



MONDRAGON ZTIM HUB: thematic challenges to promote STEM vocations among students

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1. Motivation and learning outcomes

The term STEM (Science, Technology, Engineering and Mathematics) is one of the most commonly heard concepts in both education and business when talking about the needs of the future (Li et al., 2020). However, one of the challenges facing our society is the lack of motivation and interest in STEM disciplines of secondary-school students, especially girls (McKinsey Global Institute analysis, 2020). At the same time, the implementation of STEM initiatives in education is not easy due to the need for change that is required in the classroom.

For this reason, it is necessary to generate initiatives to help schools implement STEM activities. In this sense, the MONDRAGON ZTIM HUB project has been set up. The main aim is to promote STEM vocations among young people as a tool for providing scientific-technological solutions to the different challenges facing our society. It is a network of interconnected socio-economic agents that work at a local level to develop STEM activities in both curricular and extracurricular areas.

In summary, those attending will be able to:

- Get to know the MONDRAGON ZTIM HUB initiative.
- Learn about the methodology followed for the development of thematic challenges (Challenged based learning (CBL) methodology (Nichols et al., 2016) and specifically the ETHAZI model (TEKNIKA, 2020)) that help to raise awareness and promote STEM activities in the classroom.
- Sharing of similar problems and collection of proposals for improvement of STEM proposals.

2. Background and rationale.

Nowadays, the labor market needs STEM workers: On the one hand, because the demand for jobs related to this disciplines and careers is not currently covered; on the other hand, because, although many of the future jobs have not yet been created, they will be directly related to the scientific, technological and digital development. In this context, in all levels of education, female students continue to be underrepresented. Furthermore, the number of women pursuing STEM studies and careers is far lower than that of men (EUSTAT, 2019). Therefore, it is essential to awaken professional



vocations in STEM areas among students, ensuring gender equality and starting at the lowest levels (Eusko Jaurlaritzza, 2018).

Moreover, it is known that secondary-school students' interest in and motivation for STEM disciplines, studies and careers is low. It seems that their choice of pathways changes as they grow older (Valero-Matas & Coca-Jiménez, 2021); their interest progressively decreases as they progress to higher levels (Hernández-Serrano & Muñoz-Rodríguez, 2020).

Several studies claim that there are many factors creating loss of interest in STEM, such as the traditional approach and the use of expository strategies (Hernández-Serrano & Muñoz-Rodríguez, 2020). In order to achieve greater interest in these disciplines, it is necessary to employ a practical approach to learn through interdisciplinarity, the development of practice contexts, and new and adapted teaching materials (Valero-Matas & Coca-Jiménez, 2021). This is why it is necessary for schools to implement thematic challenges in the classroom in a curricular way to make science vocations visible.

3. Workshop design.

The workshop is divided into 4 main parts as follows:

- **Contextualization: Context and introduction of the MONDRAGON ZTIM HUB initiative. (25 min)**

The MONDRAGON ZTIM HUB initiative and its context will be introduced to the attendees. Special emphasis will be placed on the importance of collaboration between actors. Our collaborative model developed for the promotion of STEM vocations will be presented.

Afterwards, we will proceed to create a small debate with the attendees to see which is the STEM situation in their origin region, if the objectives are aligned and gather for similar needs. Then, we will give our vision on the concepts mentioned above. With this small interaction, we intend to align the knowledge on the general objectives covered by our initiative and try to search for partners.

- **Development: Development of the thematic STEM challenges. (20 min)**



The core of the presentation lies in the design of the thematic challenges, designed for the 4 grades of High School. The details of the methodology followed will be shown through a practical example.

The proposal to incorporate MONDRAGON ZTIM HUB network agents in the thematic challenges developed in the classroom is shown as an innovative initiative. The challenges take place both inside and outside the classroom, this is due to the collaboration in the design of the challenges between schools and external agents that aim to provide a more real context for the challenge as well as to bring the local socio-economic environment closer to high school students.

At this point, a participatory intervention will be carried out in order to visualize the strengths and weaknesses of the proposal presented as well as get to know the interest that such a proposal can arouse.

- **Results: A sample of the results obtained to date. (5 min)**

As a result the challenge's current implementation status will be presented. Challenges have been designed with constant feedback from both school and companies. This collaboration framework will be emphasized.

Again, an interaction with attendees will be done in order to look after other methodologies applied for this aim. It will be interesting to identify similarities or how they differ.

- **Conclusions, lessons learnt and future lines: Sample of the conclusions and future lines of the initiative. (10 min)**

To conclude the presentation, the lessons learnt and conclusions obtained will be presented, as well as future lines of action. A decalogue of outputs will be presented to serve as aspects to be taken into account for future developments. The session will end by collecting information on similar projects from the participants, so that similar experiences can be shared and learnt from.

4. Significance for Engineering Education and attractiveness of the topic.

The importance and need of a STEM educational model is becoming increasingly evident both locally and globally. In Europe, for instance, a 70% job growth in sectors



such as ICT and health is expected. Accordingly, the data published in 2020 by the Basque Business Confederation indicate that the most in-demand professional profiles correspond to STEM-related higher degree studies. Nevertheless, the interest of students in STEM careers is low and industry has difficulties in finding such profiles.

If one of the principal reasons for this lack of talent is the unawareness and prejudices associated with STEM professions among young people in relation with engineering education, it is vital to break stereotypes to change the *status quo*, which are the objectives of MONDRAGON ZTIM HUB. The thematic challenges specially seeks to use STEM skills to face real-world problems and consequently to show the importance and usefulness of STEM topics. The participation of external agents provides the students a better understanding of the reality surrounding them and makes more visible and understandable engineering careers as well as reduce the fears of studying them. At the same time it encourages innovation and creativity too.

Therefore, the main value contribution of the challenges is the participation of external agents through pills or parallel actions to the challenge that allow students to acquire the knowledge or inspiration necessary to face the challenge. These will provide context and tools for their development. In short, the purpose is to bring the reality of the professions to generate solutions to a challenge in a collaborative way. This will facilitate the transition and approach to the world of the STEM professions, improving their professional development through the acquisition of technical and specifically engineering skills and improving their future employability.

The thematic challenges provide an insight into different fields of engineering, bringing students closer to the profession and showing examples of real applications. And most importantly, it reaches more girls through examples of applications with a social vocation, because that is what engineering does from our point of view.

Key words: STEM education, Challenge based learning, STEM projects, Secondary Education.



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