



Status, Challenges and Prospects of AI Education in Chinese Primary and Secondary School Classrooms

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Abstract. Artificial intelligence (AI) technology provided more ideas for industry innovation through its use in various industries. Applying AI education to primary and secondary education is of great significance to the cultivation of innovative talents in China. This paper analyses the concepts related to AI and AI education, creatively gives a humanist connotation to AI education, explores the necessity of AI education in primary and secondary schools, identifies the current challenges faced and determines the general orientation and future development direction of AI education in primary and secondary schools.

Keywords: AI Education · Primary School · Secondary School

1 Introduction

In the context of the smart era, using AI at the primary and secondary school level is a new demand in education. Gwak argues that AI education focuses on students learning AI-related content such as robotics and programming, or using AI-related logical thinking to solve problems [1]. Middleton argues that AI education focuses on how people benefit from the use of smart technologies [2].

Since 2017, China has issued a series of policies related to the establishment of AI curriculum at primary and secondary school levels. The application of AI in primary and secondary education classrooms is imperative, and the benefits it brings are huge. First, AI technology can cover all aspects of teaching in depth, promoting the improvement of course quality and effect. Second, AI technology promote the modernization of the curriculum content system. Thirdly, to promote the intelligent education of the whole people and lay the foundation for cultivating AI talents, China cannot enter the era of AI without the popularization of corresponding AI education.

2 The Status of AI Education at the Primary and Secondary School

The current curriculum for AI education at the primary and secondary school levels is not well positioned, often confused with computational thinking education, STEM education, robotics education, etc., usually copying or mixing these existing courses.

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Therefore, we need to correctly distinguish the connotation of AI education and related education to determine the overall positioning of AI education in primary and secondary schools in the era of intelligence.

Computational thinking education emphasizes the use of computer science concepts and methods to disassemble complex problems into simple and operable sub-problems, use a series of clear steps to generate solutions, and then transfer the solutions to similar problems, thus automating the problem-solving process [3]. One of the core concerns of AI education is how to design intelligent machines to replace humans to solve practical problems, so that it is no longer necessary for humans to complete the most difficult problem disassembly and abstract expression in computational thinking.

In primary and secondary schools, STEM education focuses on cultivating students' scientific literacy (S), technical literacy (T), engineering literacy (E) and mathematical literacy (M) [4]. One of the basic concepts of STEM education is based on existing subject knowledge, interdisciplinary and using multidisciplinary thinking and knowledge to solve practical problems, emphasizing students' interdisciplinary abilities. AI education also needs to cultivate interdisciplinary knowledge literacy, but it needs to break through the existing subject knowledge and way of thinking, and solve practical problems from the perspective of creating and realizing human-like intelligent machines.

Robot education involves creating, building, programming, and using robots to develop students' all-around skills and pique their interest in learning [5]. In primary and secondary schools, robotics education is mostly in the form of building robot structures, writing and debugging control programs, and designing creative projects [6]. Intelligent robots are one of the major representative achievements in the field of AI, but a great deal of fundamental knowledge and ideas such as intellectual reasoning and ethics that should be covered are not covered in AI education.

The "5Cs" in the era of AI and STEM teaching echo each other, all of which are to cultivate students' cooperation ability, communication ability, creativity ability, critical thinking ability and computational thinking ability. The foundation of AI is computational thinking. It is the capacity to approach issues using the fundamental ideas of computer science. The ability includes problem decomposition, pattern recognition, abstraction and algorithms. The main focus of computational thinking is problem solving. In the process of learning computational thinking, children develop the comprehensive ability to solve problems. AI is the ability to simulate human beings with computers, including thinking, behavior, learning and feelings. Therefore, the education of AI is that teachers must teach students the ability to "teach" and teach computers to solve problems.

3 The Directions of AI Education

AI education in primary and secondary schools needs to encourage students to be willing to carry out relevant theoretical exploration and hands-on practice, guide students to pay attention to social ethics and moral issues brought about by intelligent technology, and ultimately help students adapt to future intelligent learning and lifestyle. "Robots" and "programming" can be used as basic tools in the teaching learning design of AI courses throughout primary and secondary schools, with "creative design" and "work

development” as nutritional supplements aspects, however the overall orientation of AI education must follow the AI field. The knowledge structure, way of thinking, and trajectory of the intellectual discipline itself.

4 The Challenges of AI Education

AI teaching in primary and secondary schools lacks a unified and objective curriculum standard, and AI education is more classified as a part of information education, or placed in an elective module. The more complex theoretical concepts of AI are also presented in a small number of primary and secondary school classrooms precisely, and students’ understanding of AI concepts and principles often stagnates at the surface cognitive stage. Schools and teachers are not fully prepared to play the effectiveness of AI in teaching how to meaningfully integrate technology into the teaching process.

It is difficult for schools to control the school-based process of educational resources provided by AI. If “intelligent adaptation” education is placed in educational places other than schools, it is difficult to control it. There are ethical and security risks in the “integration of wisdom and education”. Although the combination of the two has great potential, it has not been fully released in educational practice. For teaching, we need to focus on how teachers use technology rather than the technology itself. In other words, schools and teachers are not fully prepared to play the effectiveness of AI in teaching how to meaningfully integrate technology into the teaching process.

AI education in primary and secondary schools requires strong teachers to improve teaching quality and efficiency. However, there is still a lot of room for improvement in the knowledge reserve and teaching experience of the teaching staff of AI education in primary and secondary schools. AI education does not have a clear knowledge system like Chinese, mathematics and other subjects. AI education teachers who are quite dabbled and lack professional level will lack comprehensiveness in explaining AI when they carry out teaching, and it is difficult to lead students to carry out in-depth exploration, and they cannot be solved in time in teaching. Besides, there is a lack of teaching experience in AI majors. Many AI practitioners lack teaching experience, making it difficult for primary and secondary schools to recruit suitable teachers for AI courses.

Compared with traditional subject education, AI education is a comprehensive subject, because the successful application of AI in primary and secondary classrooms requires the joint support of schools, society and families. From a social perspective, some educational institutions simplify AI courses to programming and robots, and falsely promote the performance of the courses, which affects the learning interest of primary and middle school students to a certain extent. From the perspective of parents, it mainly manifests as blindness and indifference to AI. What we do not deny is that some highly educated parents who understand the current mainstream direction are enthusiastic about AI education and let their children learn various AI-related courses from kindergarten onwards. However, many parents take further education as the ultimate goal and take an indifferent attitude towards the teaching of AI courses. There are also some parents who lead their children to study for a period of time without understanding AI due to the vigorous promotion of AI education in the education market, and then find that the content they have learned is not what they need, thus showing disappointment in AI

teaching. This also makes parents less interested in letting their children learn, which is even more detrimental to the development of AI education.

5 Perspective on the Future

First, clarify the independent and systematic curriculum, teaching and evaluation standards for AI education. Determine the basic principles of curriculum design, and help teachers design reasonable classroom teaching content. Curriculum design can generally be based on the 4P (Projects, Passions, Peers and Play) principle proposed by Resnick [7]. On the basis of the 4P principles, the design of AI courses in primary and secondary schools can be divided into four steps, namely introducing the concept of AI, experiencing AI technology, discussing the impact of AI, and completing AI projects. When carrying out AI teaching in primary and secondary schools, not only rely on teachers to explain theoretical knowledge in the classroom, but also need to pay attention to the creation of the teaching environment.

Secondly, solve the existing shortage of primary and secondary school teachers. In normal colleges and other qualified universities, AI related majors should be established to speed up the construction of disciplines and cultivate the teaching staff of AI courses in primary and secondary schools. The state can issue corresponding policies to encourage graduates majoring in AI in colleges and universities to devote themselves to the education and teaching activities of primary and secondary schools. Primary and secondary schools provide unified knowledge and literacy training for AI teachers, and relevant education departments should design an evaluation system for AI course teachers, and form a positive and effective incentive mechanism.

Finally, actively guide the society and parents to recognize AI education. The state should require primary and secondary schools to incorporate AI courses into their daily teaching activities, establish an assessment and management system for education and teaching, encourage social forces to participate in the popularization of AI, and standardize courses on AI and related instructional products in the education market. Pay attention to the supervision and maintenance of the privacy and data security of teachers and students, strengthen the guidance of students' legal ethics, and make students realize that the application of AI must abide by the laws of the country, social morality and human ethics. At the same time, teachers should strengthen the promotion of home-school joint work, help students' parents have a correct understanding of AI education through the promotion of publicity, and encourage parents to lead students to participate in AI-related science popularization activities after class, and also help students Develop good scientific literacy and lay the foundation for the advancement of AI education.

6 Conclusion

AI education is essentially an education covering a wider range of topics. At the current stage of primary and secondary schools, there is still a vague positioning of AI education. An independent curriculum, teaching and evaluation standard system has not yet been formed. There is a lack of strong teachers, and society and parents adopt negative attitudes towards AI education, etc. The implementation of AI education in

the compulsory education stage should enlighten rationality and cultivate citizens in the age of intelligence rather than “operators” of technology; it should enlighten wisdom and cultivate students’ AI thinking and problem-solving methods rather than disciplines “Professionals”; should reveal threats, clarify the impact and challenges brought by AI, and not be “bystanders” in the age of intelligence.

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