Chapter 85
Robotics-Based Learning Interventions and Experiences From our Implementations in the RobESL Framework

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ABSTRACT

In this article, the author presents Robotics-based learning interventions and the experiences at 56th Junior High School of Athens within the RoboESL Erasmus project; as well as a teaching approach using Educational Robotics. The RoboESL project aims to exploiting the potential of robotics for developing extra-curricular constructivist learning activities in schools that will help children at risk of failure or Early School Leaving (ESL) practice and develop their creativity skills, raise self-esteem, motivate their interest in schooling, and finally encourage them towards staying at school. During the implementation, students worked in a constructionist learning environment and were engaged in team activities. The author runs the project for two consecutive school years using EV3 Lego Mindstorms and participated in dissemination events organizing workshops where the students participated in the program taught elementary school pupils.

INTRODUCTION

In this report we will present our up to now twelve months participation in the RoboESL project. The goals of this project are to exploit the potential of robotics for developing extra-curricular constructivist learning activities in schools that will help children at risk of failure or Early School Leaving (ESL) to practice and develop their creativity skills, raise their self-esteem, motivate their interest in schooling, and finally encourage them to stay at school, as stated in the program's official site (Robotics-based learning interventions for preventing school failure and Early School Leaving, 2015). To go a bit fur-

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ther, we are trying to find ways to help not only students that meet programs' criteria but also students who like to get involved with robots and finally we want all of our students to have a firsthand robotic experience in our school.

Robotics have motivational effect and excite students about science. The process of developing robotic solutions provides a rich and meaningful context for engaging students in Computational Thinking practices and Computer Science content, including work-related 21st century skills. Robotics scenarios can also be used to contextualize other Science, Technology Engineering, and Mathematics (STEM) concepts (Flot, Higashi, McKenna, Shoop & Witherspoon, 2016). In addition to that, according to Organization for Economic Co-operation and Development the next production revolution (NPR) entails a confluence of technologies ranging from a variety of digital technologies (e.g. 3D printing, advanced robotics, etc.) These technologies will have far-reaching consequences for productivity, skills, income distribution, well-being and the environment, as said by the Organization for Economic Co-operation and Development (2016).

Educational Robotics is a growing field with the potential to significantly impact the nature of science and technology education at all levels (Alimisis, 2013). There is lot of robotic toolkits that have been created and could be bought and used in schools. But robots are just a tool, not the solution for everything. As Resnic said (2007) today's students should have educational approaches that help them being creative, because success is based not only on what you know or how much you know, but on your ability to think and act creatively. According to United Nations Educational, Scientific and Cultural Organization Education (UNESCO, 2015) students must have a solid foundation of knowledge, develop creative and critical thinking and collaborative skills, and build curiosity. Demo, Moro, Pina, and Arlegui (2012) state that appropriate learning methodologies such as Constructivism/ Constructionism can strongly contribute to the development of these skills. RoboESL project supports contemporary pedagogical theories in its implementation. Following the above reasoning we participate implementing exemplary and concrete scenarios using constructivist/ constructionist theories and learning models to support our innovative school projects.

We ran this project twice. The first time was during the last trimester of the 2015-16 school year (1st implementation). The team participated consisted of 10 students of 2nd grade, separated into 3 groups. The implementation of this intervention took place, after the appropriate arrangements, during school hours. The second time was the first four months of the 2016-17 school year (2nd implementation). The team consisted of 11 students of 3rd grade separated into 4 groups.

CHOICES AND PEDAGOGICAL FRAMEWORK

Framework - Ages - Selection

The age of the students of Junior High Schools in Greece is, normally, between 13-15. In our school we have students older than 15 because some of them failed to pass their classes (low performance in lessons, absences etc).

The ten students who participated in our first implementation of this program (school year: 2015-16) attended the 2nd grade -because we had in mind that some of them could participate in the next year's RoboESL project, as really happened. Their ages were from 14 to 16 years old. That means that some of them failed to pass their classes once or twice. Students chosen to participate in the program met the