Chapter 8
RoboSTEAM Project:
Integrating STEAM and Computational Thinking Development by Using Robotics and Physical Devices

Miguel Á. Conde
 https://orcid.org/0000-0001-5881-7775
Universidad de León, Spain

Francisco J. Rodríguez-Sedano
Universidad de León, Spain

Camino Fernández-Llamas
University of León, Spain

Maria João Carvalho Ramos
Agrupamento de Escolas Emídio García, Portugal

Manuel Domingos Jesus
Colégio Internato dos Carvalhos, Portugal

Susana Celis
IES Eras de Renueva, Spain

Jose Gonçalves
Polytechnic Institute of Bragança, Portugal

Jose Lima
Instituto Politécnico de Bragança, Portugal

Daniela Reimann
Karlsruhe Institute of Technology, Germany

Ilkka Jormanainen
University of Eastern Finland, Finland

Juha Paavilainen
University of Eastern Finland, Finland

Francisco J. García-Peñalvo
 https://orcid.org/0000-0001-9987-5584
Universidad de Salamanca, Spain

ABSTRACT

Digital society demands professionals prepared for the current landscape. It is necessary to teach current students how to employ and solve problems related to this constantly changing context. This requires new learning approaches that facilitate developing computational thinking skills by learning programming and applying STEAM disciplines. However, integrating STEAM and developing such skills is not easy in current educational programs. RoboSTEAM project is an Erasmus KA2 project that propose the application of challenge-based learning methodologies combined with the use of robots and

physical devices in order help learners to develop computational thinking in pre-university education environments. This chapter describes the project proposal, partners involved, activities, and outcomes and initial results obtained.

INTRODUCTION

Nowadays, everybody is involved in what is known as Digital Society and they need specific training to participate efficiently in their context. Students should be prepared for this landscape that includes new problems, new information sources, new devices and even new concepts. This requires learning approaches that help students to better understand and be prepared for the digital society. This society needs skilled professionals for ICT (Information and Communication Technologies) and there are high unemployment rates when this requirement is not satisfied.

Given this context, it is especially important for students to learn computer programming from an early age. This knowledge together with other technical skills makes possible the development of what is known as "Computational Thinking". In this way, they need to develop skills like critical thinking, problem-solving, collaboration, communication and creativity. In the specific field of school education, students need to see how these problems are solved and to "touch" the solution. In this sense, Physical Devices and Robotics (PD&R) application (Caballero-González & García-Valcárcel, 2020; Ferrada-Ferrada, Carrillo-Rosúa, Díaz-Levicoy, & Silva-Díaz, 2020; F. J. García-Peñalvo, D. Reimann, & C. Maday, 2018; Martínez, Minguell, & Bosch, 2018; Reimann & Maday, 2017; Zapata-Ros, 2019) is a popular and very valued option.

This kind of learning activities are usually linked to STEM (Science, Technology, Engineering, & Mathematics) education (Ramírez-Montoya, 2017). Degrees and learning programs related to STEM have drawn particular attention from both teachers and politicians during the last years. Different research works have shown that STEM based education can lead to more efficient worker performance and is critical to increasing a country's innovation capacity (García-Peñalvo, 2016a; TACCLE 3 Consortium, 2017). In fact, there is an important demand of professionals related to STEM. This suggests that it is necessary to attract young students toward these disciplines as stated Eurostats and PISA studies. In addition, and in order to ensure defining successful solutions, an interesting choice is to include the acquisition of creative thinking by including Arts in the equation, in what is known as STEAM (Hamner & Cross, 2013).

However, competences (Morales-Morgado, García-Peñalvo, Campos-Ortuño, & Astroza Hidalgo, 2013) such as computational thinking (García-Peñalvo, 2016b, 2017; González-González, 2019; Wing, 2006), programming or STEAM disciplines (García-Peñalvo, 2018; García-Peñalvo & Mendes, 2018) are not be developed easily by using traditional learning approaches. This is because it is not easy to summarize all this knowledge in a set of subjects without an associated loss of quality, and it cannot be focused only on some subjects or degrees (García-Peñalvo, 2016a; TACCLE 3 Consortium, 2017). This means that new educational approaches are needed and a possible option can be Challenge Based Learning (CBL). It encourages students to leverage the technology they use in their daily lives to solve real-world problems.

The present chapter summarizes RoboSTEAM project proposal, which has been granted by the Erasmus+ Strategic Partnership 2018 Programme. RoboSTEAM project aims to experiment with STEAM integration projects that help learners to develop computational thinking by using/programming PD&R

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