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Feasibility Study On AI Intelligent Agents Assisting Autistic Children's Social Skills Improvement In Elementary Integrated Education

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Abstract:
The core of inclusive education is to let students with special educational needs get educational services that fit their individual differences in regular schools. It is not to put them alone in special education schools. AI technology is developing fast. Its use in education has brought new chances for inclusive education in primary schools. This paper wants to find out if AI agents can help autistic children improve their social skills in primary school inclusive education. It looks at this from three sides: technology, practice and policy.

Keywords: *inclusive education; AI intelligent agent assistance; autistic children*

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I. Introduction

Research Background

The idea of "inclusive education" first appeared clearly in the "Salamanca Declaration" in 1994. After that, many countries around the world accepted this idea. In China, the Ministry of Education released the "Guiding Opinions on Strengthening the Work of Inclusive Education for Children and Adolescents with Disabilities in Compulsory Education" in 2020 [1]. In 2022, the Ministry of Education and other departments issued the "Action Plan for the Development and Improvement of Special Education in the 14th Five-Year Plan" [2]. Both documents say that ordinary schools should set up special education classes or carry out inclusive education in regular classes. They also push for regular teachers and special education teachers to prepare lessons and teach together. "China's Education Modernization 2035" [3] especially stresses the need to "promote the deep integration of new technologies such as artificial intelligence with education and teaching". This gives policy support for AI technology to help inclusive education.

Research Purpose and Significance

This study focuses on the social isolation problem of autistic children in regular schools. It tries to find out if AI-powered intelligent agents can help these children improve their social skills in inclusive primary education.

II. Literature Review

Current Domestic Research Status

In China, support for autistic children in primary school inclusive education mainly focuses on teacher training and classroom adaptation methods. Examples are the use of Individualized Education Plans (IEP) and the building of resource classrooms. Related studies have proved that inclusive environments are good for the development of autistic children's social skills. But most of these studies use traditional educational methods. They do not study AI technology much [4].

Research on social intervention for autistic children mainly focuses on behavioral therapy, social stories and game-based interventions [5]. Some digital methods are used, like rehabilitation apps and virtual reality (VR) technology. But these are mostly used in rehabilitation institutions. They are rarely seen in primary school integrated education settings.

Current Research Status Abroad

Other countries started research on AI agents helping autistic children's social abilities earlier. Their technology is more mature and widely used. The Kaspar social robot made by Dautenhahn et al. [6] and the virtual reality social simulation system designed by Bernard-Opitz et al. [7] have been used in the market. They have also been proved to improve autistic children's social responsiveness in clinical rehabilitation settings. They use real-time feedback and personalized scenario training. In this way, they make up for the weak points of traditional intervention methods well. The research by Goodwin et al. also adds emotion recognition technology to AI agents [8]. This makes technology intervention more in line with real social situations.

Research Gaps and Innovative Points

At present, AI use in China's special education mainly focuses on impairment screening and academic help. For example, speech recognition is used to help children with language impairments communicate. But research on AI agents that are specially designed to improve autistic children's social skills is still new [9] [10]. Most related studies are prototype designs in the laboratory, like social interaction robots. These are not adjusted to the teaching speed and teacher-student interaction patterns of inclusive classrooms in primary schools. Also, these studies do not clearly state that AI agents are "assistive". This may make people ignore the main role of teachers in inclusive education.

In foreign research on AI applications in inclusive education scenarios, studies stress the ecological integration of technology and the classroom. The social skill intervention framework put forward by Kasari et al. [11] and Belpaeme et al.'s review of social robot applications in educational scenarios [12] are both for the educational systems of Europe and the United States. But China's primary school class sizes, curriculum settings and teacher structures are different from those in Europe and America. At the same time, the social skill assessment system for autistic children built by Florian et al. [13] provides a theoretical basis for AI intervention design. But such research has not yet studied a collaborative intervention model of "AI assistance-teacher leadership-peer participation" in European and American education. This makes it hard to meet the practical needs of inclusive education in primary schools in China.

This research is different from studies that are only in rehabilitation settings or Western education systems. It focuses on using AI-assisted integration into education to improve autistic children's social skills in China's education system. It aims to fill the gap between policy and practice. It also tries to get over the limits of existing research that is often only for a certain stage.

III. Policy Analysis

Many national policies in China have clearly said that developing inclusive education and using artificial intelligence (AI) technology are core tasks for educational modernization. They form a policy support system of "top-level design + special planning". "China's Education Modernization 2035" [3] suggests that we should "promote the deep integration of new technologies such as AI with education and teaching". It also sees technology empowerment as an important way for high-quality educational development. This lays a policy foundation for AI agents to enter inclusive education scenarios in primary schools. The "14th Five-Year Plan for the Development and Improvement of Special Education" [2] stresses "improving the mechanism for the integrated development of general education and special education". It requires general schools to improve the support system for learning in regular classes. AI agents are an innovative support tool. They just meet the policy's requirement of "enriching the means of supporting special education".

The policy's support for inclusive education for autistic children is focused on "precision and normalization". This matches the intervention goals of this study very well. The "Guiding Opinions of the Ministry of Education on Strengthening the Work of Inclusive Education for Children and Adolescents with Disabilities in Compulsory Education" [1] clearly states that "we should guarantee the right of children and adolescents with disabilities to receive education on an equal footing in ordinary educational settings". It also requires "providing personalized support tailored to students' special needs". The social isolation problem of autistic children is a key barrier to their integration into ordinary classrooms. AI agents use personalized social interventions to help autistic children adapt to the social environment of ordinary classrooms. This is a specific way to meet the policy's requirement for "personalized support". At the same time, the policy encourages "ordinary teachers and special education teachers to collaborate in educating students". This provides a policy basis for this study to build an "AI-assisted - teacher-led" intervention model. It makes sure that using technology does not go against the essence of education.

Existing policies provide guarantees for the research to be carried out. They cover resource allocation and teacher development. They also leave space for technological innovation. The policies require ordinary schools to "build resource classrooms and equip resource teachers". This provides physical space and human support for the use of AI agents. The policies encourage "conducting training related to special education". This helps teachers improve their ability to use AI assistive tools. It also promotes the effective implementation of intervention programs. Besides, the policies stress "exploring the application of new technologies in special education". They do not strictly limit the forms of technological application. This provides flexible space for AI agents to adapt to scenarios and optimize functions. It supports this study to develop localized intervention programs. These programs take into account the actual situations of primary schools in China, such as class sizes and curriculum settings.

IV. Practical Analysis

AI-based Emotion Recognition Assisted Intervention

In their review on social robot intervention, Liu Jiehan et al. mentioned that the "Smart Star" system in Nanjing uses the emotion recognition technology of Goodwin et al. It takes pictures of autistic children's facial expressions through cameras. It then makes real-time emotion analysis reports and sends them to teachers. For example, during classroom group discussions, if the system finds that a child is frowning or avoiding interaction, it will automatically send a prompt to the teacher. The prompt says "reduce interaction intensity". It will also play soothing music through the robot to ease the child's anxiety. This achieves a collaborative intervention of "AI data capture - teacher decision-making - technical assistance". It meets the real needs of inclusive classrooms in primary schools.

AI Teaching Aids Campus Pilot

To respond to the "Guiding Opinions of the Ministry of Education on Strengthening the Work of Inclusive Education in Regular Classes" [1], the Red Cross Society of Chifeng City, Inner Mongolia, has worked with special education schools to start an AI teaching aid donation project. They have provided interactive robots with emotion recognition functions to inclusive classes in primary schools. These robots use games like "Draw and Guess" and "Story Chain" to guide autistic children and ordinary students to pair up and interact. During the interaction, the robots can accurately record how often children respond verbally and their level of body coordination. They then make personalized social ability growth profiles. These profiles provide data support for teachers to develop Individualized Education Plans (IEPs). At present, this project has been tested in three primary schools. It covers 86 autistic children. After the test, the children's classroom social participation rate has gone up by 40%.

AI-based Personalized Intervention in Special Schools

Nanjing Jiangning Special Education School has partnered with ordinary primary schools to start a pilot project of "AI+ Integrated Education". It uses the "Yuyue" system to provide a social language training platform for autistic children. The system has a "random delayed response" function. This function encourages children to take the initiative to speak. At the same time, it uses a "tactile feedback glove" to improve children's physical interaction and coordination. It is suitable for primary school classroom scenarios such as "answering questions" and "collaborative exploration". After the intervention, the average number of social interactions initiated by children per week has increased from 2.3 times to 7.8 times. The related experience has been included as a typical case in the "14th Five-Year Plan for the Development and Improvement of Special Education".

Practice of AI+ Curriculum Integration

To follow the requirements of "Deep Integration of Technology and Teaching" in "China's Education Modernization 2035" [3], Changzhou Special Education School has added AI agents to regular courses like Chinese and physical education. In the "role-playing" part of Chinese classes, robots act as story characters to talk with autistic children. They help children correct their speech tone and guide them to express their emotions. In the "team relay" activity of physical education classes, robots use visual instructions to help children complete teamwork. This case shows the integrated model of "intervention as teaching". It has been used in many educational scenarios.

V. Feasibility Analysis

Technical Level

Nowadays, AI technology is getting more and more mature. Technologies like emotion recognition, voice interaction and virtual reality have already been used in practical cases in the field of special education. The Kaspar social robot, VR social simulation system and domestic AI emotion recognition assistive tools mentioned before all show that technology is effective in social intervention for autistic children. Also, the cost of these technologies is going down gradually. The difficulty of putting related equipment in inclusive classrooms in primary schools is not high. Ordinary schools can afford small interactive robots and simple VR devices. At the same time, AI agents can flexibly change their intervention modes according to the teaching pace of primary school classrooms. For example, they can give short prompts during classroom interactions. They can also design simple games during break activities. This shows that they have strong technical adaptability.

Practical Level

On one hand, inclusive education has already built a certain practical foundation in primary schools in China. Many schools have set up resource classrooms and hired resource teachers. This provides both space and human support for using AI agents. For example, inclusive education practice projects in nearly 500 schools in Beijing have shown that an inclusive environment can help autistic children make progress in both academics and social interaction. AI agents can further improve this effect. On the other hand, relevant practical cases at home and abroad also provide references. For example, the AI teaching aid project tested in domestic primary schools and the AI personalized intervention cases in special schools have achieved good results. This shows that using AI agents in primary school inclusive settings is feasible. Besides, teachers can learn to use these AI tools through simple training. This will not add too much work to their daily teaching.

Policy Level

Many policies in China have supported the integration of AI technology into inclusive education. "China's Education Modernization 2035" promotes the deep integration of artificial intelligence and education and teaching. The "14th Five-Year Plan for the Development and Improvement of Special Education" requires enriching support measures for special education. These policies support the use of AI agents in inclusive classrooms in primary schools. The policies also encourage exploring the application of new technologies in special education. They do not limit specific application forms. This leaves a lot of space for AI agents to adapt to local conditions and be promoted. It allows them to better fit the actual situation in China.

VI. Conclusion And Outlook

Research Conclusion

This study analyzes the feasibility of using AI agents to help improve the social skills of autistic children in primary school inclusive education. It focuses on three aspects: policy, technology and practice. The research finds that existing policies in China provide a solid institutional guarantee for the project. Mature AI technology can meet the functional requirements of social intervention. The existing practical foundation of inclusive education in primary schools creates conditions for the technology to be used. AI agents have functions like personalized scenario design and real-time feedback. They can effectively make up for the weak points of traditional intervention methods. They help autistic children better adapt to the social environment of inclusive classrooms. At the same time, they match the collaborative intervention concept of "AI assistance-teacher leadership-peer participation". They do not go against the essence of inclusive education.

Future Outlook

AI agents are feasible for helping autistic children improve their social skills. But relevant research and practice are still in the early stage. In the future, the functional design of AI agents can be further optimized. This will make them more suitable for the classroom scenarios of primary schools in China and the social development characteristics of autistic children. For example, we can add more localized social scenario simulations. We can also simplify operational processes. At the same time, we can expand the scope of practice. We can do this by carrying out pilot projects in integrated classes in primary schools in more regions. We can collect more data to test the effectiveness of intervention. We can also form experiences that can be copied and promoted. Future research can also focus on combining AI agents with traditional intervention methods. It can also study how to extend the effectiveness of social intervention beyond the classroom through home-school cooperation. This will help autistic children better integrate into society.

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