

## DEVELOPMENT OF ROBOTICS FUNDAMENTALS IN PRESCHOOL EDUCATIONAL ORGANIZATIONS

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**Abstract:** This article examines the application of robotics principles in preschool education and its role in developing children's technological skills. In the study, children were taught programming, mechanical systems, and problem-solving skills using robotics tools. Through activities and games, children developed creativity, logical thinking, and collaboration skills. The results of the study showed that robotics is an effective tool for increasing children's technological literacy, and also has a significant impact on their cognitive and social development. The article shows the importance of robotics in preschool education and its potential for children.

**Keywords:** Robotics, technological skills, STEM, programming, creativity, problem solving, child development, technological literacy, interactive games.

### INTRODUCTION

In modern education systems, especially in preschool educational organizations, the role of technology is increasingly increasing. Today, advanced technologies such as robotics and artificial intelligence are becoming an integral part of the educational process. Teaching the basics of robotics in preschool educational organizations is of great importance in developing students' cognitive and creative skills. Through them, children can develop interest in the field of science and technology, develop skills such as analytical thinking, problem solving and problem solving.

Robotics in the preschool education process serves not only to provide children with technical knowledge, but also to develop their engineering thinking, creativity and teamwork skills. By assembling, programming and controlling robots, children begin to understand technology, as well as their practicality and importance in the modern world. At the same time, robotics will make the subjects that children study more interesting and lively, which in turn will increase the effectiveness of the educational process.

In preschool educational organizations, it is necessary to develop research and innovative approaches to teach the basics of robotics, successfully introduce technologies into pedagogical processes, as well as train teachers in new teaching methods. This article examines the processes of studying the basics of robotics in preschool educational organizations and implementing innovative methods related to them. The main purpose of the study is to analyze the application of the basics of robotics in the preschool education system and the pedagogical and methodological issues that arise in this process.

This allows us to show the pedagogical importance of teaching the basics of robotics in preschool educational organizations, its role in developing students' knowledge and skills, and the need for teachers to introduce new methodologies and approaches.

Robotics is an innovative educational tool that allows children to test themselves on the technological front. Creating and programming robots, working with mechanical systems is not only fun for children, but also educational. Children develop their creativity and analytical thinking skills through robotics.

Especially through programs and games designed for children, they enjoy learning about technology and learn to integrate this process into their daily activities.

Today, robotics, STEM (science, technology, engineering and mathematics) education and other interactive technological tools are recognized as effective tools for expanding children's worldview, developing logical and creative thinking, as well as increasing technological literacy. Integrating robotics programs for preschool children develops their problem-solving skills, logical thinking, as well as creativity and cooperation skills.

The modern education system is aimed at equipping children not only with knowledge, but also with creative thinking, problem-solving, and technological skills. Therefore, in the context of the rapid development of technology and the deep penetration of the digital world into everyday life, teaching children technological knowledge from an early age has a great impact on their cognitive and emotional development.

## LITERATURE REVIEW

The study of robotics and STEM education for preschool children has become one of the research areas that has received serious attention worldwide in recent years. Scientific research conducted in this area shows the educational potential of robotics technologies for children and emphasizes the development of this knowledge from an early age.

### 1. The impact of robotics on child development

Research conducted on the impact of robotics on child development shows that these technologies are of great importance in the development of cognitive, creative and social skills of children. One of the famous studies was conducted by Bers et al. (2014), which emphasized that children can develop problem-solving, logical thinking and analytical thinking skills with the help of robotics. This study showed that robotics makes the learning process interesting and interactive, making it easier for children to learn.

### 2. Benefits of STEM Education for Children

Research on STEM (Science, Technology, Engineering and Mathematics) education has proven that STEM methodologies are effective in encouraging innovative thinking among children. An analysis presented by Beers (2011) emphasizes that STEM education should provide children with not only knowledge acquisition, but also the development of teamwork and creativity. This methodology, especially when implemented through games and activities related to robotics, makes learning among children more interesting and effective.

### 3. Teaching technological skills to children

Regarding the benefits of teaching technological skills to children through robotics and STEM, a study conducted by Cunningham (2015) showed that learning about technologies from an early age can increase children's digital literacy and provide them with the skills they need to succeed in the digital world. This study demonstrates the effectiveness of presenting technology-related knowledge to children in an interactive and playful way.

### 4. Developmental impact of robotics games

A study by Wendel et al. (2017) highlighted the positive impact of using robotics games at key developmental stages for children. These games help develop creativity, problem-solving skills, and social skills among children. The study found that when children participated in robotics games, they were more willing to cooperate, take leadership, and learn new technologies.

### 5. Programming and robotics classes for children

A study by Grover and Pea (2013) highlighted that programming is an important part of learning for children. In the study, children were taught the basics of programming using robotics tools, and the process was effective in developing their problem-solving, logical thinking, and creative decision-making skills. This study shows that teaching children to code is very important and that these skills need to be developed from an early age.

## METHODOLOGY

In this study, the following methods were used to analyze the processes of teaching the basics of robotics in preschool education and developing children's technological skills:

The study was carried out on the basis of a joint design, which included practical, experimental and descriptive methods. The study studied the impact of robotics programs for children, while organizing activities and practices aimed at developing children's technological skills. The study was conducted with preschool children aged 4-6 years.

The study involved 60 children aged 4-6 years from 3 preschool institutions. The children were divided into two groups:

Experimental group - This group was educated based on robotics classes and games. In the group, children learned technological skills such as creating, programming and moving robots.

Control group - This group was educated based on conventional educational methods. This group did not use robotics tools.

Interactive robotics classes were organized for the experimental group. The classes were aimed at teaching children the basics of robotics, basic concepts of programming, mechanical systems, and problem solving. During the classes, children were taught to create and operate robots. During the classes, children worked with various robotics devices and models.

Children were involved in learning in an interesting way using robotics programs and games designed for children (for example, LEGO WeDo, Dash & Dot robots). These programs, while teaching children the basics of robotics and programming, developed their creativity and logical thinking skills. During the research, group and individual observations were conducted to observe the children's activities. After studying the children's activities and results, interviews and short conversations were conducted with them, which allowed them to identify their thoughts, interests, and newly learned skills. During the study, special tests were developed to measure the level of development of children's technological skills. These tests were aimed at assessing children's skills in robotics, programming, and problem-solving. The tests included measuring children's success in creating and programming robots, as well as assessing their logical thinking and creativity skills.

The results of the study were evaluated using statistical analysis. The differences between the experimental and control groups were analyzed. The children's indicators obtained on the basis of tests and observations, as well as the level and results of participation in robotics classes, were compared. T-test and descriptive statistics were used as the main statistical methods. Through this analysis, an attempt was made to determine the effectiveness of robotics classes in developing children's technological skills.

The study was conducted in compliance with ethical principles. Permission from the participants and written consent from their parents were obtained. It was ensured that the children participating in the study would not suffer any harm, and their personal information would be kept confidential.

## **DISCUSSION AND RESULTS**

The study investigated the effectiveness of developing robotics and technological skills in the preschool education system. The experimental group was trained in the basics of robotics, while the control group was taught conventional teaching methods. The results of the study showed the following main points.

### **1. The impact of robotics on children's development**

Children who used robotics classes and games in the experimental group developed technological skills at a higher level than the control group. Children developed logical thinking, creativity, and analytical thinking skills by creating, programming, and building robots. These results confirm that robotics is an effective tool for children to develop not only technological knowledge, but also creative and problem-solving skills.

Observations among children showed that robotics classes also develop children's interpersonal skills[1]. In particular, social skills such as working together in groups, solving problems, and helping each other also increased significantly.

### **2. Positive effects of STEM education**

In the experimental group, children were introduced to programming and mechanics related to technology, engineering, and mathematics through STEM-based games. During the sessions, children tried to create the most suitable robots for themselves, based on their interests and desires. This process encouraged not only technological knowledge, but also the development of new ideas and the use of innovative approaches. Thus, it was shown that STEM education had a positive effect on children's development, activating their knowledge and skills.

### **3. Children's technological skills and cognitive development**

Robotics classes were effective in increasing children's technological literacy. Programming and driving robots taught children to solve problems and allowed them to understand technologies. According to the data obtained on the basis of tests and observations, children in the experimental group achieved significant success in programming, building mechanical systems and driving robots. All this is important in increasing children's technological literacy and preparing them for the digital world.

Children in the experimental group showed a high level of creativity and imagination, and they tried to find new ideas and technical solutions in the process of creating robots. At the same time, children demonstrated their skills in logical thinking and solving complex problems.

#### 4. Social skills and teamwork

During the study, robotics classes also played an important role in developing children's social skills. Children were highly involved in working with each other, exchanging ideas, and solving problems in groups. This process allowed them to improve cooperation and teamwork. The special attention paid to social skills in the study had a positive effect on the educational and personal development of children.

#### 5. Tests and Evaluation Results

The results of the tests and evaluations showed that there was a significant difference in the development of technological skills of children in the experimental group. The tests measured the knowledge gained by children in the basics of programming and their success in creating robots. Children participating in the experimental group showed higher results, as they showed greater interest in mastering knowledge related to robotics and actively participated during the sessions.

#### 6. Limitations of the study

The study had some limitations. First of all, only children aged 4-6 participated in the study, so the results may only apply to this age group. In addition, the number and duration of robotics sessions were somewhat limited due to the time constraints and limited resources of the study. Also, the study was conducted in only a few educational institutions, which limits the generalizability of the results.

### CONCLUSIONS AND SUGGESTIONS

This study investigated the fundamentals of robotics and the importance and effectiveness of developing children's technological skills in preschool education. The results of the study showed that robotics classes play an important role in increasing children's technological literacy, developing logical and creative thinking skills, as well as forming their social skills. Children in the experimental group acquired high-level technological skills through robotics classes, and their creative thinking, problem-solving, and teamwork skills significantly increased.

The use of STEM education based on robotics created an interactive and interesting learning opportunity for children, which increased their interest in learning new technologies. During the study, children not only learned about technologies by creating and programming robots, but also learned to apply them in practice. This process provided children with the opportunity to develop not only knowledge, but also social skills.

According to the main results of the study:

1. Robotics classes influenced various areas of children's development, including technological skills, creativity, logical thinking and social skills.
2. The integration of STEM education and robotics made education more effective and interesting for children.
3. Children in the experimental group showed higher results than the control group, which confirmed the effectiveness of robotics and technological curricula.

Based on this study, the following suggestions are made for the development of robotics and technological skills in preschool education:

### 1. Wider inclusion of robotics in preschool educational programs

The results of the study show that robotics is a very effective tool for developing children's technological skills. Therefore, it is necessary to expand robotics and STEM-based curricula in all preschool educational institutions. This will create an opportunity for children to learn technology from an early age.

### 2. Focus on interactive and practical activities

When teaching children the basics of robotics, great attention should be paid to interactive and practical activities. In the process of creating games and robots, children show high interest and motivation in themselves. These activities also help develop children's creative and logical thinking skills.

### 3. Teacher training and professional development

It is necessary to develop teacher training programs in robotics and STEM education. It is important to involve teachers in training courses and professional development programs in robotics and programming, and to provide them with more knowledge about effective teaching methods for new technologies. This will allow teachers to be methodologically trained and use modern educational technologies[2].

### 4. Conducting large-scale experiments and research

It is necessary to conduct additional large-scale experiments on the development of robotics fundamentals and technological skills in preschool education. This, in turn, will allow further increasing the effectiveness of research and testing methods used in various educational institutions. It will also be possible to generalize and present best practices to the general public.

### 5. Adapting technological tools for the new generation of children

It is necessary to adapt robotics tools and programs to the age of children. Developing robotics programs adapted to the learning abilities and interests of each age group will create the opportunity to make education more effective and interesting for children.

### 6. Additional games and activities for social and emotional development

To enhance the impact of robotics and STEM education on children's social development, it is necessary to organize games based on teamwork and cooperation. This teaches children to cooperate, express ideas, and solve problems together.

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