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# USE OF ROBOT IN THE EDUCATION OF INDIVIDUALS WITH AUTISM SPECTRUM DISORDER

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**ABSTRACT**
OBJECTIVE: In this study, it was aimed to examine the importance of robot use in the education of individuals with autism spectrum disorder.
METHOD: This study was designed as a literature review since it was aimed to examine the importance of the use of robots in the education of individuals with autism spectrum disorder.
RESULTS: As a result of the literature review, it was observed that robots attract the attention of individuals with autism spectrum disorder, individuals with autism spectrum disorder prefer robots instead of playing with toys, they initiate social interaction with robots more easily, and they react to the instructions or signs of robots faster than human movement and instruction.
CONCLUSIONS: The use of robots in the education of individuals with autism spectrum disorder is certain to increase in the coming years. Because robots attract the attention of individuals with autism spectrum disorder and are observed to be effective. However, some research results indicate that the use of robots in the education of individuals with autism spectrum disorder is not effective. For this reason, more research results are needed in this field.

**Key words:** Autism Spectrum Disorder, Technology, Robot, Teaching Material

## INTRODUCTION

Autism Spectrum Disorder (ASD) is a neuro-developmental disorder observed with social communication and interaction problems and repetitive behaviours, usually occurring in the early developmental stage (1). First described by Leo Kanner (1943), the prevalence of ASD is increasing day by day. For example, ASD was observed at a rate of 4/10,000 until the 1970s (2), 1/150 in the USA in 2000, 1/88 in 2008 and 1/68 in 2012 (3). However, according to data from the Centre for Disease Control and Prevention (CDC) in March 2023, the rate was 1/36 (4).

Children with ASD show deficiencies in certain areas (5). These deficits include language and speech, communication, social emotional, inability to sort, classify and process information, and lack of behavioural flexibility. Children with ASD have problems in learning a new behaviour according to the degree to which they are affected by this disorder (6). However, there is no medical or pharmaceutical treatment for ASD. The scientifically supported intervention for ASD is education. In other words, education is the only treatment for children with ASD today. When we look at the literature, we see that many different educational methods are used in the education of children with ASD. Some of these methods are applied behaviour analysis, naturalistic teaching methods, story-based methods, self-management, and practices carried out by peers and parents (7). In recent years, robots have been used in the education of children with ASD.

## ROBOT USE IN EDUCATION

From the past to the present, mankind has chased after inventions that make life easier. The history of world technology has come a long way with the invention of the wheel, the industrial revolutions that started with the

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invention of the wheel and continued with water and steam power, followed by digitalisation. With the development of digitalisation, it has come to the present day by making advances in many fields, from information technologies to the introduction of cyber-physical systems and finally human robot interaction. The most popular of these technological phases and the subject of many news and discussions today is undoubtedly robots (8).

In the historical process, the word 'robot' was first used in a play by Czech writer Karel Capek about 100 years ago. In the Czech language, robot is derived from the word 'robota', which means 'slave (serf) or labourer'. In later years, Isaac Asimov popularised the word robot in his stories published between 1938 and 1942 (9). The robot figure, which was initially used only in games or stories, started to be used in the real world in later times. Its transition from a science fiction figure to real life took place in 1958, when General Motors introduced Unimate (the world's first industrial robot) to contribute to automobile production. Since the first use of the Unimate on the production line in 1961, robots have exploded in the field of industry. Nowadays, robots have the ability to perceive, learn, plan and act in order to interact with their environment (10) Robots perceive their environment through their sensors, collect data, make decisions and take action by providing their own control. Robots are used in industry, medicine and health, entertainment, agriculture and animal husbandry, and transport, as well as in education, especially in recent years (8).

Today, rapidly developing technology has increased its use in the field of education. Technology has increased the use of robots not only in engineering etc. but also in education (11). When we look at the literature, it is seen that we started to see the first examples of the use of robotics in education in 1971 (12) with 'floor turtle' Lego and it is seen that it has become more and more widespread (13). Experts have started to contribute to the world of science by seeing these benefits of robots and adapting them to scientific methods and applications. In general, students spend a lot of time with technological devices in the games they play in daily life.

In addition to these, when we look at the literature on robots, the use of robots in education contributes positively to effective teaching (14-16). According to Yıldız Durak, Karaoğlan Yılmaz, & Yılmaz (16), using robots for educational purposes contributes positively to learning processes.

These contributions are;

- Using robots in the field of education contributes to students' digital skills and students' cooperation (16).
- Increases interest in the lesson (17)
- Contributes positively to language development (17, 18)
- It contributes positively to social, moral and cognitive development (15,18).
- It fulfils the roles of teacher, peer or mediator (17).
- It contributes to increase students' willingness for collaborative learning and learning activities (19).
- It contributes to problem solving, finding practical solutions to problems, critical thinking, realising their own abilities, learning by doing and experiencing, increasing the level of technology use and being more willing to use technology (20).

Robots used in education are of various types. These range from low-cost single-function mechanical robot kits to LEGO Mindstorms and high-cost and multifunctional humanoid robots (17). Currently, the point where robot technology has reached is humanoid robots. Humanoid robots, on the other hand, have the ability to use facial expressions and have the ability to enter into social communication with the ability to speak. These types of robots often interact socially with students. In addition, these robots are also used in teaching foreign language, music, mathematics, etc. to students (17). These robots are widely used in educational environments for different purposes and functions thanks to their humanoid appearance, body language, communication and interaction abilities, rich repetition and practice opportunities. Humanoid robots used in the field of education are used in the classroom with teacher or assistant teacher roles or outside the classroom with social/student/home robot roles (21).

## USE OF ROBOT IN THE EDUCATION OF INDIVIDUALS WITH AUTISM SPECTRUM DISORDER

Different methods that can be effective in the education of individuals with ASD are being researched, evaluated and used. Today, robots, which have recently started to be used in the education of individuals with ASD (22, 23), open a new window to this search (23). When

we look at the literature, there are studies indicating that the use of robots in the education of individuals with ASD makes a difference. There are studies indicating that individuals with ASD pay more attention to robots than a human (24), prefer robots that interact with humans instead of playing with toys (25), initially prefer humanoid robots in social interactions (26), and react to the instructions or signs of robots faster than human movement (27).

In addition, when individuals with ASD communicate with a different person, the words and behaviour of this person may be complex and frightening for the individual with ASD. When they communicate with a robot instead of a human, robots that exhibit more consistent, stable and simple behaviours can comfort them (28). According to Dautenhahn (25), it may be more beneficial for individuals with ASD to use robots instead of unpredictable and sometimes frightening behaviours of humans. This is because individuals with ASD prefer predictable, repetitive and monotonous behaviours exhibited by robots.

Research has shown that the use of robots in education in the interaction of robots with individuals with ASD has strengths. These are

- They have problems in understanding the physical world and limitations in understanding the social world,
- Better social feedback when using a robot rather than a human
- They are more interested in education when it includes electronic or robotic components (29).

For these reasons, robots attract a lot of attention and children can transfer this interest to humans after being educated with robots. In other words, robots used for the purpose of education for children can be useful to create a bridge between the physical and social world, first working with the individual with ASD and the robot, and then preparing the ground for interaction with people in the later stages (27). When we look at the literature, it is observed that studies with robots generally include communication, social/interpersonal interactions and relationships, play, emotional well-being, sensory experiences and coping, motor skills, preschool skills and functionality in daily reality (30).
It is seen that applications using robots in the education of individuals with ASD are generally effective. On the other hand, there are reports that some applications are not effective. In the study conducted by Pioggia et al. (31), the participants interacted with robots. However, no increase was observed in the social interactions of some children and even regressions were observed in the social interactions of some children.

Different robots can be used in the education of children with ASD. These are: a) Animal-like robots, b) Mascot robots, c) Mobile robots that do not look like humans, d) Mechanical robots and e) Android robots (32).

**a) Robots in Animal Appearance:** They are robots with animal appearance. With today's technology, the ability of animal-like robots to mechanically mimic the movements, manoeuvrability and speed of animals has increased considerably. In addition, the close bonds between humans and animals are known (33). This paves the way for the frequent use of animal-like robots in the field of education.

**Figure 1.** Robots in Animal Appearance
Note:Dalgın-Eyiip (2018)

**b) Mascot Robots:** Mascot robots are a new concept. Mascot robots are humanoid, although not in full human form. Such robots are small, toy-like robots that will interact with children. These mascot robots offer the opportunity to interact with children in new ways (34).

**Figure 2.** Mascot Robots
Note:Dalgın-Eyiip (2018)

**c) Non-human-like Mobile Robots:** These are robots that do not physically resemble humans, are not fixed to a point, have the ability to move in a defined environment and can fulfil defined tasks (https://www.robotiksistem.com/mobil_robot_cesitleri.html). The limitation of this type of robot in education is that it cannot imitate human behaviour (35).

**Figure 3.** Non-human-like Mobile Robots
Note:https://tr.roboct-tech.com/mobile-robot-components/omnidirectional-mobile-platform/autonomous-mobile-platform.html

**d) Mechanical Robots:** This type of robot consists of many visible mechanical parts and has a human appearance (cited by 32).

**Figure 4.** Mechanical Robots
Note: Dalgın-Eyiip (2018)

**e) Android robots:** This type of robot resembles humans and can imitate some human behaviours (Şen, 2021). Even advanced ones can exhibit behaviours close to human behaviours. According to Chang et al. (34), android robots have body language and abilities to give more human-like social behaviours; these robots can be more interesting for students.

**Figure 5.** Android robots
Note:https://www.robotiksistem.com/robot_nedir_robot_tasarimi_yapimi.html

## CONCLUSION

In general, with the advancement of technology, robots have started to enter every aspect of human life. Especially in the coming years, it is certain that it will enter our lives even faster. It is certain that it will be widely used especially in the education of individuals with ASD in the coming years. Because robots attract the attention of individuals with ASD and exhibit more consistent movements than humans. This causes individuals with ASD to approach robots with confidence without fear. However, although there are research findings that robots are effective in the education of individuals with ASD, they may not be effective in every individual and every behaviour. For this reason, more research results are needed on whether robots are effective in the education of individuals with ASD.

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