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Activities and experiences through RobES project opportunities

Tassos Karampinis

Abstract

The 56th Junior High School of Athens is a member of the RoboESL program for two consecutive school years. We use interdisciplinary educational robotics' projects discussed in RoboESL meetings with the other members and the committee that support us. Our goal is to help our students improve their grades and change their attitude towards school; especially those who don't like school settings. Our first implementation took place during the last trimester of 2015-16 school year using three EV3 Lego Mindstorms and our second implementation took place during the first four months of 2016-17 school year using four EV3 Lego Mindstorms. Apart from that, we tried to benefit from the hardware obtained by the program resources, organizing workshops where students participating in the program taught elementary school pupils, participating in exhibitions, making after school lessons and trying to introduce robotic lessons in our school curricula as interdisciplinary technology-computer science projects.

Keywords: RoboESL, creativity, educational robotics, EV3 Lego Mindstorms, Problem Based Learning

The development of robotic enhanced curricula for the RoboESL project: overall evaluation and expected outcomes

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Abstract

Theoretical framework

The two-years-long RoboESL European project aims at providing materials, and their experimental evaluation, to support the use of Educational Robotics (ER) in curricular and extra-curricular activities in order to contrast the risk of Early School Leaving and, more generally, to try to compensate some possible weaknesses of the learners. In fact ER has already proved effective in promoting attractiveness, a rewarding constructionism, learning by doing, happy team working, all positive aspects in the expected direction of the project. One of its outputs is the design and implementation of ten exemplary curricula: around these curricula the project includes some teacher training activities together with a preliminary experimentation and evaluation at school. The curricula are inspired by the general principle to promote new interests in STEAM and they are designed in terms of hands-on activities possibly related to real life.

Research design

It is relevant to summarize the requirements that the progression of exemplary projects must fulfill:

- Contextualization;
- Possibility to diversify a curriculum in more or less simple variants;
- Progressive introduction of new blocks of the programming language;
- Promoting team work.

Robotics in a classroom is acceptable and desirable provided it shows these characteristics:

- Accessible;
- Pedagogically and methodologically well-established
- Cost-effective
- Inclusive for students and teachers.

There a general consensus that ER is powerful tool for promoting project-based learning, computational thinking, peer education, team working, learning by doing, Inquiry based education. The abovementioned conditions may empower this potential increase students' self-esteem and make them think more easily that a life-long learning is a no more avoidable requirement for their future activities and success. So all these aspects have a sensitive impact with respect to the main goals of the RoboESL project and they have guided the development of the curricula. Each curriculum includes a description, the pedagogical objectives and learning methodologies, technical guidelines, and evaluation tools in form of a worksheet.

Contents

In the first RoboESL conference we presented the development of the first five curricula and how we organized the teacher training phase. Now the complete set of ten curricula is available and so the overall perspective is also clear. The presentation will show the general development of the curricula and some significant details (the associated paper will enter in deep details specifically for the second half of curricula). It will be also the occasion to offer an overall analysis of the obtained results and some remarks on the expected outcomes.

Keywords: Roboesl, Educational robotics, Mindstorms EV3, Teacher training, Early school leaving.

Robot as agent in reducing risks of early school leaving

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Abstract

The project "Robotics-based learning interventions for preventing school failure and early school leaving" mainly emphasizes educational robotics as learning agents to lessen the risks of school failure and early school leaving (ESL). The reason that this principle was chosen is that students, who are exposed to the risks mentioned beforehand are often disappointed by the educational system, the traditional methods used by the educators; and have lost their learning motivation. It is a common practice to use educational robotics, while working with students who have expressed an interested in programming, electronics, etc, however there are only a few studies on the role of robotics to work with students who are a part of the risk groups of ESL, which is why the results summarized in this study are a significant contribution for the comprehension of the matter. During the project, teachers were prepared to use robots as learning agents, in order to promote the active involvement of students in the learning process by giving them the opportunity to test their acquired knowledge in practice, by constructing the robots and programming their activities. Thus, the educators promoted the students' comprehension of subjects, such as math, physics and programming by using learning agents, while at the same time promoting the development of students' mutual cooperation, peer learning and self-efficacy. Which had a positive impact on students assuming responsibility for their learning achievements and as a result lessened the risks of school failure and ESL.

The aim of this study is to investigate how the robot can be involved in learning process to reduce school failure and early school leaving (ESL) risks.

The research tools make a mix method of investigation including mainly questionnaires before and after activities for students and teachers who were involved, a structured observation tool to collect data from the activity observation. The SPSS programme is used to process the data and analyse them together with the data from observations and discussions with teachers. Data are collected by quantitative and qualitative research methods.

The findings include descriptive analysis, verification of the data, interpretations, illustrations, and conclusions.

Keywords: robot as agent, early school leaving, robotics-based learning

Robotics in a modern school - a necessity and a challenge

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Abstract

Rapid growth of technologies determines to introduce changes in a learning process. In teaching process dominates the knowledge of facts and the competences are not developed sufficiently. For contemporary student it is necessary to teach things for the future, let them experiment, selfeducate and to work in a team.

Robotics is a great challenge for children to learn the basis of programming and construction. It is a new approach to the learning process. The students learn not only to cooperate, but it is an excellent platform for the development of different competences. The comprehension of robotics is significant in many spheres, for example, in maths, information science, physics, languages, natural sciences,computers, music, biology and technology. Robotics is developing many skill: algorithmical and systematical thinking, programming, communication and presentation skill, work in a team, imagination, creative abilities.

´´To Water or Not to Water´´ The Arduino approach for the irrigation of a field

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Abstract

In this paper we present a teaching approach using Educational Robotics within the RoboESL Erasmus project. Having in mind that students ought to have the control of their learning, we adopt contemporary pedagogical theories (collaborative learning, constructionism, project-based learning) and we suggest a novel educational approach in order to encourage the weaker students to maintain a positive attitude towards school by preventing school failure and Early School Leaving. The proposed activity, entitled "To Water or Not to Water", was suggested by the students after the end of RoboESL program and examines the optimization of the irrigation procedure. Students were organized in teams and designed a full automated system based on Arduino Uno platform, which took account all the necessary factors related to the given problem. The proposed approach motivates students to experiment within an environment that promotes inquiry, in order to find solutions to technical issues related with a given problem. The proposed methodology was based on "hands on" learning through the interaction between students as well as by the direct feedback from the automated system.

Keywords: Robotics education, Early School Leaving, RoboESL, Arduino, constructionism, project-based learning, irrigation.

From being past RoboESL students to becoming Robotics-teacher assistants

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Abstract

Robotics-based learning provides a very useful tool in education. The impact in students' attitude is very vivid that they often become teacher assistants in fresh to Robotics pupils. With this study the author presents how previous prone to failure students (of RoboESL Program) became active Robotics-teacher assistants.

Keywords: Robotics, Robotics-based learning, Early School Leaving, School Failure, educational robotics, RoboESL.

Teacher Education in Educational Robotics: the ROBOESL Project discourse

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Abstract

This paper introduces the teacher education part of the European project ROBOESL (Robotics-based learning interventions for preventing school failure and early school leaving).

Early school leaving (ESL) is a long process of school disengagement closely connected with school failure. Rarely a single factor lies beneath ESL. However, many students failed in school or early school leavers identify the curriculum as discouraging factor towards staying at school, find educational content boring and not related to real life. They are rarely offered with opportunities to develop their creativity, to work on hands-on activities and to learn practical skills useful in their life. In addition to these, teaching practices are indicated as dry and far beyond students' needs.

During last decade, studies assure that Educational Robotics (ER), if coupled with a suitable learning framework such as Constructivism/Constructionism (Piaget, Papert) and project-based learning methodologies, can create an attractive learning environment keeping students interested and motivated with hands-on, fun learning activities that promote children's creative thinking, teamwork, and problem solving skills.

However, ER is often introduced in schools as suitable only for science and technology majors or for talented children. Very differently from this misconception, the ROBOESL project introduces ER as a learning tool for all the children with focus on those at risk of school failure and ESL. To this end, a training curriculum was designed accordingly for teachers to enhance educational robotics uptake in teaching and learning using innovative, learner-centred and constructivist pedagogical approaches.

ER methodology requires that learners themselves are active with a high need to explore, to discuss and to share experiences and ideas. Hence, teachers in ROBOESL training courses are encouraged to change their role to facilitators and enablers. They learn to design and implement relative simple robotic projects in the context of scenarios from everyday life using robotics kits such as Lego Mindstorms. The curriculum emphasizes that it's acceptable for teachers/learners to fail during their projects; experiential learning and learning by making is highly appreciated; so instead of giving them step-by-step instructions, they are advised to try and figure out how to do it themselves.

ROBOESL training activities have served as the primary medium for supporting school partners' staff to implement projects with their students. Two short joint staff training courses have been carried out so far combining short physical mobility of staff with the use of an e-class to enable staff to implement the learning activities in schools. Finally a 3rd course is planned in the end of the project for partners to make reflections on experiences, best practices and lessons learned.

Keywords: educational robotics, teacher education, ROBOESL project