

IT and Technology & Design Teachers Views on Utilizing Robots in Instruction

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Abstract: Robots are useful tools for teaching mathematics and physics and engineering subjects in K-12 setting; they can be utilized in classrooms for explaining difficult and complex concepts because they capture the imagination of students. Rapid developments robotics technology in recent decade, institutions and researchers have employed robots to support K-12 education. Furthermore, Educators are increasingly interested in the potential of robots in education for learners. Due to its multidisciplinary nature, robots are considered a gateway to STEM education. Researchers in educational field are looking answers of Can robots in classroom reshape K-12 STEM education, and foster new ways of learning? In the present study, IT and Technology & Design Teachers' views on utilizing robots in instruction was investigated. Furthermore, teachers' willingness to use robots in diverse learning settings. The findings of the research revealed that most of the teachers were not employed robots in their teaching. However, overwhelm majority participants expressed their willingness of using robots in their education specifically in STEM education. Teachers reported that robots can be utilized as an instructional support tool in the classroom.

Keywords: Robots, IT teachers, STEM, Technology and Design, Education

Introduction

Autonomous or pre-programmed electromechanical tools are called robots. They can generally be controlled by a computer. It is possible to control the robots with a remote control. According to the definition of robot made by the American Robotics Institute in 1979, a robot is a programmable, multi-functional machine that carries goods, parts, tools or special devices from one place to another or performs certain tasks in order to perform certain tasks.

The word robot was first used in the theater play "Rossum's Universal Robots" written by the Czech writer Karel Capek Rossum in 1921 (Hemal & Menon, 2018). The word "robota" in Czech means "forced worker, slave". Isaac Asimov used and popularized the term robotics in his science fiction novels and short stories. Asimov was a visionary in the 1930s who envisioned a positronic brain to control robots. Asimov stated in his "Three Laws of Robotics" that the purpose of robots is to serve human beings, and that a robot can never choose

its own goals over people's. The articles of this law can be summarized as follows:

1. A robot may not harm or injure a human.
2. A robot does not comply with the orders given to it by humans that do not conflict with the 1st Law. must obey the process.
3. A robot must protect its own existence as long as it does not conflict with the 1st and 2nd Laws.

There are various reasons why robots are preferred in industry and education. In general, robots are preferred in the following situations. However, when making this choice, costs are always considered.

- Jobs with high labor costs
- Works requiring extreme attention
- Risky and dangerous work in terms of health and work safety in cases where it is done by humans
- Jobs that require very high heat
- Non-hazardous but repetitive and boring work

Today, the usage areas of robots are becoming more and more widespread. This situation also raises concerns that people will lose their jobs.

Second Robots in Education

The use of robots in education began in the 1960s with Seymour Papert's Logo (programming language) Turtle (robot). Lego/Logo is an environment where design can be done in the classroom. Logo is a computer program material for designing their own machines with Lego parts consisting of toy motors and sensors and for controlling the machine. Resnick, Ocko Papert, stated that for Logo it is not just lego pieces and software, but also a special learning and unconsidered (Gaudiello& Zibetti, 2016).

Educational robots enable students of all ages to become familiar with and deepen their knowledge of robotics and programming, while at the same time learning other cognitive skills (Khanlari, 2016). Robots in instruction may motivate students in order to support interdisciplinary learning activities in STEM education (Barak & Assal, 2018). Educational robots can easily be adopted into engineering, science, technology and mathematics based teaching activities (Karaahmetoglu, 2019).

Robots emerged as helpers supporting humans in their first reflections on social media and history. Today, robots are used in many fields, from industry, space exploration, military defense, medicine, education to treatment or rehabilitation to entertainment. Successful results are obtained at a high rate from the studies carried out with robot types (Şişman, 2016).

Şişman (2016) investigated the level of interaction of children with autism with a socially interactive robot and the success of the robot in teaching children with autism to sing. Four children with high-functioning autism, aged 7-9 years, were included in the study. During the application, the robot was guided by a researcher

remotely via the web application. Robot sing a song called "Our Body" and repeating it four times in each lesson, using body movements according to the words of the song. The application was carried out in the form of both individual and group activities. As a result of the research, it was determined that one child could sing the whole song in accordance with the rhythm, the other child could sing half of the song by himself, and he sang the rest of the song with the help of the teacher.

Cincioglu, et al. (2015) in his study on the effect of robotic technology use on foreign language, he observed that the materials used in the field of robotics are effective on students' understanding and speaking while providing foreign language education.

Method

This research is a qualitative study to investigate IT and Technology & Design Teachers' views on utilizing robots in instruction. It was assumed that the teachers participating in this study had sufficient knowledge about robotics. In this study, a semi-structured interview form consisting of 8 open-ended questions was used for IT and Technology & Design teachers. The answers given to the questions in the interview form used were used in the research by making content analysis. Interview is the most frequently used data collection tool in qualitative research. In order for the interview to be used as an effective and efficient data collection method, it is necessary to understand the main features, strengths and weaknesses of this method, to prepare an interview form that will facilitate access to qualitative data and to adopt the principles recommended to be taken into account in the process of conducting the interview (Yıldırım & Şimşek, 2008).

The semi-structured interview form that was prepared was presented to two experts working in the Department of Computer Education and Instructional Technologies at Süleyman Demirel University, Faculty of Education, of which I am a student, in order to get the opinions of the experts. After the expert opinion was taken, necessary arrangements were made and took its final form. The semi-structured interview form used in the research was gathered by open ended questions form with listed on a paper the IT and Technology & Design teachers in Isparta in person. Teachers allowed enough time to write their answers. The study group of the research consists of 10 IT and Technology & Design teachers working in Isparta. A semi-structured interview form was applied to 10 information technology teachers participating in the research.

Participants

10 information technology teachers participated to the study. 9 of the 10 teachers interviewed are male. The average age of the interviewed teachers is 39.9. The average years of experience of the interviewed teachers is 12.5. 6 of the 10 teachers interviewed had not used a robot before.

Results

The opinions of the participants about the robots were combined under four compiled headings. The analysis was made and entered as numerical data in the computer environment.

Table 1. Participants' keywords about robots

| Keywords | Frequency | % |
|-------------------------|-----------|----|
| Mechanical tool | 4 | 40 |
| Artificial Intelligence | 2 | 20 |
| Military & Industry | 2 | 20 |
| Programmed vehicles | 2 | 20 |

When the data obtained in the analyzes were examined, 40.0% (n=4) of the participants identified robots as a mechanical device, while 20.0% (n=2) associated robots with artificial intelligence. At the same time, while 20.0% (n=2) of the participants thought that robots were used in industry and military rather than education, the remaining 20.0% (n=2) said that the robots were pre-programmed and would act at the level we programmed (see Table 1).

Participants' response to "have you used an educational robot before?"

Table 2. Participants' use of educational robots

| Use of robot | Frequency | % |
|--------------|-----------|----|
| Yes | 4 | 40 |
| No | 6 | 60 |

While 40.0% (n=4) of the participants answered yes to the question of whether they used a robot, 60.0% (n=6) answered no.

The opinions of the interviewees about how to use robots in education were compiled under two headings. The analysis was made and entered as numerical data in the computer environment.

Table 3. Participants' response for "How robots can be used in instruction?"

| How to use | Frequency | % |
|----------------------|-----------|----|
| Auxiliary tool | 9 | 90 |
| Assistive technology | 1 | 10 |

While 90.0% (n=9) of the participants stated that they could use robots as an auxiliary element, 10.0% (n=1) answered that they can only be used to support students with disabilities in learning.

Table 4. Participants' response to "Would you consider using an educational robot related to your field?"

| Use of robot | Frequency | % |
|--------------|-----------|----|
| Yes | 8 | 80 |
| No | 2 | 20 |

80.0% of the participants (n=8) answered that they were considering using a robot related to its field, while 20.0% (n=2) were hesitant to use it.

P6 reported that "I would only use robot to reinforce learning". On the other hand, P9 reported to the questions as "No, I didn't think. I don't think robots will be useful when even human interaction is so difficult, but maybe for course repetition." The opinions of the participants on the field of education that robots would be useful in were compiled and combined under two headings. The analysis was made and entered as numerical data in the computer environment.

Table 5. Participants' response to "In which fields can robots be useful in education?"

| | Frequency | % |
|------------------|-----------|----|
| In all subjects | 7 | 70 |
| Limited subjects | 3 | 30 |

P1 reported to the question as "It can be useful in language and special education." P8 reported as "It can be used to embody abstract concepts and teach analytical thinking." The opinions of the interviewees about the problems they may encounter while using robots in the lessons were compiled and combined under two headings. The analysis was made and entered as numerical data in the computer environment.

Table 6. Participants' response to "In Which Fields Can Robots Be Useful In Education?"

| | Frequency | % |
|-----------------------------|-----------|----|
| Mechanic & Technical issues | 8 | 80 |
| Distractibility | 2 | 20 |

While 80.0% (n=8) of the participants thought that Mechanical and Technical errors would cause problems, 20.0% (n=2) answered that they would cause distraction.

Discussion & Conclusion

The results of this study indicate that robots are perceived by IT and Technology & Design Teachers to be a useful tool for teaching and learning. Regarding the positive effects of robotics as an assistive technology and foreign language learning, this study concurs with Cincioglu, et al. (2015) and Şişman (2016).

Participants perceive that robots can be integrated into curriculum to teach foreign language and can be used as

an assistive technology. However, it is surprising for the researcher that the majority of participants perceive robots can pose mechanical and technical problems while utilizing them in teaching and learning environments. Robots can provide visual and hands-on activities to students in problem solving through Problem-Based Learning. They can also provide an opportunity for students to connect the robotic lessons with their real-lives experiences.

The findings of the research revealed that most of the teachers were not employed robots in their teaching. However, overwhelm majority participants expressed their willingness of using robots in their education specifically in STEM education. Teachers reported that robots can be utilized as an instructional support tool in the classroom.

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