DEVELOPING LOGICAL THINKING OF PRESCHOOL CHILDREN THROUGH ROBOTICS

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Abstract

The rapid development of digital technologies has significantly influenced modern education systems, including early childhood education. Robotics has become an innovative educational tool that helps develop cognitive, creative, and problem-solving abilities in young learners. This article examines the role of robotics in developing logical thinking skills among preschool children. Logical thinking is an essential component of cognitive development that enables children to analyze situations, identify relationships, and make reasoned decisions. The study highlights the pedagogical potential of robotics activities in preschool settings and explains how interactive technological tools can stimulate children's curiosity, reasoning abilities, and collaborative learning. The article also discusses practical strategies for integrating robotics into preschool education and outlines the benefits of robotics-based learning environments for young children.

Keywords

robotics education, preschool education, logical thinking, innovative technologies, early childhood development, STEM learning

Introduction

In recent years, innovative technologies have become an important component of educational systems worldwide. The integration of digital tools into teaching processes allows educators to improve the effectiveness of learning and develop essential cognitive skills in students from an early age. Among these technologies, educational robotics has emerged as a powerful pedagogical tool, particularly in early childhood education. Preschool age is a crucial period in a child’s cognitive development. During this stage, children actively explore the world around them and begin to develop fundamental intellectual abilities such as reasoning, classification, comparison, and problem solving. These abilities form the basis of logical thinking. Logical thinking allows children to analyze situations, identify patterns, understand cause-and-effect relationships, and make conclusions based on evidence. Traditional preschool education methods focus primarily on play-based learning, which remains an essential element of child development. However, modern educational approaches increasingly combine play with innovative technologies in order to enhance children's intellectual growth. Robotics represents one of the most

promising tools for achieving this goal. Through interactive activities involving robots, children can experiment, explore, and solve problems in a playful and engaging environment. The purpose of this article is to analyze the role of robotics in the development of logical thinking among preschool children and to examine the pedagogical opportunities provided by robotics-based learning activities in early childhood education.

Theoretical Background

Logical thinking is one of the most important components of intellectual development. It involves the ability to analyze information, establish relationships between objects or events, and draw conclusions based on reasoning. In early childhood, logical thinking develops gradually through various forms of cognitive activity, including play, experimentation, and interaction with the environment. Educational psychology emphasizes the importance of active learning experiences in the development of logical thinking. Young children learn best when they can manipulate objects, observe outcomes, and reflect on their experiences. Robotics provides a unique environment for such activities because it combines physical interaction with problem-solving tasks. Educational robotics refers to the use of programmable robotic devices as tools for teaching scientific, technological, and logical concepts. In preschool settings, robotics activities are usually simplified and adapted to the developmental level of young learners. Children may engage in tasks such as assembling simple robotic models, programming robots to move along specific paths, or solving challenges that require sequencing actions. These activities encourage children to think systematically and logically. For example, when programming a robot to move forward, turn, or stop, children must understand sequences, patterns, and cause-and-effect relationships. As a result, robotics naturally promotes the development of algorithmic and logical thinking skills even at an early age.

Robotics in Preschool Education

The introduction of robotics into preschool education creates new opportunities for developing children's intellectual and creative potential. Robotics activities can be integrated into the curriculum through project-based learning, problem-solving tasks, and collaborative exploration. One of the main advantages of robotics education is its interactive nature. Children are actively involved in constructing and controlling robots, which stimulates curiosity and motivation. Unlike passive learning methods, robotics encourages children to experiment and discover solutions independently. Robotics activities also promote teamwork and communication skills. Preschool children often work in small groups while building or programming robots. During these collaborative activities, they share ideas, discuss possible

solutions, and learn to cooperate with peers. Such interactions support both social and cognitive development. Another important benefit of robotics education is its connection to STEM learning. STEM stands for science, technology, engineering, and mathematics. Robotics activities naturally integrate elements of these disciplines by allowing children to explore simple engineering structures, mathematical patterns, and technological concepts in a playful manner. Through robotics, children gain early exposure to technological thinking and digital literacy, which are essential skills in the modern world.

Developing Logical Thinking through Robotics Activities

Robotics-based learning activities contribute significantly to the development of logical thinking among preschool children. Several types of activities can be used to achieve this goal. First, sequencing activities help children understand logical order. For example, children may program a robot to move along a specific path by arranging command cards in the correct sequence. If the robot does not follow the intended path, children must analyze the commands and identify the mistake. This process strengthens reasoning and analytical thinking. Second, problem-solving challenges encourage children to think critically. Teachers may present tasks such as guiding a robot through a maze or reaching a target location. Children must plan their actions, predict outcomes, and adjust their strategies when necessary. Third, robotics activities stimulate creativity and imagination. Children can design their own robotic projects, invent stories involving robots, or build simple mechanisms. These creative experiences enhance flexible thinking and allow children to explore different problem-solving approaches. In addition, robotics supports experiential learning. When children observe how their commands affect the robot's behavior, they gain immediate feedback about their actions. This feedback helps them understand logical relationships and reinforces learning through experience.

Pedagogical Conditions for Effective Implementation

In order to successfully integrate robotics into preschool education, several pedagogical conditions must be considered. First, teachers should receive appropriate training in robotics education and digital pedagogy. Educators need to understand how to guide children through robotics activities while maintaining a playful and supportive learning environment. Second, robotics tools should be age-appropriate and safe for preschool children. Many educational robotics kits are designed specifically for young learners and include simple programming systems based on symbols or colored blocks rather than complex coding languages. Third, robotics activities should be integrated into existing educational programs rather than treated as isolated lessons. For example, robotics tasks can be connected with mathematics, storytelling, or creative play activities. Finally, teachers should

encourage exploration and experimentation. Instead of providing ready-made solutions, educators should guide children to discover answers independently. This approach supports the development of logical reasoning and problem-solving abilities.

Conclusion

The integration of robotics into preschool education offers significant opportunities for developing logical thinking among young children. Robotics activities create an engaging learning environment where children can experiment, solve problems, and explore technological concepts through play. By participating in robotics-based learning experiences, preschool children develop important cognitive skills such as reasoning, sequencing, and analytical thinking. These skills form the foundation for future academic success and lifelong learning. Furthermore, robotics education supports creativity, collaboration, and early STEM literacy. When implemented effectively, robotics can become a valuable tool for modern preschool education and contribute to the holistic development of children. Therefore, educators and educational institutions should consider expanding the use of robotics in early childhood education. By doing so, they can provide children with innovative learning experiences that prepare them for the technological challenges of the future.

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