

The Application and Challenges of ChatGPT in Preschool Education

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Abstract. At present, the application of ChatGPT in education has been widely discussed. However, further research and discussion are needed on how to better integrate artificial intelligence in preschool education for young children aged 3-7 years. This paper analyzes the existing research on the application of AI in young children and concludes that the benefits of AI in preschool education can not only help improve and enrich curriculum design but also contribute to the development of artificial intelligence education. However, there are several challenges associated with AI in preschool children. First, artificial intelligence has limitations in children's language understanding. Second, children's emotional needs may not be satisfied. Last, there are doubts about the rationality of the suggestions made for young children. Based on the Pre-operational Stage of Piaget's children's cognitive development, this paper provides the following insights for the integration of ChatGPT and preschool education. One of the future works for ChatGPT is to combine the multimode to understand children's language. Another approach is to be used as a virtual partner to develop young learners' interpersonal communication and emotional management through scene simulation. Additionally, ChatGPT should provide simple and specific suggestions, according to the cognitive development characteristics of young learners.

Keywords: ChatGPT, preschool education, Piaget's theory, the pre-operational stage.

1. Introduction

With the rapid development of artificial intelligence, people's lives are increasingly inseparable from the digital world. Artificial intelligence (AI) literacy, as an important component of digital literacy, has also become one of the essential qualities for everyone today. A growing number of countries have applied artificial intelligence in the practice of preschool and primary education. Educational robots (ER) can not only help improve the cognitive and learning abilities of preschool children but also promote the development of computer thinking (CT) in children [1-2]. OpenAI released ChatGPT on November 30, 2022, which is a natural language processing tool driven by artificial intelligence technology. In particular, it demonstrates remarkable language understanding and text generation capabilities by connecting a vast number of corpora, marking a significant leap forward in the development of conversational artificial intelligence. Although ChatGPT has been widely discussed in various educational practices such as nursing education, higher education, and medical education, there is limited research and practice in the field of preschool education.

Piaget's theory of cognitive development in children provides a framework for understanding how children acquire knowledge and develop cognitive abilities. Piaget proposed four stages of cognitive development in children, including the Sensory Motor Stage, Pre-operational Stage, Concrete Operational Stage, and Formal Operational Stage. Each developmental stage exhibits different cognitive characteristics within its specific age range. By combining this theory, we can gain deeper insights into how ChatGPT can better integrate with preschool education.

The main purpose of this paper is to explore the benefits and challenges of integrating ChatGPT into preschool education. Additionally, by analyzing the intersection of ChatGPT and Piaget's theory, we aim to investigate how ChatGPT can support the practice and development of preschool education.

2. The Benefits of ChatGPT Application in Preschool Education

2.1. The Potential of ChatGPT in Curriculum Design

The extensive data sources and multi-domain coverage of ChatGPT guarantee the broad applicability of its model. ChatGPT can extract keywords and present diverse answers based on key information provided by users. One of the characteristics of preschool education activities is diversity, making ChatGPT have great potential in the curriculum design of preschool education. Hu Nan used a mixed research approach to explore the differences between higher education textbooks and ChatGPT in designing preschool education teaching activities under the same teaching goals [3]. The results indicate that in terms of designing curriculum activities, the activity design in textbooks focuses more on the teacher's presentation and lacks connection with children's life experiences. On the contrary, ChatGPT proposes simulating real-life scenarios and encourages children to understand abstract concepts through practical activities. Therefore, preschool education teachers can continuously enrich their teaching activities, innovate teaching skills, and design curriculum plans that are more in line with children's cognitive characteristics through the application of ChatGPT. This not only reduces the workload of preschool education teachers but also satisfies children's curiosity. However, the design of ChatGPT's curriculum is not perfect, and specific teaching implementation still needs to be adjusted by teachers, due to issues such as teacher-student ratio, teaching environment, and material preparation.

2.2. The Application of ChatGPT Promotes Artificial Intelligence Education

Nowadays, artificial intelligence (AI) has entered people's daily lives, and its influence has spread to various fields in society where data can be collected [4]. As future consumers of such services, it is necessary to expose children to artificial intelligence technology (AI) and provide AI education. Yau investigated the perspectives of K 12 teachers on artificial intelligence education through phenomenological research methods, and ultimately identified six types of teacher concepts, including improving the application of artificial technology in daily life for students; understanding the basic concepts of artificial intelligence; cultivating moral values for the correct utilization of artificial intelligence; stimulating students' interest in artificial intelligence; developing practical skills in machine learning; inspiring the development and design of future artificial intelligence for students [5]. Therefore, ChatGPT can be integrated into the teaching of preschool education to promote artificial intelligence education in this domain. Children can not only learn about knowledge about artificial intelligence but also learn new methods of problem-solving and new perspectives of thinking through application. In addition, early artificial intelligence education can help cultivate the ethical construction of artificial intelligence applications, including excessive dependence, criticism of information accuracy, privacy protection, and security awareness. Through subtle early applications and educational processes, new citizens in the digital age can be nurtured.

3. The Challenges of Applying ChatGPT to Preschool Education

AI has been widely integrated into every aspect of children's lives, whether it is learning or entertainment. Due to the rapid development of artificial intelligence, young children are more likely than ever to interact with AI, so it is essential to consider AI's limitations and challenges in facing the young generation.

3.1. The Difficulties of AI in Language Comprehension

The language of preschool children is still in the process of development, and their ability to express themselves is limited. First, due to differences in language habits, pronunciation, or vocabulary accumulation, each child may have different ways of expressing the same content, and the content they express may only be understood by caregivers who are familiar with the child's language. Second, at this stage, children's language is constantly evolving from quantitative to

qualitative changes, and they may not be able to fully express their emotions and needs due to their limited language skills [6]. At the last, when children's language expression is limited, body movements become the language of communication, and children will express and understand through gestures and actions. Dialogue-based AI development relies on statistical patterns to understand language, which processes a large amount of textual information and contextual correlations to achieve similar real-life dialogue interactions with users. However, in the face of children's imaginative scenes and unconventional speech patterns, conversational artificial intelligence may not truly understand the intentions behind children [7]. Therefore, children may feel frustrated and rejected during the interaction process with AI, due to they can not be understood. In addition, most importantly, the ages of 3 to 6 are a golden period for children's language and cognitive development, and without proper guidance, it may hinder children's language development.

3.2. The Limitations of AI in Meeting Children's Emotional Needs

In preschool education, the relationship between teacher and child is a crucial layer of interpersonal relationships for young children. A good teacher-child relationship not only helps young children maintain healthy and stable emotions but also contributes to the development of children's sociality and the formation of good personalities [8]. Therefore, teachers' emotional care for children has significant value. However, artificial intelligence does not accurately recognize children's emotional needs and provide nonverbal encouragement and support like teachers. Although artificial intelligence can respond to positive or negative words in the text and interact with users through the training of big data models, for young children whose language expression is not mature, there are still difficulties in clearly expressing their emotions, and artificial intelligence finds it difficult to capture the emotional needs behind them. Therefore, errors in language comprehension and the inability of artificial intelligence to timely capture emotions can lead to the generation of negative emotions in children. Moreover, children at this stage have the characteristic of pan spirituality, believing that everything has life. If children treat artificial intelligence as real people, the negative experience of communication between them may hinder children from establishing good relationships with others.

3.3. The Limitations of AI in Providing Solutions for Children

Artificial intelligence can develop diverse solutions through users' questions, not only solving practical problems but also providing users with novel perspectives. However, conversational artificial intelligence still has limitations in providing solutions for young children. To begin with, artificial intelligence may provide children with advice that does not fit their age group. One example is when Snapchat's My AI chatbot was talking to a 13-year-old child user, it encouraged the child to use candles and music to increase the atmosphere during sexual intercourse with her 31-year-old partner [7]. And this may mislead children into making serious mistakes. Next, the advice provided by artificial intelligence may be too complex for children to understand. The cognitive development level of young children is not yet mature enough, and they are mostly exposed to daily things around them. Through contact with these specific things, young children will gradually gain an understanding of the world. Although artificial intelligence can provide users with a wide range of professional answers, the abstract and complex concepts it provides are beyond the cognitive range of young children. In addition, the diversity of answers can also confuse them. Therefore, in the face of the application of artificial intelligence in preschool education, it should be further improved based on the characteristics of children's cognitive development stages.

4. Suggestions for the Application of ChatGPT in Preschool Education

Conversational AI such as ChatGPT has brought both opportunities and challenges to preschool education. Therefore, to better apply ChatGPT in the field of preschool education, it is necessary to combine an understanding of the cognitive development characteristics of children at this stage. As a

developmental psychologist and proposer of the theory of cognitive development, Piaget proposed that cognitive development is the process of individuals adapting to their environment and showing unique cognitive characteristics at different ages. This theory has had a profound impact on children's education and psychology, providing theoretical support for how to provide children's education. Piaget divided the cognitive development process of children into four stages, including the Sensory Motor Stage (0-2 years old), Pre-operational Stage (2-7 years old), Concrete Operational Stage (7-11 years old), and Formal Operational Stage (after 11 years old). Children in preschool education are mainly in the Pre-operational Stage. Therefore, by understanding the cognitive development characteristics in this stage, ChatGPT can be better applied in preschool education.

4.1. Comprehending Children's Language within Multimodal Interaction

ChatGPT can be combined with various interactive approaches to enhance the understanding of young children's language. Piaget noted that around the age of 4, young children become very curious about the world and want to know everything, which is known as the emergence of primitive reasoning [9]. to as the emergence of primitive reasoning. As a chat program with a rich corpus, ChatGPT can help children expand the scope of their concepts and broaden the depth of their knowledge. In addition, at this stage, children will also assign symbolic meaning to people and things, whether through drawings or gestures. In the early stages of children's language development, sounds, brushes, and gestures become their "language" for expressing their desires. Therefore, ChatGPT can enrich its interactive methods based on speech and text recognition. By combining with virtual reality technology for motion capture, ChatGPT can improve children's language understanding. It is also possible to explore the emotional essence behind children's art through the combination of image recognition and painting. Moreover, ChatGPT's understanding of individual language can be enriched through personalized feedback from child caregivers. Furthermore, children should be encouraged to provide feedback on the use of ChatGPT, and artificial intelligence technology should continuously improve the accuracy of children's language understanding.

4.2. Providing Emotional Companionship as a Virtual Partner

Piaget suggested that children in the Pre-operational Stage have abundant imagination and curiosity, and believe that everything has life. Therefore, ChatGPT can act as a virtual companion to accompany their lives, providing emotional needs and entertainment for them. While artificial intelligence cannot replace genuine human interaction, the actual process of interpersonal communication is not perfect. Children need to acquire much during this process of interpersonal communication, including how to accept criticism, how to solve conflicts, how to care for others, and how to avoid discrimination. ChatGPT can assist children in learning emotional expression and improving their emotional management skills by creating engaging simulated interactive experiences. Teachers can also simulate the process of interpersonal communication through theme setting, achieving interaction between students and virtual partners. During the interaction, children will experience the emotional impacts brought about by virtual partners. Through these experiences, children will learn to treat people with a positive rather than a negative attitude. Therefore, the setting of virtual partners can not only satisfy children's curiosity but also accompany them to meet their emotional needs and help them develop prosocial skills.

4.3. Offering Suggestions Combined with Children's Experiences

Piaget proposed that children at this stage have limited cognitive abilities and lack abstract thinking abilities. First, children's cognition is self-centered, often viewing problems from their perspective and unable to engage in empathy. Secondly, children at this stage still rely on concrete objects for cognitive construction. Therefore, artificial intelligence technology should be further improved based on the cognitive characteristics of preschool-aged children. In the first place, when communicating with children on ChatGPT and providing suggestions, limited suggestions can be provided in concise language based on common objects and situations around the children, such as schools, parks, family,

and friends to facilitate their understanding. Additionally, the first-person narrative perspective can be increased to enhance children's sense of self-immersion. For example, in a story presentation, two trial teaching activities were compared using the first-person and story character perspectives. The results showed that 73% of children could accurately answer story questions in the first-person narrative, while only 40% of children could answer questions from the character perspective [10]. Therefore, ChatGPT should further improve and enrich its expected conciseness in conversations with young children based on their cognitive characteristics at this stage.

5. Conclusion

In summary, in the context of the digital age, ChatGPT has great potential in the field of preschool education. However, its application for preschool children also presents many challenges, including difficulties in language comprehension, limitations in meeting emotional needs, and restricted applicability of children's suggestions. This paper integrates the cognitive development characteristics of children in the Pre-operational Stage of Piaget's cognitive development theory, including self-centeredness, generalization, and concrete operational thinking, and proposes suggestions for the application of ChatGPT in preschool education. These include implementing the combination of ChatGPT and multimodality, providing emotional companionship as a virtual partner, and proposing concrete, concise, and limited solutions. However, there is still a relatively limited amount of research and practice in the field of preschool education and the application of artificial intelligence, further experiments and explorations are necessary.

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