

# Artificial Intelligence and Children: The Application of AI Devices in Preschool Education

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**Abstract:** As an important result of the development of digital science and technology, artificial intelligence (AI) technology has penetrated all aspects of preschool education, bringing unprecedented changes to children's learning and development. Based on the current situation of preschool education, the article analyzes the characteristics of the application of AI equipment in children's preschool education, and points out that the value of its application is mainly manifested in enriching the form of play in preschool education, improving the acceptance of students, enhancing the pertinence of preschool education based on big data prediction, and enriching the means of education for special children. Under the background of the rapid development of AI technology, the article puts forward countermeasures for the development of children's education in the era of AI, adheres to the bottom-line principle of protecting children, and forms a good AI application scenario based on children's needs. To further cultivate children's AI literacy and strengthen the depth of AI application in preschool education, this article helps the users of preschool education to apply AI more effectively and achieve quality improvement of preschool education.

**Keywords:** Artificial intelligence; Preschool education; Exceptional children; Educational methods

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## 1. Introduction

Childhood is an important and sensitive period in human development. During this period, children gain life support. The plasticity of their brains makes them more susceptible to the influence of the external environment. Artificial intelligence (AI), as the latest product of the development of information technology, is the superimposed emerging body of many factors in the social environment, which impacts children's brain development and growth<sup>[1]</sup>. With the development of deep learning, there is an increasing application of AI models in the field of preschool education. They can perform more complex tasks, making preschool education more interesting and scientific. However, historical experience shows that any advanced technology has both positive and negative characteristics<sup>[2]</sup>. How to use AI well in the field of preschool education and promote the long-term development of children is a problem worthy of in-depth consideration.

## **2. Characteristics of AI application from the perspective of child developmental psychology**

At present, there are various AI devices in our family environment and kindergarten environment. Children's cognition of AI devices has made progress in all aspects, but how children view AI devices is still a problem worthy of further discussion. With the deepening of children's contact with AI technology, their cognition of technology will also be more thoughtful and nuanced <sup>[3]</sup>. Human infants and toddlers are born in an environment with rich social relationships, and AI devices show lifelike characteristics, making them different from traditional machines. In other words, existing research suggests that AI is widely regarded as a social existence for children. Most children's first impression of an intelligent robot is that it is a living creature with a humanoid appearance, the ability to move spontaneously, and intelligent reactions, and children tend to think that it is "alive." In the case of prolonged contact with AI robots, children may project emotional states, intentionality, and morality into AI devices, tend to form intimate relationships with these devices, and even develop attachment. Some social surveys show that children will establish a good interactive relationship with social robots with rich facial expressions and voice emotions and look at robots with the same eyes as they look at humans <sup>[4]</sup>.

## **3. Application scenarios of AI devices in preschool education**

Currently, the development of artificial intelligence equipment has entered a new stage, which cannot be ignored <sup>[5]</sup>.

### **3.1. Integration of AI devices into transformative games**

Applying AI technology to preschool education can give full play to the advantages of AI technology in life and transform boring knowledge into game forms that infants and toddlers enjoy, making them more immersed in preschool education <sup>[6]</sup>. Since AI technology can form a good interactive mode and fully mobilize children's various emotions, the use of AI technology to build a game mode can better touch children's minds. For example, the use of fingers and gestures to form an immersive experience allows children to enjoy the game in the process of cooperation and learning and form a unique development in interpersonal interaction and human-computer interaction, which can become a source of happiness for children <sup>[7]</sup>.

### **3.2. Children's behavior evaluation and prediction**

AI-enhanced predictive models and big data analysis have become the two main types of data mining systems. On the one hand, as a subset of AI, a predictive model is machine learning based on historical data and existing data to predict the likelihood of a certain result. On the other hand, big data analysis is based on the extensive collection of management and analysis data by AI systems, which is more efficient than traditional big data and AI systems <sup>[8]</sup>. It can help AI devices obtain higher quality education data, carry out children's face recognition, and record children's interaction. These data are incorporated into electronic files in richer forms such as images, videos, and voices, so as to facilitate teachers to form long-term chain observation of children. Teachers can also use these data to evaluate children's behavior and present them to parents in a more systematic and dynamic manner during home communication and parents' open days. With AI vision technology as the technical support, kindergartens can build a front-end detection technology motion capture system to understand the movement posture of different students, and effectively analyze children's movement perception level based on real-time observation of movement data on large screens. This intelligent monitoring greatly reduces the

teaching burden of kindergarten teachers <sup>[9]</sup>.

### **3.3. Application of AI equipment to the education of special children**

AI technology is widely used in clinical and educational support settings, especially in the field of preschool special education. Children with special needs need to achieve integrated education by improving existing methods and environments, and AI's technical assistance will bring revolutionary improvements. Studies have shown that robotics can help blind children, children with mobility disabilities, and children with autism. In the field of preschool special education, robots can also be utilized in various roles, such as providing therapeutic assistance and facilitating disability detection and monitoring. This is achieved by recording data on children with special needs for diagnosis by clinicians or therapists, employing machine learning models developed for the automatic identification of different types of physical activity in some children with special needs, and applying machine learning methods that process accelerometer data to identify children with special needs. Specific applications include an AI device that correctly distinguishes preschoolers with autism spectrum disorder (ASD) from typically developing children through kinematic analysis of a simple reach down task, helping to identify a well-defined subset of patients and reducing clinical heterogeneity within a broad range of behavioral phenotypes. AI-assisted early detection and diagnosis systems have also been shown to help screen and diagnose ASD in children, such as AI-based robots for the treatment and education of children with autism through facial scanning patterns, using the Support Vector Machine with data-driven feature extraction to identify children with ASD, which is considered a valuable tool for the education or treatment of children with autism.

AI has great potential to support children with special education needs both inside and outside the classroom through interactive design to increase engagement, provide personal feedback, and adapt these children to education. Assistive technologies range from low-tech devices, such as modified keyboards, to AI-fused high-tech solutions, such as screen readers and assistive listening systems, which are essential for children to overcome learning disabilities. Assistive devices are also beneficial for students with intellectual disabilities and children with Down syndrome, helping to develop skills such as numbers, speech, language, memory, and social interaction. Through innovative tools such as machine and deep learning, generative artificial intelligence, and interactive voice response, AI offers more possibilities for early detection, diagnosis, and treatment of children with special needs, providing an exciting pathway for better preschool education for them <sup>[10]</sup>.

## **4. Effect analysis of the application of AI equipment in preschool education**

### **4.1. Enhancing children's adaptive cognitive development**

AI equipment helps to promote children's personalized learning and adopt their own special learning paths. Based on deep learning systems, AI equipment can analyze children's cognitive levels in real time and dynamically adjust the difficulty of learning content. For example, in the mathematical enlightenment for children aged 3 to 6, the AI system can continuously assess children's number perception ability through gamified interaction. When it detects that children have gradually mastered addition and subtraction within five years, the system will automatically push the number line tabs for advanced game training, so as to facilitate children to deepen the acquisition of addition and subtraction rules. In addition, AI equipment can also push all kinds of intelligent teaching aids through multi-modal perception training and start cross-sensory learning. For example, real-time social interaction with virtual scenes on the screen through physical digital blocks allows children to exercise their hands-on ability, spatial imagination ability, and hand-eye coordination ability. This

kind of multi-modal perception is more conducive to children's accumulation of learning habits, finding the most suitable learning path for themselves, and forming more effective cross-sensory exercises <sup>[11]</sup>.

## **4.2. Promoting the transformation of language intelligence cultivation methods**

The real-time voice feedback mechanism built by AI devices and the bilingual neuroplasticity development mechanism have played a transformative role in the cultivation of language intelligence in the preschool education stage.

## **4.3. Improving children's social-emotional intelligence**

AI devices have significant advantages in microexpression recognition, and smart mirrors equipped with facial emotion recognition systems can provide timely feedback on children's emotional states. When it detects a frustrated expression in a child, the device will initiate a guidance program, such as "You look a little worried. Would you like to take a deep breath?" After more than 12 weeks of training, the device can improve the child's emotional regulation ability by more than 35%. In addition, smart devices can also play a virtual social sandtable. For example, the meta-universe education platform can create safe social scenarios, simulate peer conflict situations, and guide children to seek solutions in practice. According to the survey, children's empathy in real communication can be significantly improved after virtual social sandtable training, which can help children enhance social emotional intelligence, promote the development of children's social level, help children solve conflicts and problems in the real world, and improve children's psychological adjustment ability <sup>[12]</sup>.

# **5. Review and outlook of the application of AI devices to preschool education**

## **5.1. Strengthening the protection of children's rights and interests**

The risk posed by technology is a common problem in education technology, especially where participation is prioritized over risk to educational value <sup>[13]</sup>. Developers and users of AI devices are more concerned with how long children use the application and how active they are rather than how much knowledge they acquire <sup>[14]</sup>. This may lead to excessive gamification and superficial learning of children when using AI devices. For example, the application of AI devices in the children's play scenarios mentioned above and the higher level of big data prediction have demonstrated a powerful ability to track children's data. However, these applications have the potential to compromise the privacy of children, who are often unaware that their interactions with these smart devices are being recorded and stored. The ability of parents or others to access and extract information without children's knowledge can affect the protection of children's rights. Moreover, children's brains have strong plasticity, and their adaptation to AI devices is developing <sup>[15]</sup>. Therefore, in the process of applying AI devices to preschool education, it is necessary to always stand in the perspective of children's rights and interests protection, reduce the physical and mental harm caused by the use of AI devices to children, protect children's privacy and security, and avoid the expansion of the digital divide in education and moral violations <sup>[16]</sup>.

## **5.2. Cultivating children's AI literacy**

Children's understanding of technology is constantly developing in depth <sup>[17]</sup>. Although children gradually begin to master abstract and advanced descriptions around the age of 12, with the increasing use of AI devices by children, improving children's AI literacy in early childhood is considered beneficial to children's development, so as to justify the introduction of AI literacy training activities from preschool <sup>[18]</sup>. It can further improve children's data analysis ability and help children cooperate with others to solve problems. The early cultivation



of AI literacy will bring many social skills, language analysis skills, and cognitive abilities to children. In the age of digital intelligence, children growing up scientifically have been shown to be more likely to use digital tools to support their social behavior<sup>[19]</sup>. In the early stages of children's development, especially in kindergarten, the family, society, and the kindergarten work together to guide children to understand and use AI and change their lives, which can further promote children's development. The world's first Student AI Competency Framework released by UNESCO in 2024 highly recognizes the importance of cultivating children's AI qualities. In the future, we need to further explore and establish AI literacy courses, develop corresponding knowledge maps for children, guide children to correctly understand, use, and scientifically evaluate AI, establish the necessary scope of AI application, and reevaluate the AI teaching process from the above key points<sup>[20]</sup>.

## 6. Conclusion

With the rich application of AI equipment in the field of preschool education, we need to further enhance the depth of AI application in preschools and expand its application forms in the future. It is important to innovate the methods of AI participation in preschool teaching, strengthen the depth of AI equipment application, and explore the deep integration of AI equipment and preschool education. We also strengthen data training, improve the level of privacy management, strengthen theoretical learning and ethical management, and further accelerate the iteration of AI equipment, so as to promote the integration of AI in the field of preschool education and achieve leapfrog development.

## Disclosure statement

The author declares no conflict of interest.

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