

## INNOSOC Case Study

*(selected for Valencia 2017; extended version)*

Case Study title:

### Promoting STEM Studies among Young Students

Keywords: science, technology, engineering, mathematics, promotion, young students, vocation

H2020 challenge addressed by the Case Study: Europe in a changing world - Inclusive, innovative and reflective societies

#### Introduction to the Case Study

The study of **Science, Technology, Engineering and Mathematics (STEM)** has suffered a strong decrease during the last decade in Western Countries [1]. Causes of this decrease are very diverse, but it seems necessary to take actions to improve the perception that future students have about these studies and to introduce technology to high school classrooms.

Despite that the number of ICT jobs decreased a 10% in Europe during the period 2006-2010, it is expected that Europe will require one million of ICT professionals in a short future. Moreover, it is a fact that a good development in ICT is crucial to face economic or social crisis. Nevertheless, two main factors that contribute to maintaining, or even worsening, this situation are: (i) setup of **high school studies**; and (ii) perception pupils have regarding **technological studies** [2].

On the one hand, the balance among Arts, Humanities and Social Sciences, and Science and Technology in secondary studies and Baccalaureate is not uniform neither agreed in all European countries. In some high schools the **Science and Technology** Baccalaureate is not fully completed due to a lack of material resources (a science laboratory is far more expensive than a conventional classroom). Moreover, Technology and Computing syllabuses are sometimes optional and programs of Mathematics and Physics are less extensive than during the 90's and 2000's decades.

Additionally to this scenario, students have a negative perception of technological studies: **difficult** and **poorly paid**. Finally, but not less important, society perceives that ICT professionals are nerds and media presents them as funny strange people without glamour. This is completely obvious if we make the comparison between *The Bing Bang Theory* and *CSI* characters where both characters are supposedly scientists. It is even worse if compared with the image of other professionals as lawyers, doctors or brokers [4]. Moreover, STEM studies are **less attractive to girls** - only a 10% to a 20% of ICT students are women, and those numbers are not increasing throughout the time [5].

INNOSOC students, supervised by INNOSOC lecturers, will collaborate on answering how to reverse this situation by the promotion of STEM vocations among Secondary and High Schools students [3][6]. The key idea is that University students, who are closer to these young students in age and culture, develop **new strategies of promotion**. These activities will be conducted as a part of the ERASMUS+ blended mobility and will be finalized during the INNOSOC Valencia 2017 workshop in late May 2017.

### **How this Case Study is related to the selected H2020 challenge?**

One challenge for Europe is to become an **international player** with a specific importance without losing the values that characterize our civilization [1]. These values will lead to **inclusive, innovative and reflective societies**.

In order to succeed in this field, it will be crucial that new generations, who are digital natives and users in European society, deeply dominate the technological languages as well. These technological skills will make European society independent of external factors and will allow us to develop **social policies, integration and international cooperation** which are our own. Giving young people skills in STEM disciplines will allow EU to tackle H2020 challenges, since most of them are connected with an advanced technology development. Access to STEM disciplines for the most disadvantaged groups of population should also be ensured, as a way to promote their development and integration, in that way actively working to eliminate the **digital gap** inside the EU. Finally, the **downward trend of girls** going for technological vocations should be reversed. Poor technological skills will take them to a worse professional and social development thus improving the **gender wage gap** and inequality level.

### **How this Case Study is related to the INNOSOC project?**

**"Innovation" as a core INNOSOC topic.** STEM skills are tools for innovation. Anybody can have a very innovative idea than can improve people's life, but to develop and make this idea real a huge amount of knowledge and work is needed. In our time both knowledge and work will be related to STEM skills in one way or the other. The innovation perspective of this case study could be recognized in focus on the technological culture that is needed to make innovation real.

**Intercultural topics, with focus on "Multicultural teams"**. Different STEM students from different countries will discuss situations in their countries and ideas to promote the STEM studies. It is expected that they focus on: i) *gender gap* of these studies; and ii) *access to the ICT resources* in different communities.

**ICT topics, with focus on "Innovative engineering based on ICT"**. ICT resources are crucial to promote STEM studies: audio visual information, social networks, open access platforms, information and courses, on-line studies, multiple platforms and non-traditional teaching and learning strategies.

**Student projects, with focus on "Case studies on how ICT can contribute to innovative societal development"**. University students enrolled in STEM studies will raise ideas to encourage Secondary and High School students to follow the STEM-based careers. Their view is very valuable since they are closer in age and culture.

### **Questions that need answers during the Case Study development**

Questions that need answers include but are not limited to the following:

#### **Knowing the State of the Art.**

- Which is the current situation of STEM studies in your own country? Has it improved or decreased in the last 10 years?
- How is the access to STEM studies from Secondary/High School studies in your own country?
- What is the percentage of girls addressing these studies in your own country?
- What is the perception that young students have about scientists and engineers?

#### **Designing strategies.**

- How can STEM studies be more attractive to young students and girls in particular?
- What is the most appropriate age for the promotion actions?
- Which promotion actions are more effective?
- Are ICT tools effective for promotion?

#### **Hands on.**

- What problems (economic, temporal, logistic, social, personal resources, knowledge, skills...) occur during promotion actions?
- How can benefits of actions be measured?

### **References**

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### **Knowledge and skills needed for developing the Case Study**

*(P: prerequisite; D: desirable, but not necessary)*

- To have a previous knowledge on the situation of STEM studies in the student country as well as interests and vocations of young students (P)
- To be sensitive to gender and socio-economic inequality aspects (P)
- To have a previous knowledge and skills on ICT resources (P)
- To be innovative, curious, proactive and open-minded (D)
- To be prepared to work in multi-disciplinary and multi-cultural teams (D)

### **Figures describing this Case Study**



Figure 1. Young students in a demonstration of SoundCool <http://soundcool.org>, an application of electronic music developed in collaboration with the Technical University of Valencia (UPV)





*Figure 2. A class of (In)Security in wireless networks given by a Telecommunication Engineering student to High School students*



*Figure 3. Young student using a Tenori-on app in an electronic music demonstration*



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for the Societal Challenges

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