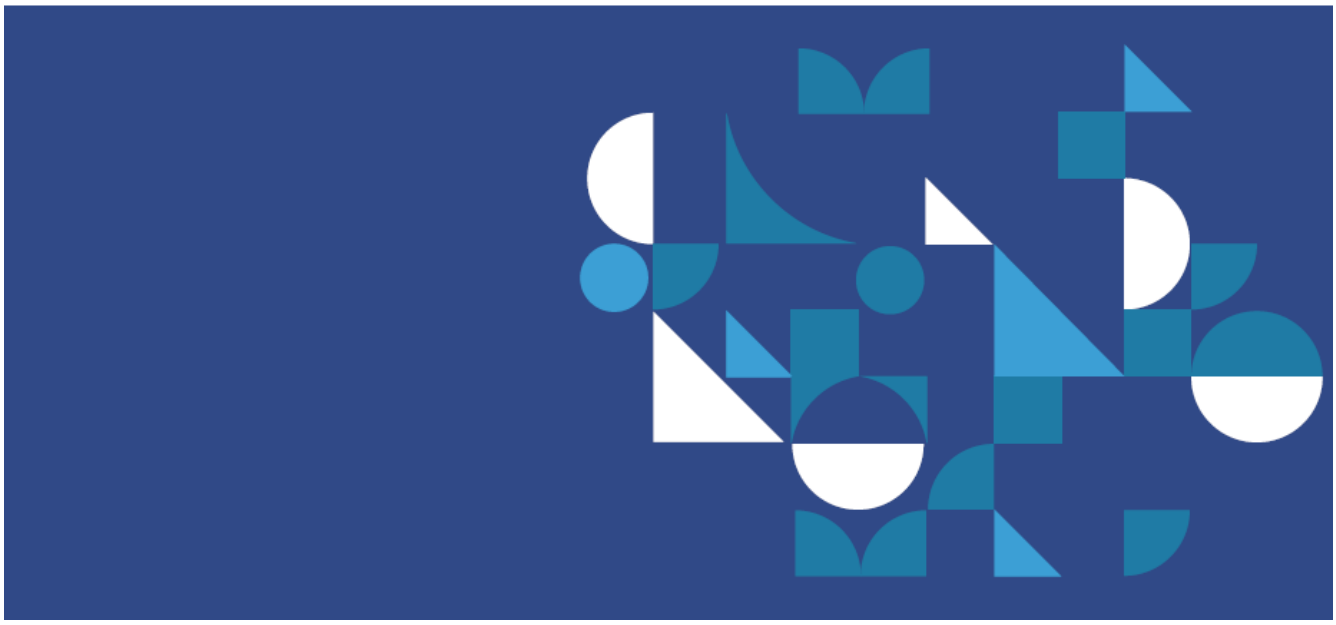
Industrial Engineering and Management of European Higher Education



Deliverable: **E-LEARNING PEDAGOGICAL STRATEGY**

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OUTLINE

Introduction

The goal of the Task T4.2 is to describe the best pedagogical practices to be followed for the preparation of the e-learning modules looking its specific delivery. It contains guidelines and practical information for the partners to develop the e-learning modules, when they start to translate the training materials prepared for the traditional course (R3.4).

Special attention will be paid to the learning paths, connecting contents with skills and developing specific assessment techniques, including potentially the serious gaming alternative. Indeed, recommendations for implementation from D4.1 carried out at the T4.1 will be considered as well.

Pedagogical models to be supported

E-learning infrastructure enables different pedagogical models, from the simplest content management system (CMS), working as a simple content repository for different learning objectives until more sophisticated models involving competences and other interactive elements.

For sake of coherence, in this document we will cover the more extensive model as other solutions are just using few options. We started with the introduction for the logic of the adopted model, using the approach from one of the partners of the IE3.

New generations currently attending university courses exhibit specific behaviour, not observed in earlier generations, as the result of being exposed to internet and social media tools from the beginning.

Currently most of research studies are focused on Millennials, but the younger, lesser-known generation now named as Generation Z grew up without much fanfare [1]. The oldest of this post-Millennial generation arrived to college in 2014, and more than four years later, Generation Z students fill our classrooms, and campus programs [2]. Although not everyone born in a generational period shares the same values or experiences, they do share a common context that shapes their world view. Thus, generational research can provide institutions with valuable information to design effective policies, programs, and practices.

No different from generations before them, Generation Z's focus when coming to college is to learn and acquire the skills necessary for their future careers. Learning for them, however, is markedly different from that of previous generations. Findings from North-eastern University's Innovation Survey highlight that Generation Z students prefer to engage in hands-on learning opportunities in which they can immediately apply what they learn to real life, and they describe the ideal learning environment as “need[ing] to be actively doing the learning to obtain the most information.” University officials continue to face new challenges in meeting the needs of an increasingly diverse student body and fulfilling an expansive institutional mission [3]. To configure more efficient learning procedures is a requirement, but this behaviour can be identified as well as to professionals looking to enlarge their knowledge.

Because of the highlighted characteristics of over-stimulation, digital multichannel sources, lack of patience, it becomes even harder managing classes lasting one hour and a half and involving many slides and concepts. Providing a vibrant learning environment for Generation Z will require creative approaches that combine social interactions, technology, and assignments that simulate real-life work situations or are community outreach projects. New technology platforms may be required as well as faculty development to learn methods for teaching Gen Z that includes more than technical approaches.

The interest of such learning structure is that enables self-guided, independent asynchronous learning of concepts as auxiliary but yet relevant elements. By giving learners the option for such learning path, when the course involves blending or synchronous activities, such organization opens a bigger space for innovation. This is because when formal lecture presentations of contents are removed, more options for training oriented approaches appears, including open discussions about relationship between concepts or case studies.

More practical application to real cases, including software tools are well suited, emphasizing the opportunities to acquire additional soft skills linked to the cooperative work and noisy environments.

Based on the preliminary work carried out in [4] the competence concept was adopted by following the current status of the art, where scholars have identified two main categories of competences, Individual and organizational competencies. Still, independently from the adopted taxonomy, it is convenient to fix the competence understanding, which will require, a definition, a description, and a measurement criteria (see Figure *1*).

Figure 1.- Competence understanding.

As the approach is addressing Z-gen participants, which are fully digital, it is clear according to introduction that there are some constraints to consider, such as digital based media where the central element are video content, but also their lack of patience, with attention limited to 8 secs, and clear motivation for the added value for the concepts gathered in relation towards the labor market. Actually, such characteristic behavior is a key element to select a micro-learning based approach to gather fundamental concepts, which is also well connected with some other characteristics from the targeted learners, as they also exhibit social behavior but also individualism for learning patterns and experiences [5], [6].

Providing a hybrid design involving both, synchronous and asynchronous activities as well as individual and social behavior, if combined properly, can make the difference against more classical courses, in particular when new generations are targeted, as they are also concerned with applicability of the university time and opportunities after college.

Based on those aspects, it is worth to consider some degree of complementarity between the theoretical knowledge background (with good characteristics to be acquired on their own pace, according to their preferences and already existing knowledge) and practical skills, when applied to solve specific engagements (in this case the value comes from sharing different alternative solutions among participants able to understand each alternative as well as to discuss values and limitations).

Preparing learning experiences to emphasize shared learning, to be developed at least partially at classrooms strongly depend on the topic and the practical capabilities being mobilized. However, far away of the practical assessment of the exhibited performance, including steering information at team level, this work focuses the interest in tools enabling the learning path of the required concepts, tools and relationships. Therefore, the proposal is, when addressing the first aspect, to develop micro-learning content for each of the elements as well as for the relationship themselves, in such a way each learner can define their own path having the opportunity to jump into the concepts and relationships according to their needs, having the opportunity to assess their level of gathered knowledge.

Implementation details

Main reason for micro-learning is to facilitate concept acquisition for Z-gen members as the visual teaching such as tik-tok, youtube, etc., shall be one way but not the exclusive one. To organize concepts and relationships a full competence structure need to be provided. Competencies describe the level of understanding or proficiency of a learner in certain subject-related skills [7]. On the other side, competency-based learning or skills-based learning, refers to systems of assessment and grading where learners demonstrate these competencies.

It was decided to use classical Learning Management System (LMS) as a convenient tool to implement the Competence framework, and Moodle was selected for this purpose, as indicated in Figure 2, where its different entries are grouped under the taxonomy keyword. It looks to define every framework row, by setting the language string keys used to describe competencies at each level of the framework [8]. In present case, the adopted taxonomy organizes the knowledge in four layers, where the concept is the atomic item and skill is the capability of getting concepts working together, either for knowledge or just when used by a specific tool to carry out detailed outcome. Combination of skills will provide integrated perspective in a higher level, named competency. Finally, competencies are arranged by Domains of knowledge [9].

For each of the domains or knowledge areas, several competences can be linked. Therefore, when Organizational Domain is considered, it was decided to highlight competency for Setting up the Characteristics, as well as agent's recognition and relevant activities and roles. Finally, it was decided to include the competence to recognize different methodologies relevant for the field (see Figure *2*).

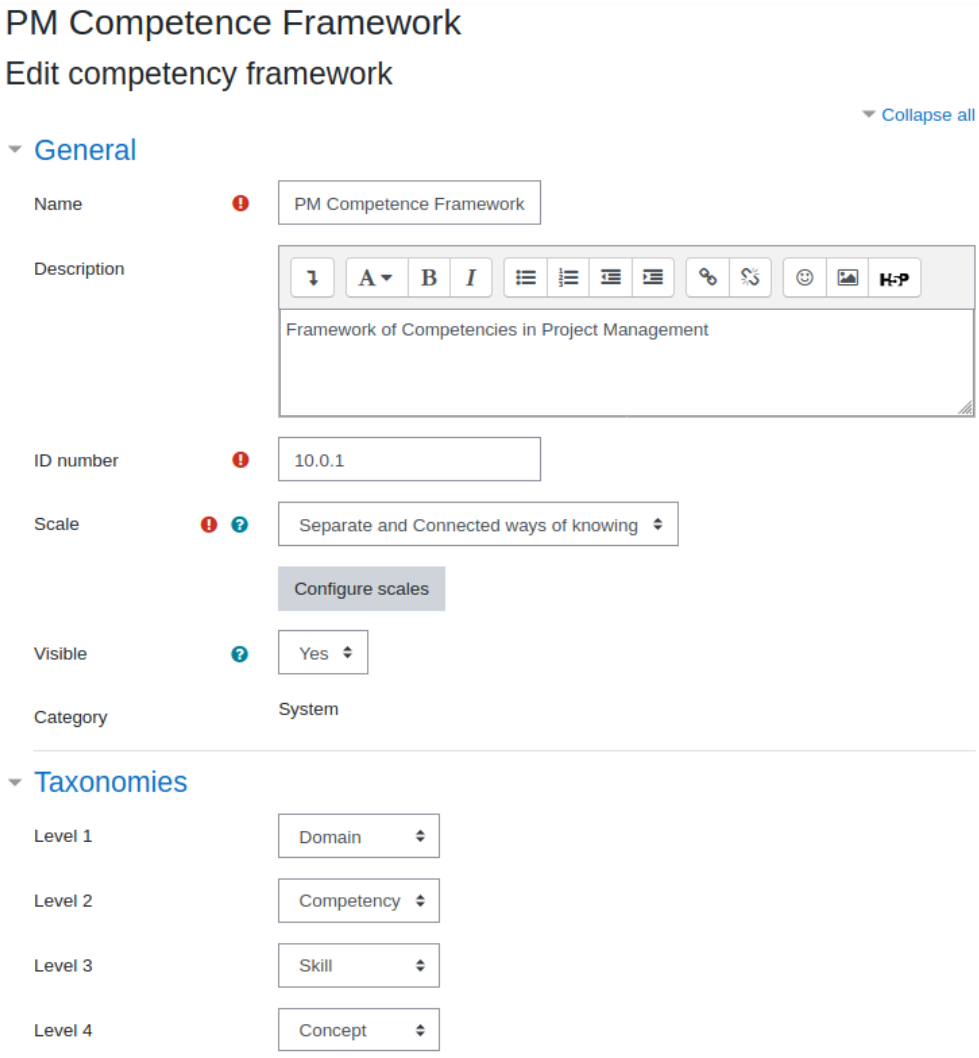

Figure 2.- Implementation of the Competence Framework.

By following the same approach, when a single competency is selected different skill entries become relevant. Just as an example, when Project agents is selected as competence, relevant skills are identifiable, such as,

- understand the value creation for Project Manager as well as their typology,
- understand the relevance and responsibilities for all the legal entities around the project,
- understand the work for different contractors as well as their relationship,
- understand the implications for the project owner / product owner,
- understand the Project Engineering roles and responsibilities,
- understand the team work involved in both, project execution and project management.

Such structure can be realized at the competence framework definition in Figure *2*, where the atomic elements can be related to them as appropriate. In our case, the skill related to the Project Management understanding can rely on her responsibilities, the relevant knowledge areas s/he will be required to manage.

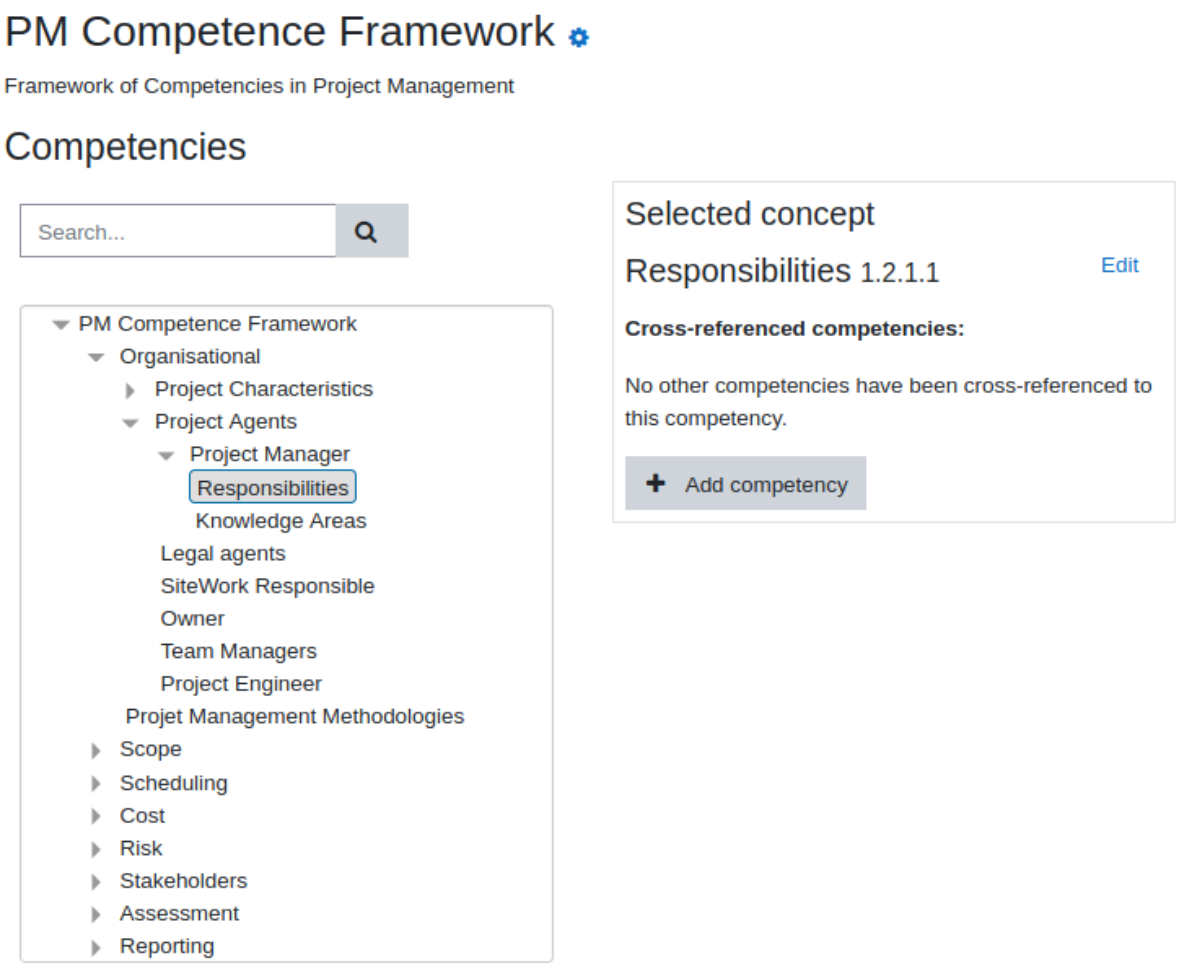

Figure 3.- Implementation of skill items into the Competence Framework.

In order to be consistent, it is possible to link either skills or concepts to competencies other than the one hierarchically related, as exhibited in Figure *3*. In this way it is not needed to replicate same concepts across the different competencies.

Another interesting concept is the competency rule. They can be added to any competency in a framework, as long as it has children. A competency rule can be used to automatically mark as complete a parent competency when all children of it are complete. Linking the child competencies to course activities combined with the competency rule 'Mark as complete when all children are complete' will award the parent competency to a learner when s/he has successfully completed the course activities or when s/he gets the required proficiency level.

The next step to implement a proper micro-learning context is to generate different learning artifacts, including concept and relationship explanations as well as some exercises able to demonstrate gaining enough insights. In Figure *4* different micro-learning items are presented, some of them text based for reading, some of them video based and, to validate the gathered knowledge a quiz linked to a competence rule.

Figure 4.- Implementation of micro-learning for contents.

Regarding assessment of competences, depending on the concepts, they can include classical questionnaires involving either multi-choice, true / false, or numeric questions, but also those other more advanced ones such as those introduced in Figure *5*.

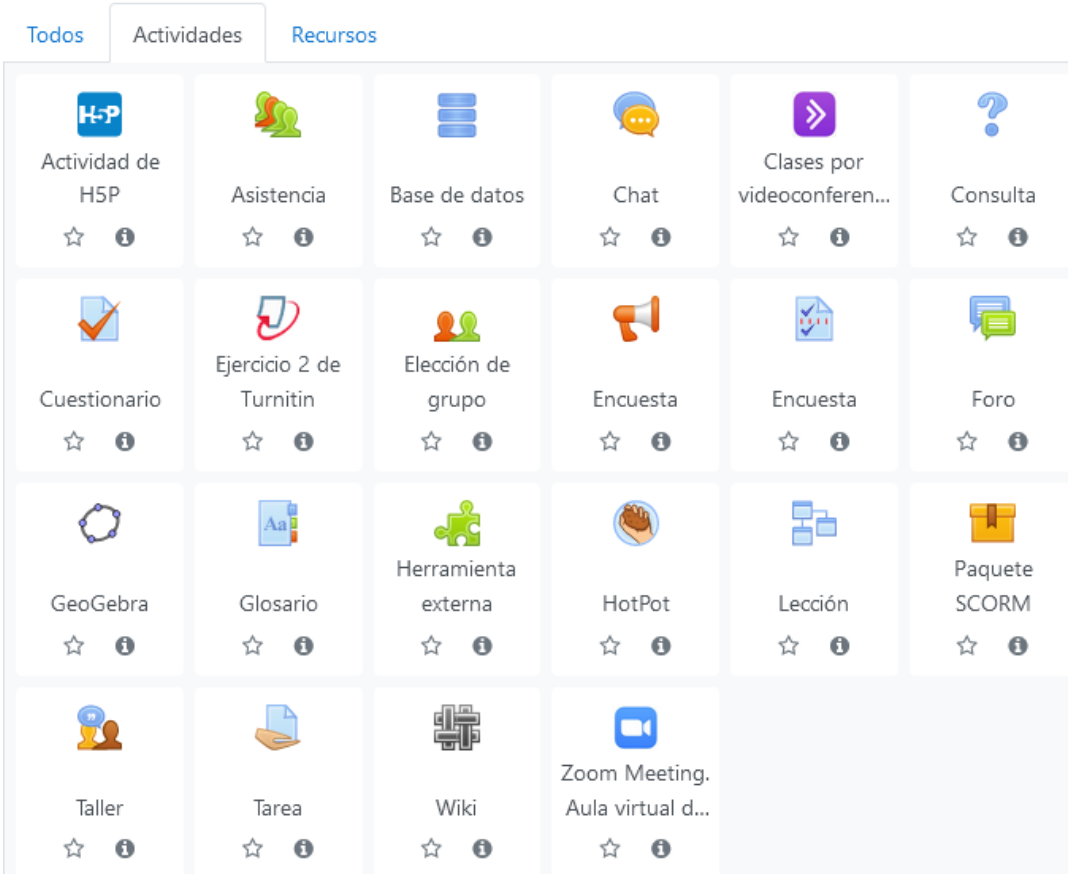

Figure 5.- Different alternatives to assess concept knowledge or understanding.

It is worth to mention that in addition to the assessment task itself, the experience can be reused to provide additional feedback to learners when the workshop activity is accomplished, because of the learner not only experience the rubric based assessment to the non-direct question, which requires to mobilize additional understanding, but she also will learn by analysing what other colleagues did, and how they faced the task. In such a way both, individual and social learning become possible, while still asynchronous assessment was undertaken.
In addition, still room remains to implement additional serious gamification techniques for synchronous experiences, when competition stimulates participation between learners. Literature show that serious games have a potential of creating learning environments to better reach the educational and training goals [10]. The game design characteristics and game elements are need to be explored in detail for increasing the expected benefits of the gaming environments, in particular when the synchronous dimensions are used to increase the engagement levels.

Conclusions

In the T4.2 f the IE3 project a set of Pedagogical e-Learning Strategies have been developed, where the most comprehensive one was fully detailed, including implementation details. Therefore, a proposal to leverage the new requirements coming from Z-gen learners has been elaborated.
The strong aspect to be emphasized is work inside a competence framework approach, but differentiating the personal learning from the shared learning, where both spaces are specific and complementary.
For the basic knowledge acquisition, were concepts, tools and basic relationships are involved, a micro-learning based context has been proposed, where different type of media content are available, according to the learning preferences of the audience and where some kind of asynchronous learning is encouraged. In this way implementations of flipped classroom methodologies fit perfectly with the proposed framework.
For the social learning, the focus is to address more sophisticated problems or issues where different solutions can be proposed and where discussing advantages and limitations of each of them are valuable. Indeed, where implementation of specific ideas provides benefits to the participants as they can analyze their own work as well as the work of competitors. Such aspects can be emphasized either by synchronous serious gamification tools, or because of asynchronous assessment tools.
With separation between individual asynchronous concept based learning and synchronous social oriented activities focused on increasing learning practical dimensions through team participation on case study analysis, team oriented project development, discussions, and similar activities, the course design is in accordance to the interest the new generations exhibit regarding its education pattern. Indeed, visual content for learning and micro-learning also match with their requirements for attention and gamification stimulates competitiveness as a key for increasing their engagement. The remaining aspect to be carefully considered is the vertical and horizontal integration, which requires deeply strategic design for the degree, including links to other requirements which are out of the scope of the current planning level as identified in this contribution.
Keeping the attention level at course design considering competences as common driver for learner achievements, and in order to facilitate the deployment, the competence framework and tools have been implemented into a classical LMS such as Moodle, where the competences module has been enabled.
From the formal point of view all the elements required to digitally improve the Industrial Engineering and Management concepts have been reviewed. However, it is needed to recognize that implementation details need to be collected, by running the experimental courses and identifying aspects to be improved.

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