Chapter 86
The RoboESL Project:
Development, Evaluation and Outcomes Regarding the Proposed Robotic Enhanced Curricula

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ABSTRACT

In this article, the authors summarize the development of the first half of curricula designed for the RoboESL project. They then give some more details about the second half of curricula. Through development, the authors adopted LEGO Mindstorms EV3 as an educational robotic platform, the curricula can be adapted to other platforms after some possible simplifications. Having a clear overall perspective of the project, one section of the paper is devoted to providing a comprehensive analysis and some remarks on the expected outcomes.

1. INTRODUCTION

The RoboESL project ('Robotics-based learning interventions for preventing school failure and Early School Leaving' - roboesl.eu) is an Erasmus+ key action 2 funded, two-years long European project dedicated to the development and experimentation of robotic-enhanced curricula aimed at providing new engaging activities in the class. The developed materials should support the use of Educational Robotics (ER) in curricular and extra-curricular activities and lead their experimental evaluation, in order to contrast the risk of Early School Leaving and, more generally, to compensate some possible weaknesses

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of the learners. ER has already proved effective in promoting attractiveness, learning by doing and team work (Sullivan, 2008; Eguchi, 2015; Mikropoulos & Bellou, 2013; Kandlhofer & Steinbauer, 2016), and in rewarding constructive behavior. One of the outputs of the project is the design and implementation of ten exemplary curricula accompanied by some teacher training activities, alongside a preliminary experimentation and evaluation at school.

The curricula provide teachers with a set of well-balanced tools to develop the maximum potential of ER, promoting learning and bringing out diverse capabilities. We are aware that the ER is a powerful tool but the introduction of robotics in classroom has to be subjected to some important conditions to be really effective. The three conditions that we consider absolutely necessary are:

- **Accessibility:** The tools should be easily accessible, both in terms of usage complexity and cost.
- **Pedagogical and Methodological FOUNDATION:** ER does not mean to teach of a specific discipline like robotics, but rather a didactical approach to learning, based on constructivist and constructivism theories. For this reason, the designing and realization of activities involving the use of robots should be supported by a clear awareness about these methodologies and about the aims that the teacher hopes to achieve.
- **Inclusiveness:** the activities should significantly involve all the students, even those with special needs (including in this definition both fragile or weak and gifted students). Teachers should also feel fully comfortable with when working with ER involved, even though the role they play may be different from the way they act in traditional contest (Alimisis, 2012; Ertmer, Ottenbreit-Leftwich, Sadik, Sendurur, & Sendurur, 2012).

Complying with the abovementioned conditions, robotics may become a didactical tool able to support teachers in empowering the students' self-esteem and showing them that life-long learning is an unavoidable requirement for their future activities and successes. All these aspects have a sensitive impact on the main goals of the RoboESL project and have guided the development of the curricula. Each curriculum includes a description, the pedagogical objectives and learning methodologies, the technical guidelines and the evaluation tools in form of a worksheet.

The curricula are almost all oriented to promote new interests in STEAM (Science Technology Engineering and Mathematics, together with Art), without neglecting references to humanistic subjects.

The sequence of the ten curricula has been designed taking into account the following requirements:

- All the activities must be contextualized (i.e. they must not have their aims in themselves) and the contextualization should refer to easily conceivable real-life situations. This aspect is significant for the pedagogical approaches that we want to exploit in our project, like situated learning (Chang, Lee, Wang, & Chen, 2010) and constructionism (Mikropoulos & Bellou, 2013; Alimisis, 2013);
- Each curriculum is built around a basic activity with the addition of some possible variants of increasing complexity, so that it remains accessible to most of the students without limiting excellence, accordingly to the constructivist perspective;
- Programming blocks are introduced progressively and only when their necessity is easily understood by learners;
- All the projects should stimulate teamwork, promoting synergy among the different attitudes of each students.

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