Research on the Application of Artificial Intelligence in Special Education

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Abstract: The prevalence of disability population in China will continue to grow in the next 40 years. The development of special education is an important way for children with physical disabilities to obtain equal educational resources. With the development of science and technology, the development and wide application of artificial intelligence (AI) technology has provided a lot of help for special education. This paper expounds the importance and necessity of special education and the enforceability of AI application in the field of special education, from the current situation of disabled people and the current situation of computerized education in China; Then, from the perspective of special education teachers, special students and parents of special students, this paper expounds the role of AI in the field of special education, including assisting teachers in teaching, helping students learn, assisting parents in supervision. This paper discusses the need for a digital standard of AI application in special education to define the disability severity, provide reference for the classification of disability, and to refine the use, scope, function of AI application in special education.

1. Introduction

According to the information released by the UNESCO Asia Pacific Education Bureau in 2019 and the latest data of the World Health Organization (WHO), more than 1 billion people worldwide have some form of disability, of which 93 million are children under the age of 14 [1].More seriously, the number of people with disabilities continues to increase sharply due to factors such as demographic trends and the increase of chronic diseases [2].The report on the 70th anniversary of the protection of the rights and interests of the disabled in New China points out that China has 85 million disabled people, which is the country with the largest disabled population in the world, accounting for 6.34% of the total population. Their relatives are as high as 250 million, accounting for nearly one sixth of the total population, that is, one in six people is related to the disabled. The current disability rate of China's population will continue to grow in the next 40 years. It is predicted that the total number of people with disabilities in China will reach 65.3% by 2050, which will be twice that of the current total number of people with disabilities in China [3].

By the end of 2018, there were 1.04 million disabled children aged 0-14 in China with certificates [4].Due to their different behaviour ability or thinking from ordinary people, disabled children are socially excluded and their families are also discriminated to a certain extent, which makes them gradually become a marginal group in society. Education is related to the well-being of thousands of families and the harmony and stability of society. Therefore, the development of special education has attracted attention. In order to protect the right of disabled children to school, the state requires in the 14th five year plan to ensure that high-quality special education resources should be benefitted by every child and adolescent with different types and degrees of obstacles, the ability to integrate into society should be cultivated and the pursuit of a better life of disabled children should be met [5].

2. Current status of special education in china

According to the white paper by Chinese State Department, between 2012 and 2018, China's special education development focused on securing the school enrolment rate of people with disabilities. With the development of special education, the enrolment rate of school-age children has greatly increased [6]. However, the concept of inclusive education proposes that in order to provide high-quality and effective education, children with special needs should be enrolled in regular classes or schools that are appropriate for their age level and learning characteristics, and learn in the same educational environment as regular children. Therefore, an increase in enrolment is far from meeting the goal of high quality education. Children with different kinds of disabilities have the need to attend classes, but their needs will vary depending on the type of disability, so the educational goals and educational methods needed will also be different, which leads to a higher demand and greater requirement for the number and professional ability of special education teachers in school. In addition, due to the special nature, parents generally have overly high expectations for the professional education of school teachers. However, teachers spend most of their time working on a one-to-many basis, which make a lot of work. As a result they are unable to meet the demands of parents of children with special needs, which leads to conflicts between teachers and parents. Due to the limited number of regular national special education schools and the fact that a formalized, standardized and systematic training program with clear training goals is deficiency for special education students [7]. There is a shortage of special education teachers in China in terms of quantity and low professional competence, and it is impossible to accomplish the goal of teaching according to different disabilities in a short period of time with only teacher strength. The "Thirteenth Five-Year Plan for Education Computerized" states that education computerized should be persistently promoted and quality education resources should be expanded [8]. In need of educational resources, the rapid development and extensive practice of artificial intelligence (AI) in the field of special education has become more necessary to meet the teaching needs.

3. AI and special education

The term Artificial Intelligence (AI) was first proposed in the Dartmouth Workshop in 1956, and its connotation is defined as the intelligence of a machine simulating a human [9]. It is a marginal discipline at the intersection of natural and social sciences, and it is a technology typically characterized by big data, cloud computing, brain science, supercomputing, etc. Its core is to build knowledge, learning, reasoning, planning, perceiving, communicating, moving things, using tools expected to manipulate machinery and other abilities similar to or even beyond human beings, and it has strong technical advantages in the fields of intelligent decision-making, deep learning, and emotional computing [10]. AI has a powerful database in which fast retrieval and accurate screening of information keywords can be achieved [11]. Nowadays, AI technology has been developed and progressed significantly, and it is gradually penetrated and applied in all corners of people's lives. The wide application of tools such as accurate recommendation, big data prediction, and intelligent assistants in life has continuously refreshed people's understanding of AI and their expectations of AI in terms of convenient life.

AI education is a new field after the cross integration of AI and pedagogy. It aims to integrate AI and education, use advanced scientific and technological means to help education, and achieve the purpose of higher teaching quality, fairer education and more diversified teaching aids. At present, the technical means of AI applied to the field of special education include: computational intelligence technology, learning analysis technology, data mining technology, image recognition, machine learning, natural language processing, speech recognition, computational intelligence, virtual reality, augmented reality, hybrid reality and other technologies.

3.1. AI assist teachers in Teaching

Children with special needs have a wide range of learning differences between individuals,

depending on the type and degree of disability, and will encounter adjustment problems in regular schools. In order to respect individual differences and meet the special educational needs of children, it is necessary to pay attention to the physical and mental development and potential development of each special child in the education process, so special attention from teachers and individualized counselling are needed when attending classes. However, in the current environment of one-to-many education, the computerized of individual tutoring is low, and teachers tend to ignore the needs of individual students for learning tutoring, resulting in uneven educational resources and leading to problems such as student bias, reduced interest in learning, and reduced motivation. The combination of artificial intelligence and neural network can be used to collect and analyse the information of past learning status and learning progress, and customize the adaptive learning plan to meet students' personal situation, thus achieving the purpose of helping students learn and assisting teachers in teaching. At the same time, teaching data clusters can be established, allowing administrators or education experts to propose evaluation opinions and improvement plans in data analysis and comparison.

As a typical application of artificial intelligence, voice recognition and bionic technology in education, educational robots can collect and organize teaching materials for teachers and assist them in their teaching tasks. In the classroom, teachers and students can be connected through AI education systems so that teachers can know whether students are satisfied with the quality of the course and whether that knowledge appeals to them; students can also seek help from teachers to answer questions without hesitation, thus promoting interaction between teachers and students, deepening communication between teachers and students, and increasing the motivation of both sides in the classroom. For students with significant mood swings, AI technology can give the teacher timely feedback and adjust the class content so that some of the content does not cause discomfort to the students.

3.2. AI help students learn

Children with special needs are different from normal children due to differences in physical symptoms, gender, special education needs, or co-occurrence with other conditions. After enrolment, an assessment is needed to determine the level of disability of the student and to classify and assign them to classes. The intelligent teaching system developed based on artificial intelligence technology is based on algorithms and data, applying computational intelligence technology, learning analysis technology, data mining and other technologies, which can grasp the dynamic learning process of students, use it as a basis to understand the learning level and situation of students, select appropriate learning content for students, regulate the appropriate learning progress, and in the teaching process can automatically generate appropriate questions according to the learning goals of different students and students' In the teaching process, appropriate questions and answers can be automatically generated according to different students' learning goals and students' current levels, and by judging whether students' answers are correct, the learning content and progress of students can be dynamically adjusted [12], and the differences among students can be intelligently analysed, so that all-round weighing considerations can be made to formulate precise solutions and improve the energy efficiency of education. The system can be used to judge the situation of children with special needs when they enter schools or institutions. The intelligent system can import relevant information and generate questions that can be used to test the children and provide a more comprehensive assessment of their current level of development in terms of their correctness, speed of answers, and cooperation. Students can collect information through smart devices, build their own database, and accurately push relevant related information through big data analysis to expand their horizons and minds, so that learning content is no longer limited to textbook knowledge, to deepen the depth and breadth of knowledge, and to judge students' mastery of knowledge, to enhance students' self-awareness, and students' initiative and enthusiasm in learning.

Through EEG information acquisition technology, students' brainwave states during learning can be collected, analysed and classified for the purpose of identifying learning states and quantifying

the cognitive level of learning. Then, macroscopic analysis is performed by big data technology to give the intensity of the optimal external brainwave signal intervention and the location of the required stimulation for students while learning, to change the key neural substrates of the human brain [13] to enhance brain performance and improve cognitive abilities.

Students with physical disabilities may encounter problems in the learning process that they cannot perceive through their own senses and thus cannot learn and think well. For example, students with visual disabilities cannot acquire knowledge through vision, but can only associate new things through touch or sound information. The combination of artificial intelligence and neural networks can help students with visual impairment to establish visual sensory functions by collecting, processing, and analysing individual learning data to give a set of teaching programs suitable for the student [14], and then combining brain computer interface (BCI) technology to reconstruct neural signals in the visual cortex to help students with visual impairment to achieve the effect of helping students to learn.

For students with communication and expression disorders, it is difficult for teachers to understand the learning and psychological state of students through external performance and verbal communication. The brain-computer interface technology, developed in brain science, does not rely on peripheral neuromuscular [15] to achieve direct interaction between the brain and the outside world. Students with communication and expression disorders can wear brain-computer interface devices to collect EEG signals from each student for analysis to determine whether the student's attention is focused or whether the student's mood swings are normal. Teachers can obtain real-time information about their attention, interest points, cognitive level, and emotional changes, and adjust teaching strategies based on the information obtained to provide targeted real-time instruction and improve classroom learning efficiency [16]. For example, for children with autism, their attention span is short and fragmented, and they need constant intervention from outside to ensure learning effectiveness. Georgopoulos et al. proposed a fuzzy cognitive map method for the identification and diagnosis of Specific Language Impairment (SLI). Diagnosis with a fuzzy cognitive map approach, which is able to detect attention levels in assessment exercises by combining performance data with user-generated data from interactions, and this study yielded satisfactory results on clinical cases [17].

For physically challenged students with disabilities, the combination of artificial intelligence and rehabilitation robots can assist in movement and learning. For example, a functional surrogate rehabilitation robot [18], a rehabilitation medical robot linked with BCI, can physically assist the wearer with the operations he or she wants to perform by analysing his or her EEG signals, making it possible for people with physical impairments to complete learning movements on their own and increasing their interest and autonomy in learning. Teaching assisted with intelligent speech recognition allows children with physical disabilities to ask questions with robots or intelligent educational systems through technologies such as speech recognition and natural language understanding and analysis, and the systems use natural language to answer questions, help students complete searches, and other tasks to assist in teaching.

For learners who cannot follow the class, artificial intelligence combined with virtual reality technology, with interactivity, immersion and fantasy as the main features, establishes a simulated teaching space, provides learners with a variety of virtual and learning scenarios, mobilizes the user's visual, auditory and tactile senses, reshapes the teaching modal information to make up for the lack of learners who cannot follow the class, provides an immersive The learning environment helps learners make the same response as the actual scene, enhances the response mechanism of learners and increases the amount of input to practical training, revisits the memory of knowledge, achieves a deeper understanding and internalization of the knowledge learned, and improves the learning experience and students' interest in learning. It allows learners to receive timely guidance and assistance from virtual tutors in the process of knowledge learning, presents book knowledge in a simpler and more intuitive way in the form of practical training guidance, and allows learners to generate a more complete, extensive, and valuable response mechanism in the contextualized learning process [19]. Combining a technique combining computer vision detection and brainwave

detection proposed by Rao Dong Yu for online learners' attention detection [20] allows tracking and intervention of students' learning status in distance education. Image recognition, machine learning, and natural language processing techniques can also be used to quickly recognize images and analyse and retrieve the required content to perform photo search for online question and answer.

3.3. AI assist parents in supervision

As a disadvantaged group, special children require behavioural records of teachers, teaching assistants, and others responsible for education to ensure that special children are not harmed at other levels. CreditSPMS, an intelligent performance appraisal management system, uses accurate computer systems in the age of artificial intelligence to conduct quantitative index assessments of teachers' ethical standards, and incorporates the assessment results into performance appraisals to quantitative evaluation of teacher ethics [21]. Through technologies such as big data and block-chain [22], various aspects of students' moral, academic, psychological, and reading content are collected during the implementation of education and teaching to provide a comprehensive individualized evaluation of students, enhance the interaction between parents and teachers, achieve simultaneous cooperation between families and schools, and cooperate in educating children, which is conducive to the academic development and healthy physical and mental growth of children with disabilities, and give spiritual Students are given spiritual support, recognition and encouragement to improve motivation for learning. Using the combination of AI and technologies such as face recognition attendance, thermal imaging monitoring, and data analysis and prediction, children's behaviour can be tracked and collected, data analysed, and scientifically predicted to assess the child's physical and mental health status as well as help determine whether early medical or psychological intervention is needed. For children with problems, parents can be reminded of early detection, early identification and early guidance.

4. Discussion and thinking

4.1. Orientation of teachers in the age of artificial intelligence

Artificial intelligence is widely used to assist teachers in teaching, largely replacing the repetitive and mechanical teaching activities of teachers. In the teaching process, the teacher's role has changed from that of a preacher to that of a guide and helper of students' learning, and AI has to a certain extent liberated the teacher's workforce, but ultimately it cannot replace the teacher's role in forming moral cognition, moral judgment, and adopting corresponding behaviour in specific teaching situations. The improper use of educational technology may even lead to the alienation of teachers' and students' behaviour and generate ethical problems in education.

4.2. Requirements for parents in the era of artificial intelligence

Artificial intelligence technology can also play a role in assisting parents to supervise when assisting teachers in teaching. This supervision is not only a protection of children's life safety, but also a means to understand and accompany children. Compared to traditional education, this approach increases the way parents understand their children and also brings the communication distance between parents and teachers closer. However, the application of artificial intelligence in education, parents are no longer just send their children to school and give the education to the teacher's role, but also to comply with the development of the times and technology, trying to keep up with the pace of technology, learn to use technological means to achieve mutual trust between teachers and students, mutual understanding between teachers and parents, the effect of mutual cooperation, promote the teacher, parents and students between the emotional exchange In addition, we will promote emotional communication, thought collision, teaching interaction and positive feedback among teachers, parents and students, so as to better accompany children's learning and growth, assist teachers in teaching and communication.

4.3. Protection of students in the era of artificial intelligence

The application of artificial intelligence is inseparable from the support of big data, and the

development of special education needs to grasp all aspects of information about children with special needs, and import these into the learning system to develop corresponding learning plans for children with special needs. In this process, the privacy information of special children will be involved, such as personal physiological information, personality traits, intelligence level, disability level, etc. Although artificial intelligence technology has played a strong role in supporting special education, there is also the possibility that artificial intelligence education applications leak children's privacy.

4.4. The need for standards in the age of artificial intelligence

With AI in special education in full swing, more and more companies, R&D organizations and individual organizations are getting involved in the industry. However, each organization has a different understanding of special education and its needs, and each organization has its own insights into the application of AI in this field, thus setting different standards of use. In the general social environment, using different standards in the same industry will inevitably lead to internal conflicts in the industry, which leads to the lack of wide applicability of products, duplicated and redundant functions, and even the waste of resources. Therefore, an industry standard is needed to define the degree of disability, to give reference to disability classification, and to refine the use of AI in special education, the scope of its role, its functions, and the adjustment of the corresponding parameters of its internal structure (e.g., a data-based standard for classifying the disability level of special children). With this standard, the communication between parents, teachers and students with disabilities can be appropriately adjusted to avoid conflicts caused by high parental expectations and insufficient teacher energy, so that children can receive the same level of education at school and at home, and to increase the positive influence of the living environment on their physical and mental development.

5. Conclusion

China's special education started late and faces the difficulties of limited number of national special education schools, large base of special children, wide distribution and differences, small number of special education teachers, low professionalism, many affairs other than teaching, and high expectations of special children's parents for teachers. The advantages of artificial intelligence technology in education have gradually emerged, and it has great positive effects in the field of special education. It can effectively assist teachers in teaching: replacing the repetitive and mechanical work that special education teachers perform in the teaching process, helping teachers to judge and switch the difficulty level of educational content, and assisting special education teachers in the implementation of personalized education. It allows teachers to have more time to think about better teaching contents and methods, and more energy to care for students' emotional and spiritual needs. Helping students learn: Through the combination of AI and machine learning technology, computational intelligence technology, learning analysis technology, data mining and other technologies, EEG analysis technology, big data, virtual reality technology, etc., we help special children with physical, expressive and cognitive disabilities to learn. Assist parents in monitoring: Assist parents in monitoring teachers' teaching behaviours, tracking the physical conditions of special children, and detecting, identifying, evaluating and early intervening in physical and mental problems of special children. However, because the construction of digital education infrastructure in China is not yet complete, the combined application of AI and special education still has a long way to go in the development of China's special education industry.

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