mechanics (Chalmers University of Technology); BSc in Mechanical Engineering (Norwegian University of Science and Technology – NTNU); BSc and MSc in Mechanical Engineering (Politecnico di Milano – PoliMi); BSc in Mechanical Engineering and MSc in Automotive Engineering (RWTHAachen University); BSc in Automotive Engineering and MSc in Automotive Systems (Technische Universität Berlin – TU Berlin); BSc in Mechanical Engineering (Universitat Politècnica de València – UPV); BSc in Electric and Hybrid Vehicles

Engineering and MSc in Mechanics of Vehicles and Construction Machinery – Faculty of Automotive and Construction Machinery Engineering (Warsaw University of Technology – WUT); BSc and MSc in Mechatronics (specialization in Photonics Engineering) – Faculty of Mechatronics (Warsaw University of Technology – WUT).

For Energy Engineering: MSc in Sustainable Energy Systems (Chalmers University of Technology); MSc in Energy and the Environment (Norwegian University of Science and Technology – NTNU); MSc in Energy Engineering (Politecnico di Milano – PoliMi); MSc in Energy Engineering (RWTHAachen University); MSc in Energy Engineering (Technische Universität Berlin – TU Berlin); MSc in Energetic Technology for a Sustainable Development (Universitat Politècnica de València – UPV); MSc in Power Engineering (Warsaw University of Technology – WUT).

For Computer Science: MSc in: Computer Science – algorithms, languages and logic; Computer Systems Networks; High-Performance Computer Systems; Data Science and AI; Interaction Design and Technologies; Software Engineering and Technologies (Chalmers University of Technology); MSc in Informatics (Norwegian University of Science and Technology – NTNU); MSc in Computer Science and Engineering (Politecnico di Milano – PoliMi); MSc in Electrical Engineering, Information Technology, and Computer Engineering – Faculty of Electrical Engineering and Information Technology (RWTHAachen University); MSc in Computer Science – Faculty of Computer Science (RWTHAachen University); MSc in Computer Science (Technische Universität Berlin – TU Berlin); MSc in Informatics Engineering (Universitat Politècnica de València – UPV); MSc in Computer Science (specialization in Artificial Intelligence and MSc in Data Science (Warsaw University of Technology – WUT).

For Urban Planning: MSc in Architecture and Urban Design and MSc in Architecture and Planning Beyond Sustainability (Chalmers University of Technology); MSc in Urban and Ecological Planning (Norwegian University of Science and Technology – NTNU); MSc in Architecture and Urban Design (Politecnico di Milano – PoliMi); MSc in Transforming City Regions (RWTHAachen University); MSc in Urban and Regional Planning (Technische Universität Berlin – TU Berlin); MSc in Advanced Architecture, Landscape, Urban Planning and Design (Universitat Politècnica de València – UPV); MSc in Architecture for Society of Knowledge (Warsaw University of Technology – WUT).

Here below you can find a link to one of the shared excel file used to collect the information stated before. This is just an example related to the Energy Engineering pilot study programmes:

<https://polimi365->

[my.sharepoint.com/:x/g/personal/10806910\\_polimi\\_it/EQtPN5RzZqREu1Jd2uaOEggB44TeSQLbBPoHU5YO](https://my.sharepoint.com/:x/g/personal/10806910_polimi_it/EQtPN5RzZqREu1Jd2uaOEggB44TeSQLbBPoHU5YO)

[IbOi8Q?e=IW3gXW](https://my.sharepoint.com/:x/g/personal/10806910_polimi_it/EQtPN5RzZqREu1Jd2uaOEggB44TeSQLbBPoHU5YO?e=IW3gXW)