Educational Robotics and Down syndrome: Investigating student performance and motivation

Kalliopi Aslanoglou
University of Thessaly
Department of Special Education
Volos, Greece
kaslanoglou@uth.gr

Theodora Papazoglou
University of Thessaly
Department of Special Education
Volos, Greece
thpapazo@uth.gr

Charalampos Karagiannidis
University of Thessaly
Department of Special Education
Volos, Greece
karagian@uth.gr

ABSTRACT

This paper addresses the implementation of a particular didactic scenario using educational robotics in special education and examines its impacts. It reports on a single subject experiment study which involved the design, implementation and evaluation of a didactic intervention in which a child with Down syndrome (CDS) constructed and programmed a programmable robot, using the Lego Wedo 2.0 kit, in order to learn about one particular subject of History (the Odyssey in Greek Mythology). The research questions are related to the impact of this particular educational robotics intervention on the performance of the child and the motivation to participate. The qualitative results collected through initial/final evaluations, interviews and non-participative observation are very encouraging. It seems that there was a positive effect both on the performance and motivation of the child. Educational robotics seem to offer new opportunities and potentials in alternative education of children with Down syndrome.

CCS CONCEPTS

Human-centered computing; Empirical studies in HCI

KEYWORDS

Special education; down syndrome; educational robotics; history; performance; motivation

ACM Reference format:

Kalliopi Aslanoglou, Theodora Papazoglou, Charalampos Karagiannidis. 2018. Educational Robotics and Down syndrome: Investigating student performance and motivation. In *Proceedings of Software Development and Technologies for Enhancing Accessibility and Fighting Info-exclusion 2018 (DSAI 2018). ACM, New York, NY, USA, 7 pages.* https://doi.org/10.1145/3218585.3218600

DSAI 2018, June 20-22, 2018, Thessaloniki, Greece

https://doi.org/10.1145/3218585.3218600

1 INTRODUCTION

Educational robotics (ER) is a broad term that refers to activities, educational programs, platforms, sources, and pedagogical philosophy with the use of particular robotic packages. In the last decades, research interest in educational robotics has begun to increase worldwide. That can been attributed to the fact that children seem to have a particular interest in new technologies such as robots and are enthusiastic when they come into contact with these applications 0. The different kinds of programmable robots with autonomous capability to complete specific missions within a changing environment offer new opportunities for innovative as well as alternative ways of teaching and learning 0.

ER can be related to various subjects and in this way can help children come in contact with basic programming concepts. Moreover, with ER teachers can create a learning environment in which children can interact in order to deal with problems of the real world, and work towards a reasonable and feasible solution. ER can be an innovative educational tool for children in order to gain basic building and programming experiences 0. With robotics children can learn concepts of science, engineering, technology and mathematics. In addition, they can improve their social skills as well as design, communication and creativity skills 0. There are indications that ER can help the performance of typical development children 0. It is considered a pioneering technology which combined with the appropriate educational method could lead to encouraging results on motivation and learning.

In the recent years, there has been keen interest in educating children with Special Educational Needs and improving methods in order to reduce possible barriers to their learning. However, research in ER for the teaching and learning of children with special needs is limited in the literature worldwide and especially in Greece. Some studies, that were conducted with students with special needs, concluded that the students were ready to plan, start and continue even a difficult task when ER was used in the appropriate way 0. It is also well known that in the teaching of children of typical development as well as children with different disabilities, ER can help them maintain their attention to the teaching process for a long period of time as well as their level of participation high 0. It is also supported that technology accompanied with student-centred methodology can offer to students worldwide new possibilities to learn and put into practice important cognitive and social skills 0.

ER education requires the construction and programming of a robot to perform a mission. According to the relevant literature, typical development children can easily meet these requirements 0, while positive indications exist also in the special education domain 0. In the past few decades, research about the connection of ER with the education of children with special needs (e.g. autism) has begun to attract the interest of researchers and educators. We should take into consideration that students with special needs need major modifications and adjustments to the curriculum and the educational tool itself. Moreover, their education requires much and useful knowledge as well as necessary professional skills 0. Related literature does not include studies which connect ER with the education of students with Down syndrome (SDS) especially in Greece.

2 PURPOSE OF THE STUDY AND RESEARCH QUESTIONS

The objectives of this study is to investigate whether the use of specific educational activities using an innovative technological tool, such as educational robotics, can contribute to improving the performance of a child with Down syndrome in some key objectives related to the History and in particular the Odyssey. In addition, it examines whether the child can understand in a satisfying level basic concepts and programming commands (visual programming). At the same time, it aims to study whether the use of educational robotics can increase motivation, participation, and the maintenance of the attention of this particular child with Down syndrome child.

So the research questions of this particular study are:

1) Can the use of educational robotics enhance the performance of a Down syndrome child in a particular cognitive field (Odyssey)?

2) Can the use of educational robotics enhance the motivation of a Down syndrome child during the educational process?

3) Can a Down syndrome child understand basic robotics' concepts and operate the main functions (robot construction and visual programming for a mission)?

3 METHODOLOGY

Methodology is an important part of every study since it presents and justifies the way in which a survey was organized and conducted. In the present study, the methodology is that of qualitative research. To be more specific we used the single – subject experimental study in which the participant was one child with Down Syndrome. The research tools are that of qualitative research (initial/final evaluations, interviews and non-participative observation) with the use of some quantitative research tools as complementary. The research analysis was mainly content analysis and some quantitative estimations of scores. There was a particular research procedure, the participant was chosen, extensive information about the child's background was collected and analysed and the research questions and methodology were formed. It should be noted that the objectives and the activities were based on the interests and weaknesses of the particular child.

3.1 Participants

In this particular the participant was a child with Down's Cognitive Disability Syndrome. The participant is girl that was chosen based on specific criteria (attending Primary School, Official diagnosis with Down Syndrome, cognitive difficulties). This particular child has official Down syndrome diagnosis, so it is especially important to investigate whether this child will be able to respond successfully to educational robotics and that eventually learning the Odyssey will be more effective using this alternative means than with traditional way. In addition, as mentioned above, the other criterion was that the child (although she is a thirteen-year-old), she attends Primary School and faces cognitive difficulties in various subjects including History and Language. It is worth mentioning that there was already a prior acquaintance of the researcher with the child.

Taking in to consideration the age of the child, we chose the suitable educational kit (Lego Wedo 2.0 with compatible software), educational robotics kit that is addressed for children attending Primary School. This Lego Wedo 2.0 educational robotics kit includes sorting discs, sensors, labels, tilt sensor, motors and several components for students. Desktop and tablet-backed software provides a handy programming environment and includes the WeDo 2.0 course package covering life, physics, space and space science and other engineering projects.

It worth mentioning that the child was facing difficulty in the cognitive field of History, in maintaining information in memory and her narrative ability was poor and limited in small phrases. At the end of the research it will be ascertained whether, finally, educational robotics as a new technology helped to reduce the difficulty in these areas.

This study was conducted in the context of an undergraduate thesis of the first researcher in the Department of Special Education of the University of Thessaly (Greece). Support was offered from the second researcher who is a PhD candidate in the same Department and was present in all the meeting with the child and offered help into the planning and implementation of this particular research. The supervisor of this thesis was a Professor in the same Department (third researcher) who offered valuable support with his expertise in New and Innovative Technologies and Special Education.

In the survey, the first researcher was the educator who organized, planned and carried out the activities and generally all research. The second researcher provided support for the equipment, the planning and the implementation of the research and the third researcher was the supervisor Professor The place for the meetings was the New Technologies-Computer Laboratory of the Department of Special Education, which was clear from noises and other elements that would cause discomfort or distraction to the child and would have made it difficult for her to concentrate.

3.2 Characteristics of people with Down Syndrome

Most of the children born with Down Syndrome are identified by their birth because they have some external features. More specifically, they have a broad and short skull on the back with loose skin in this area. Their face looks flat, the eyes oblique in the shape of an almond, the eyelids thick, the lips thin and dry with cracks, the teeth small and bad. In addition,

the hair is thin, straight and short, hands and feet close and wide with thick fingers, weight and height at birth smaller than normal and muscle tone is reduced resulting in sluggishness 0.

The characteristics of these children also relate to cognitive abilities and behaviour. Their index of intelligence ranges from 35-70, with girls showing an overall mild mental deficiency. Language development shows normal growth, but slows down during the first two years as a consequence of the slow rate of myelination. As far as language development is concerned, children in this syndrome are slow to speak, their mouth muscles respond slowly, creating joint problems. Linguistic perception is less problematic than linguistic expression 0. As far as narrative capacity is concerned, it is lower than that of typical children. The reason is telegraphic and of course the use of links, molecules and functional words limited. When the dialogue is predominant, children with Down syndrome often do not start a discussion, they do not enrich a subject, but nevertheless, as has been found, they respond to clarifications when asked. The acoustic short-term memory of these children lags behind the optic 0. However, children with Down syndrome in the field of social skills show very high performance, a feature that stands out immediately. Finally, it is characteristic of children that they are easily anxious when their usual program is changed and thus have a lack of attention and planning 0.

The particular girl who participated in the research presents the characteristics of children with Down syndrome. To be more specific, she has shown delay in her development stages. As far as her language development is concerned, she had a smooth linguistic development. However, the use of complex phrases has seemed to have delayed. Also, she does not use gestures, but imitates quite a number of acts, behavior which is maintained until now. Difficulties also arise in narrative ability, as she cannot engage in dialogue and does not have the capacity to enrich her speech on a particular subject. In addition, she faces difficulties in self-programming her daily routines and life. In the classroom she is usually distracted and unwilling to participate because loses her interest easily but she is not hyperactive. As far as her fine motor abilities are concerned, she presents some serious difficulties.

It must be noted that her memory capacity is high because she has a very well-functioning short-term memory, but not so good long-term with the exception of some events that have impressed her. It is important to emphasize that, regarding the history lesson, she presents considerable difficulties both in narrative ability and in the description of events and the maintenance of them in her long-term memory. Finally, she is characterized (by her family and teachers) as an extremely social person with developed social skills and cooperative personality.

3.3 Procedure

The study used the qualitative method because it describes and understands individual phenomena and contains a small sample. The difference in quantitative and qualitative data in social research is, in fact, the difference between numerical and non-numerical data 0 The research may have followed the qualitative method, but it also used some quantitative tools. The study can be characterised as an "experimental study with one subject", is an empirical investigation that belongs to qualitative research and aims at the study of specific cases and tries to draw conclusions through continuous measurements 0.

It is important to mention how the experimental study was designed and implemented. The experimental study with one subject follows specific stages. Initially, a semi-structured interview was conducted to obtain information for the cognitive and general profile and background of the child. Then, an initial evaluation was carried out with specific relevant activities without introducing the independent variable (intervention with educational robotics) and the child's score was recorded. The intervention phase followed, where the independent variable was inserted and measurements of the dependent variable (performance and mobilization) were performed at seven consequent meetings. The level of the child's motivation and participation was measured with specific research tool and observation in all the meeting of the main intervention phase. Finally, the final evaluation of the performance (the same as the initial) was carried out and the results are compared with those of the initial evaluation. A re-evaluation was carried out after 1,5 months to draw conclusions about the maintenance of the results. These evaluations are crucial for research process because important information is gathered, recorded and used to conclude to the results of the study 0.

3.4 Educational objectives

According to the educational objectives set for the intervention, the child should be able to:

1. narrate/reproduce the adventures of Odysseus (1st research question)
2. keep in memory the adventures of Odysseus (1st research question)
3. improve her narrative ability (1st research question)
4. participate in the educational process and show high level of motivation (2nd research question)
5. distinguish programming commands, connect the robot to the computer and finally execute and operate the program (3rd research question)

3.5 Intervention Meetings

1st meeting: Initial evaluation.

Description: At this meeting several activities were conducted and the record sheet of the initial evaluation was completed to verify the child's knowledge in the particular field of knowledge, using images with destinations of Odysseus and appropriate questions (Figure 1).

2nd meeting: Construction, programming and connection of the Odysseus' robot-ship.

Description: At this meeting, the child built the robot-ship using step by step instructions, programmed it using commands and connected it to the computer (Figure 2).

3rd meeting: Teaching the Odyssey using the map and the robot without programming it.

Description: At the third meeting, a power point presentation (made by the first researcher) was used, and the child put and stuck images of each destination on a large map on a desk. Then, the child narrated the events of each destination with the help of the researcher and the pictures on the map. Her narration was

accompanied with the movement of the robot (with her hands) without it being programmed to work automatically (Figure 3).

4th meeting: Narration of Odyssey using and programming the robot-ship to travel from destination to destination.

Description: In this meeting, with the help of the pictures, the child programmed the robot to travel from destination to destination, making measurements with non-typical measuring instruments (colorful markers). In this meeting she tried to figure out a way of making the right number of steps in order the robot to reach each destination.

5th Meeting: Composition of the Odyssey with the use of educational robotics and speech development activity. measurements and the right programming. At each destination, the details of the events were reported and attempts to expand her speech, narrative ability and verbal expression were made using questions. (Figure 4).

Description: At the fifth meeting was the combination of all the above, that is, the map was used and the child programmed the robot to travel to all the destinations, making the appropriate.

6th meeting: Final evaluation.

At this meeting, the child was able to program the robot-ship to travel to the destinations. of Odysseus and to narrate some details about his experiences in each one of them.

7th meeting: Re-evaluation after a period of 1.5 months.

Description: The same research tools and procedure were used for the re-evaluation as the final evaluation was followed.

The following figures are photos taken during the intervention and show examples of the material and activities.

Figure 1: Images for the destinations of Odysseus used for the intervention (initial/final/ re-evaluation and main research phase)

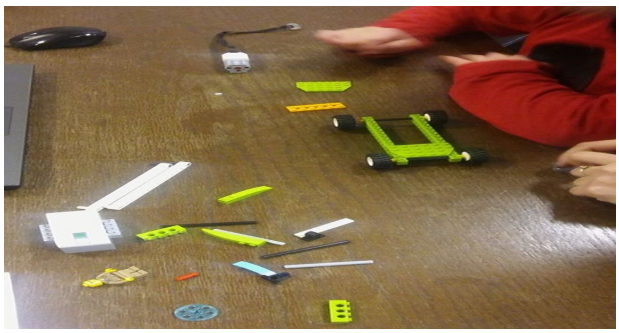

Figure 2: Robot construction with instructions

Figure 3: Images of each destination on the map

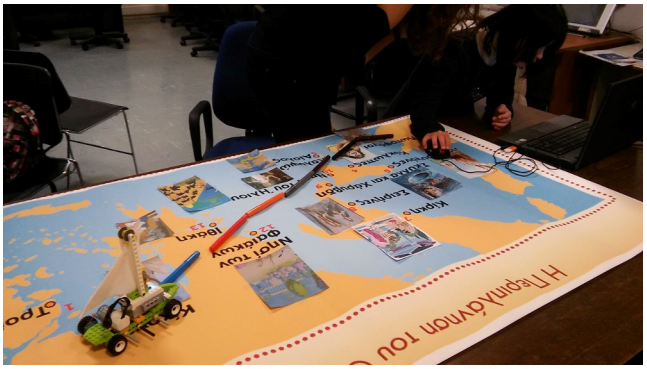

Figure 4: Interventions with the Robot and the Odyssey map

3.6 Data collection and analysis

Data collection and analysis tools were qualitative and some quantitative (estimation of scores). In particular, we followed a semi-structured interview with parents and educators of the child in order to obtain valuable information about the child's cognitive and general background. Then, the main intervention was made using the tools of the initial and final evaluation and the observation key of the motivation based on specific axes 0. The observation key of the motivation included factors such as the child's behaviour, desire, interest in the whole didactic process with emphasis to the interaction with the educational robotics tool. As far as the initial evaluation tool was concerned, this was a record-sheet that included the destinations with their names and events, which were recorded as correct or incorrect depending on the child's answers with some additional comments by the researcher. The final evaluation tool was the same as the initial evaluation with the addition of the programming area that the child was taught. Finally, the re-evaluation tool was the same as the final evaluation tool in order to draw conclusions for the maintenance of the results. The analysis of the results that were collected, was mainly content analysis, with some additional measurements of scores for the performance.

4 RESULTS

The results of the research are presented in turn according to the research questions described before:

4.1 Performance

In the initial assessment, the child's score of the correct answers was 1/13, that is one correct answer to the thirteen destinations of Odysseus examining their names separately, but also the narration of the events-details. At the first meeting of the main intervention she managed to meet the demands of the robot to a large extent and effectively. In particular, she was asked to follow the instructions for the construction and whenever it was difficult to provide support and guidance from the researcher. At the points that the child encountered difficulty were those that were very small but she still insisted on completing them without any help.

As the meetings of the main intervention proceeded, she started to manifest better performance. As far as the subject of Odyssey was concerned the child was helped by the map, the numbers on the destinations and the pictures in order to report the destinations and some basic comments-details about them. The results of the next meetings were positive, we put pictures on the map and they attracted her attention, the numbers helped her to remember the order of the destination, while the introduction of the robot and its programming kept the child concentrated on the task. She faced difficulty in joining the beginning point with the final destination. While showing the next destination, she could not place the robot in the right direction to 'look' at the next destination. To overcome this difficulty, we used colour markers and the marker's point looked in the direction to which the robot should go. Of course, in addition to the difficulty in linking the destination, there was also difficulty in narrating the events which took place at each destination which according to the literature is a significant deficit and difficulty for children with Down syndrome 0.

As the meetings proceeded, she didn't find so much difficulty because she seemed to like the robot programming and she was doing the commands very willingly. What complicated it was the creation of complete verbal phrases and at first, she was reluctant to express herself, but then she did it on her own, and could not continue if she did not narrate the events. She started gradually to remember all the details from the destinations and the programming. Through the interventions and through the evaluation process followed, there appeared to be a major increase in child performance in all activities with an increase in her verbal expression, that is to say narrative ability, which was one of the child's main deficits 0.Generally, during the main intervention and engagement with the robot, an increase in performance was observed since she managed to recall correctly all the destinations and the basic events forming more complete phrases.

From this final evaluation the results were equally important because we observed the same score as the last intervention meeting, that is to say score 13/13. To be more specific, she put in the correct order the destinations, told their names correctly, and programmed the robot in the appropriate way as well as narrated the facts of each destination with basic details. The difficulty that she met was in the sequence of the destinations but with regard to for the events she remembered them and there seem to have managed mnemonic maintenance. When the map and the robot were used, this difficulty with the destinations was not met and the child moved and he programmed the robot – boat with correct way. At the final evaluations she was given a little help for the details of the two destinations with certain questions and encouragement. We can conclude that, through the whole intervention and mainly comparing the initial and final evaluation, it has appeared a significant increase and improvement concerning the performance, narrative ability and operation of the robot programming by the child.

4.2 Programming concepts and operations

The second activity of the first meeting concerned the introduction of programming. To learn the programming (Figure 5) images with basic commands were introduced. These pictures helped the child and she did not face any serious difficulty in the programming. Of course she had to repeat the process several times in order for her to understand and operate it correctly and without any help. She often struggled to remember the "speed" command, but she did not have any other difficulties and showed joyful willingness to continue. With regard to the use of the computer to construct the robot programming, it was only difficult to use the mouse where the icon had to be extended and drawn into the table where the commands were placed. Because she had already been accustomed to the commands through the use of the pictures, she did not find it difficult to identify or place in order. As for the connection of the robot to the computer, it was not difficult for the child, because the robot had a button that became blue when it was connected to the computer (function which impressed the child).

In the end the programming and the discrimination of commands was evaluated (forward direction, rear direction, start, end, speed and time) and the connection of robot as well as the making and implementation of program. While the programming was something new for the child and she came in contact with them for the first time we did not do any initial evaluation for this. From the final evaluation of process of programming and the commands (score 9/9), we can support that there was no difficulty in the programming and the commands and no difficulty in the connection of the robot and the implementation of the program.

Figure 5: Images of the commands of Educational Robotics (Wedo 2.0 software)

4.3 Motivation

As far as the motivation is concerned, it was evaluated at all meetings through observation and there have been positive

indicators. To be more specific, we observed high level of motivation through factors such as the desire to engage (verbal and non-verbal), the time of contact, the time of engaging in activity, the external encouragement-prompt, the desire to complete the activity and the interest of the child. In all meetings and in all areas, she showed positive behaviour and had a pleasant mood and cooperative behaviour (expressed behaviour), usually expressed positive feedback and followed the activities without pressure (desire to engage), while her eyes were focused on activity during the longest period of activity (contact) and hands only dealing with the material (hands-on activity time). In addition, she usually needed a small amount of prompt to continue and complete the activity (external prompt), never abandoned the activity unless it had completed it (desire to complete the activity) and throughout the educational process the robot and the programming attracted the interest of the child (interest). Of course, there were certain moments when she was reluctant to engage in this activity but this was in cases related to the learning of Odyssey, because the learning of the particular field of knowledge has been combined with the traditional way of teaching in the past. By using robotics and programming. However, the interest of the child was expressed in verbal and non-verbal way by the participant during the whole process.

4.4 Re-evaluation

Regarding the re-evaluation meeting after some time (1,5 months), results were as positive as those of the final evaluation. More specifically, regarding performance, she remembered almost all the names of the destinations, having difficulty in two destinations and in their sequence. But with little help from researcher she found the right answer. With regard to the events-details that occurred at each destination, it encountered no difficulty and recalled the majority of the names of the destinations (11/13) and all the details-narration of events (13/13). As for the programming she recalled successfully all the commands (6/6) and the connection of robot as well as the making and the implementation of program (score 9/9). The level of motivation was again high with positive indicators and the child showing and expressing enthusiasm and willingness to participate.

5 CONCLUSIONS AND FUTURE WORK

In conclusion, the results from this study indicate positive results and Educational Robotics seemed to have contributed to these. Concerning the research questions, performance has improved significantly, motivation indicators have emerged, and some basic programming concepts and commands have been understood and effectively operated by the child.

This study aims to enrich the existing literature with new data on the material, the activities, the tools and the way they can be implemented in order to have a positive impact on the learning of children with Down syndrome 0. It has also put into practice a new educational tool such as Educational Robotics, collected data and drew results in the teaching Greek Mythology to a child with Down Syndrome. At the same time, it has presented some issues and concerns which need to be taken into consideration regarding the education of Down syndrome children using educational robotics 0. In addition, this study is one of the first studies in Greek Literature concerning the benefits of using Educational Robotics in teaching children with Down Syndrome.

On the contrary, the limitations of this study concern the small number of participants involved in the study and the small number of meetings, but this was due to the limited time. One other limitation is that the study was a small-scale research done in the framework without many research tools and without many participants. In addition, the use of images on the Odyssey map may have attracted the interest of the child and facilitated its learning and the extraction of positive results. In other cases, without the use of images, the results may have been different.

It is advisable in the future to expand this research having more time for doing more evaluations. Furthermore, in future it is important to carry out similar studies with a larger sample or participants with different special educational needs, even comparative studies with typical education students. Consequently, other tools and educational robotics kits could be utilized in different subjects or similar research could be repeated with additional activities.

To conclude with, it is worth emphasizing that the positive results of this study cannot be attributed exclusively to the educational robotics kit, the activities or to its use in the educational process. The combination of many elements can contribute and have a positive effect on learning especially in special education. The results of this study are not applicable to the entire population of individuals with Down syndrome. However, this study is one first research effort towards finding, designing, creating specific and innovative educational material, and making appropriate use of it with a student-centred method in the learning of children with Down syndrome and can be used for future research.

6 ACKNOWLEDGMENTS

We would like to thank the child who participated in the study as well as the parents and educators who gave us their permission and important information about the child's cognitive and general background. It is also necessary to thank the University of Thessaly and especially the Department of Special Education for providing us the appropriate equipment, the space and the valuable support in order to conduct this particular research.

7 REFERENCES

[1] PEKaP (Greek Union of Computer Science Teachers). (2010). Educational robotics in elementary school, (dide.ilei.sch.gr/keplinet/education/docs/pekap_edurobotic.pdf, last access 01/03/2018)

[2] Raptis, A., & Rapti, A. (2014). Learning and teaching in the information age,Volume 1. Athens. Aristotle Raptis Vasaiou.

[3] Alimisis, D. (2013). Educational Robotics: new challenges and trends. Themes in Science and Technology, 63-71.

[4] Johnson, J. (2003). Children, robotics, and education, Artif Life Robotics. ISAROB.

[5] Margetusaki, A., Anagnostakis, S., & Michaelides, P. (2008). Informal learning in an educational robotics environment. 4th Greek Conference on Didactic of Computer Science, Patra.

[6] Kärnä-Lin, E., Pihlainen-Bednarik, K., Sutinen, E., & Virnes, M. (2006). Can Robots Teach? Preliminary Results on Educational Robotics in Special. 6th International Conference on Advanced Learning Technologies. IEEE Computer Society.

[7] Andruseac, G. et al. (2015).Benefits of new laboratory tools in research and education. Recent Advances in Computer Science, 19th International Conference on Computers. Zakynthos.

[8] Anagnostakis, S., Margetusaki, A., & Michaelides, P.G. (2008). Possibility of a robotics educational lab in schools. 4th Panhellenic Conference on Computer Science Teaching. Patra.
[9] Karatrantou,A., Panagiotakopoulos,Ch., & Pieris,E. (2006). Lego Mindstorms removable constructions in the distribution of natural physics in the primary school, Information and Communication Technologies in Education.
[10] Terzidis, S., Goumanakis, G., & Spyratou, E. (2009). A proposal for teaching systems. 5th conference on syropets in education. Syros.
[11] Pennisi, P., Tonacci, A., Tartarisco, G., et al (2016). Autism and Social Robotics: A Systematic Review. Autism Research, 165-183.
[12] Polychronopoulou, S. (2010). Children and teenagers with special needs and potential, Volume B. Athens. ATRAPOS.
[13] Sarafidou, C.-D. (2011). Bridging quantitative and qualitative approaches: Empirical Research. Athens. Gutenberg.
[14] Babbie, E. (2011). Introduction to social research. Athens. Criticism.
[15] Agaliotis, I. (2011). Educational assessment of pupils with learning and adaptation difficulties: The Assessment System of Learning Needs. Athens. GRIGORI.
[16] Mautone J. A., DuPaul, G. J., & Jitendra, A. K. (2005). The effects of computer-assisted instruction on the mathematics performance and classroom behavior of children with ADHD. Journal of Attention Disorders, 9, 301-312 .
[17] Darais, K.A. (2002). Reading, writing and people with Down syndrome. Thessaloniki. University Studio Press.
[18] Viazis, A. -O. (2012). Genetic Syndromes Related to Cognitive Deficiency - Mental Delay. Clinical Pediatric Psychology, 314-355. Thessaloniki. GOTSIS.
[19] Virnes, M. (2008). Robotics in Special Needs Education. *IDC 2008 Proceedings - Doctor*