Educational Robotics and Asynchronous Learning Platforms: A Powerful Combination to Enhance Education in Special Schools

Paraskevi Papadopoulou
MSc Applied Informatics
Department of Computer, Informatics and Telecommunications Engineering
International Hellenic University, 62124, Serres, Greece

Alkiviadis Tsimpiris
Department of Computer, Informatics and Telecommunications Engineering
International Hellenic University, 62124, Serres, Greece

Dimitrios Varsamis
Department of Computer, Informatics and Telecommunications Engineering
International Hellenic University, 62124, Serres, Greece

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Abstract

The aim of this study is to combine the benefits of an asynchronous training platform with the advantages of educational robotics, in order to improve learning opportunities of special education schools. The main objective is to develop a course in an asynchronous platform, which can be used easily by teachers of special schools without any knowledge of educational robotics and programming. The content of this course and the corresponding educational material, follows the special school’s study framework, adapted to the curriculum of the students with mental disabilities. The thematic modules of the course include many teaching tools, like texts, videos, sounds, robotic constructions, step by step instructions. Each thematic module is organized to guide the users in order to achieve a feasible and measurable educational goal.
Keywords: asynchronous education platform, educational robotics, mental disability, special education courses

1 Introduction

In the international literature there are several studies that demonstrate the potential of robotic technology for the development of skills in children with disabilities and its usefulness in the context of inclusive education. According to this, it seems that educational robotics can help the specific population to interact with the environment, promote exploration and learning opportunities, to develop social and interactive behavior, to improve independence and to engage constructively while (Adams, 2017). Educational robotics can be an important factor in building self-esteem and empowering children with disabilities, allowing them to control their own robotic device while exploring the environment (Eguchi, 2010). Kook and Kim (2010) used a robot in play activities to compare students’ cognitive ability and development with and without disabilities while students handling objects and participating in games were found to improve cognitive, social, motor and language skills (Kim, 2010). Neto and his colleagues set up an educational robotics lab for 24 students from public schools that included students with Down syndrome. The authors concluded that educational robotics promotes the interdisciplinary, inclusive education of students with disabilities (Neto, 2014). Since 2011, Conchinha and his colleagues have been dealing with students with a variety of disabilities including mental disability. Children program and interact with a robot according to the instructions provided in the manual, applying programming exercises. Although students follow the instructions provided, they are given the opportunity for autonomy and learning skills through the testing process. (Conchinha, 2011) The advantages of educational robotics are constantly confirmed by new research data, however there are some difficulties in its application in practice. The absence of the necessary equipment is hinders its implementation in the educational process. The shortcomings are mainly related to the necessary educational robotic packages with material for the creation of robots, shortcomings in the technological equipment of the school such as computers and computer rooms (Cuban, 2001). The pedagogical process in educational robotics focuses on the student who is called to make various artifacts. Naturally, equipment damage is likely. Equipment needs to be repaired or replaced, which is difficult for a public school to manage (Khanlary, 2015). Another deterrent to the use of robotics is the lack of knowledge of teachers about this subject. Generally, there is a difficulty in new technologies which is further strengthened in the case of robotics where the combination of many technologies is required (Khanlary, 2015) (Magrato, 2014) [?].
The selected cognitive objectives will be presented below, in the analysis of the modules of the course. The teaching methods used in the formulation of the teaching plans are the following: a) multi-sensory teaching methods, b) guided learning, c) repetition, d) individualized teaching, e) constructivist constructivism. Simple and interesting activities for children were selected. The constructions with the LEGO WeDo 2.0 robotics package contained in the teaching plans are easy and quick to assemble. The code proposed for the construction planning is simple and does not contain complex commands. The chosen platform is the Open e class, one of the most well-known and popular, used for asynchronous education and freely distributed. This platform mainly seeks the integration of new technologies, correct and effective use of the internet in the educational process (Openeclass.org, 2020). The educational robotics package in the lesson plans is the WeDo 2.0 Core Set. This is a basic package that comes with free software and is designed for elementary school students. It is made by LEGO to enhance students’ skills in science and offer them in a simple and playful way, knowledge of engineering and programming (education.lego.com). The Wondershare Filmora application was used to edit videos uploaded to the e class platform. Wondershare Filmora is an easy-to-use and modern video editing software. (Filmora.wondershare.com). One of the applications used to create exercises-games that have been uploaded to the e-class platform, is the Wordwall application. Wordwall can be used to create interactive and printable activities (Wordwall.net).
2 Implementation

These are the main results of the paper. The course titled: "Special education courses using educational robotics", consists of seven modules. All cognitive areas and goals, are compatible with the curriculum proposed by the pedagogical institute for people with intellectual disabilities. Picture of the course structure as presented on the e class platform:

The modules that have been selected to be developed concern:

Diagram 1: Cycle of Interaction

- 1st: Introduction of students to LEGO material
- 2nd: Presentation of the LEGO WeDo 2.0 package /Presentation of programming commands
- 3rd: Comprehension of spatial concepts: Forward-Backward
- 4th: Comprehension of spatial concepts: Up and Down
- 5th: Comprehension of time concepts: Slow-Fast
- 6th: Comprehension of basic colors. Red, Yellow and Blue
- 7th: Comprehension of the hand washing stages

The course is designed so that the content of each section can be easily understood. For each section there is a relevant picture as well as a short description that concerns its objectives. Specifically, the first two modules, which are preliminary courses, concern the introduction of students to the LEGO material and the presentation of the LEGO WeDo 2.0 educational robotics package that is used. In addition, the basic programming commands are presented. These courses are considered necessary to precede the rest as they offer basic knowledge to students, but also provide valuable information to teachers.
Subsequently are presented the rest of the sections on space-time concepts, basic colors and the hand washing process. In order to successfully consolidate the above concepts, the specific sections contain comprehensive teaching plans, with a variety of activities. The activities related to educational robotics are accompanied by detailed instructions. All suggested activities, are available on the platform or described in detail. The general goal is the easy effortless of the course by teachers, regardless of their level of knowledge in robotics and technology. In detail, each section of the course contains the following:

- Lesson plan
- Presentation of the lesson plan, divided into activities
- Video describing the activities
- Instructions for construction with LEGO WeDo 2.0 building materials, presented with pictures
- Instructions for construction with LEGO WeDo 2.0 building materials, presented with video
- Instructions for the proposed constructions
- Recommended video links
- Links to online games in the WordWall application
- Worksheets
- Evaluation sheets
- Questionnaire from the platform tools

Each lesson plan includes the objectives, teaching methods used, materials needed, and activities suggested. The same lesson plans are given in the form of a presentation. In addition there is a video for each lesson where the activities are analyzed and additional examples and alternatives are given. For the proposed constructions with LEGO WeDo 2.0, instructions are given in two forms, a step-by-step presentation with images and video. For any construction included in the teaching plan, there are detailed instructions.

The videos that are suggested to be presented to the students are in the form of a link. The same goes for games that have been created to consolidate concepts. In addition, worksheets are provided that allow the teacher to examine whether the students have achieved the objectives. Finally, a ready for use self-assessment sheet is given for both student and teacher.

http://83.212.59.112/projects/eclass/courses/137/
Figure 1: Video instructions for back-and-forth movement of the robot

Figure 2: Step by step building instructions for robots

3 Conclusion

After the end of the paper and the completion of the course on the platform a number conclusions can be drawn. The visualized and descriptive structure of the course makes it easy to use, even for a teacher with limited knowledge of technology. The files are placed in each section in the order in which they should be studied and implemented. As a result, the lesson on the platform will be a useful and easy-to-use tool for a special education teacher. The activities proposed and the teaching methods used in the lesson and its sub-
sections, succeed, according to the author’s experience, to maintain the interest of students with intellectual disabilities and be effective. In particular, the activities related to educational robotics manage to spark the imagination and creativity of children. In each action proposed, many alternatives are given so that it is easier for the teacher to adapt them to the needs of each of their students. The constructions are simple and the explanations are given in simple and understandable terms. In summary, in case a special education school could acquire the LEGO WeDo 2.0 educational robotics package, the course developed on the platform would be a very useful tool for any teacher who would like to integrate educational robotics and new technologies in their class.

References


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