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INTEGRATION OF BIG DATA AND INTELLIGENT TECHNOLOGIES: DRIVING DIGITAL TRANSFORMATION AND INNOVATION IN EDUCATION

With the deepening development of social, economic informatization, and networking, a new generation of artificial intelligence technologies based on mobile internet, Internet of Things, cloud computing, big data, etc., continues to advance. Data mining has been widely applied in various industries, gradually integrating into the field of education. People are beginning to understand and utilize artificial intelligence, leading to significant development and progress in current society. Integrating artificial intelligence with auxiliary learning is a new trend, changing traditional teaching models and innovating teaching methods. At the same time, it promotes the development of students' innovative thinking and provides a more systematic evaluation and diagnosis of students' learning outcomes. In today's society, AI education is driving the digital transformation and innovation of education.

Keyword: *Big Data, Artificial Intelligence, Digital Transformation, Education*

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ИНТЕГРАЦИЯ БОЛЬШИХ ДАННЫХ И ИНТЕЛЛЕКТУАЛЬНЫХ ТЕХНОЛОГИЙ: СТИМУЛИРОВАНИЕ ЦИФРОВОЙ ТРАНСФОРМАЦИИ И ИННОВАЦИЙ В ОБРАЗОВАНИИ

С углублением развития социальной и экономической информатизации и сетевого взаимодействия продолжает развиваться новое поколение технологий искусственного интеллекта, основанных на мобильном Интернете, Интернете вещей, облачных вычислениях, больших данных и т. д. Интеллектуальный анализ данных широко применяется в различных отраслях промышленности, постепенно интегрируясь в сферу образования. Люди начинают понимать и использовать искусственный интеллект, что приводит к значительному развитию и прогрессу в современном обществе. Интеграция искусственного интеллекта во вспомогательное обучение – это новая тенденция, которая меняет традиционные модели обучения и внедряет инновационные методы преподавания. В то же время это способствует развитию инновационного мышления учащихся и обеспечивает более систематическую оценку и диагностику результатов обучения учащихся. В современном обществе образование с использованием искусственного интеллекта является движущей силой цифровой трансформации и инноваций в образовании.

Ключевые слова: *большие данные, искусственный интеллект, цифровая трансформация, образование*

1. Integration of Educational Digital Transformation and Big Data

1.1 Concept and Importance of Digital Transformation

Digital transformation refers to the integration of digital technology into all areas of activity, fundamentally changing the way humans engage in these activities and bringing value to individuals

and society as a whole. In this sense, digital transformation is not merely the application of digital technology to achieve automation; it signifies the impact of digital change on human habits, behaviors, lifestyles, and every social and cultural phenomenon.

Today, technological innovation has permeated every factor of production, becoming a tangible productive force. "Being digitized" implies that every social and cultural phenomenon relies on digital technology, making digital technology a driving force for social change. Therefore, when discussing social digital transformation, the greater perspective is a humanistic endeavor to improve human life through digital technology.

Educational digital transformation involves integrating various educational elements with information technology, utilizing digital tools and platforms to improve the process of teaching and learning and enhance the quality of education. In today's rapidly evolving digital age, educational digital transformation has become an inevitable trend.

Educational digital transformation meets the needs of the era. With the rapid development of science and technology and the widespread use of the Internet, we live in a digital world. Students grow up in an environment inseparable from digital technology and have a natural adaptability to digital learning methods. Meanwhile, the shortcomings of traditional educational models, such as limited teacher resources, monotonous learning content, and lack of flexibility, have also prompted the need for educational digital transformation. It provides students with a wider and more diverse range of learning opportunities. Through online courses and learning platforms, students can learn anytime, anywhere, breaking the limitations of time and space and achieving cross-regional sharing of high-quality educational resources. Online learning can also provide personalized, adaptive learning experiences to better meet the needs of students.[6]

Educational digital transformation can improve the quality and effectiveness of teaching. Through digital tools and platforms, teachers can access a wealth of teaching resources, including online courses, learning materials, interactive teaching aids, etc. These resources can provide teachers with richer teaching tools and methods, stimulate students' interest in learning, and improve teaching effectiveness. At the same time, educational digital transformation can also explore and analyze students' personalized learning experiences, customize teaching based on students' learning progress and styles, and help students better understand and absorb knowledge.

Educational digital transformation can also promote the sharing and collaboration of school and educational resources, improving the teaching level of teachers. Through online collaboration platforms, schools and teachers can share teaching resources and experiences, engage in teaching method exchanges and discussions. This collaboration and sharing can strengthen the teaching force, improve the overall teaching level, and further promote the development of education.

1.2 Overview of the Application of Intelligent Technology in Education

Artificial intelligence was born in the 1950s, with Alan Turing formally proposing the concept of thinking machines in 1950, envisioning machines capable of autonomously or interactively performing various human-like tasks in various environments. The fantasy that one day machines could possess human perception and intelligence to accomplish tasks that only humans can do has persisted. Currently, artificial intelligence is divided into logical, biomimetic, and physiological approaches. Essentially, it is the study of using machines to mimic and execute certain intellectual functions of the human brain, and developing related theories and technologies. The fundamental idea is to simulate or achieve human intelligence using computers, to simulate human thought, consciousness, and activities, eventually being able to think like humans, or even surpass human intelligence, and possess the ability for deep learning. The big data of the Internet further provides the learning materials needed for artificial intelligence, representing an advanced form of Internet development. In October 2016, the White House Office of Science and Technology Policy released two reports, "Preparing for the Future of Artificial Intelligence" and "The National Artificial Intelligence Research and

Development Strategic Plan," indicating the increasing global attention to artificial intelligence. Renowned artificial intelligence expert Nick Bostrom defines superintelligence as "much smarter than the smartest human brain in almost every field, including scientific innovation, general knowledge, and social skills." Artificial intelligence is not a joke in science fiction but a real existing super technology. Unmanned driving, unmanned supermarkets, Baidu Brain, robots, AlphaGo defeating humans, facial recognition, smart speakers, facial payment, etc., are entering people's lives, learning, and work.

In China, in July 2017, the State Council officially issued the "Development Plan for the New Generation of Artificial Intelligence," emphasizing the use of intelligent technology to accelerate the reform of talent training models and teaching methods, and construct a new education system including intelligent learning and interactive learning. In April 2018, the Ministry of Education of China issued the "Action Plan for Innovation in Artificial Intelligence in Higher Education Institutions," advocating the promotion of the development of intelligent education, exploration of new teaching modes based on artificial intelligence, reconstruction of teaching processes, and application of artificial intelligence in teaching process monitoring, learning analysis, and academic level diagnosis.[4] In the same year, the National Natural Science Foundation of China included educational artificial intelligence in scientific research topics, establishing multiple research directions such as educational intelligent agents, educational robots, online and mobile learning, comprehensively covering scientific issues in the field of education.

As of March 2024, a search in CNKI using the title "Artificial Intelligence + Education" showed a total of education artificial intelligence papers published, spanning 10 years from 2014 to the end of 2023 (excluding newspaper articles). It can be seen that the number of education artificial intelligence articles published before 2014 was indeed relatively small, but in recent years, the number has rapidly increased, as shown in Table 1.

Table

Statistics of Chinese Education Artificial Intelligence Literature from 2014 to 2023

Year	Journal Papers	Master's Theses	Doctoral Dissertations	International Conference Papers
2023	1300	54	3	8
2022	974	101	4	13
2021	1102	123	9	5
2020	1082	125	6	2
2019	992	85	4	9
2018	601	29	0	3
2017	194	16	3	10
2016	18	1	0	0
2015	0	0	0	0
2014	3	0	0	0

In recent years, artificial intelligence technology has undergone significant development, particularly in the integration with education in areas such as computer vision and machine learning. The application of artificial intelligence in the field of education is showing a rapid growth trend. Against the backdrop of dual promotion from national policies and the industry, several key technologies of artificial intelligence are playing an increasingly important role in the education sector and are gradually being widely applied. Artificial intelligence will become a crucially adopted technology in the education sector, deeply integrating with education and sparking profound changes in education.

2. Case Study: Application of Intelligent Technology in Education

2.1 Case One: Personalized Learning System

Personalized learning is a teaching model that tailors learning plans and teaching resources to each student based on individual differences and learning needs. Traditional educational models often adopt a one-size-fits-all approach, overlooking the differences among students. Personalized learning can provide each student with the most suitable learning content and teaching methods based on factors such as their learning style, interests, and abilities, helping them better understand and master knowledge. Artificial intelligence technology plays an important role in personalized learning. The following are several typical applications of artificial intelligence in personalized learning:

Content Recommendation: Artificial intelligence can analyze students' learning data and behavioral patterns to understand their learning interests and preferences, thereby recommending suitable learning content for them. For example, recommendation systems based on machine learning algorithms can recommend relevant learning resources and courses based on students' historical learning records and evaluations.

Progress Tracking: Artificial intelligence can automatically track students' learning progress and performance, promptly identify learning difficulties and issues, and provide corresponding guidance and support. By analyzing students' answer patterns and learning data, artificial intelligence can assess students' mastery of the content and adjust learning plans and teaching content accordingly.

Intelligent Tutoring and Interaction: Artificial intelligence can engage in intelligent tutoring and interaction with students through natural language processing and machine learning technologies. For example, virtual tutors can answer students' questions, explain concepts, and provide guidance and assistance based on students' answers and thought processes.

2.2 Case Study Two: Intelligent Teaching Assistance Tools

Computer-assisted instruction (CAI) is the utilization of computers to replace teachers, weaving relevant teaching content into various courseware for learners. Individuals can choose learning content and progress according to their needs, thus making teaching content more visualized and diversified. Currently, both domestically and internationally, CAI plays an important role in school education and home education. However, most early CAI systems utilized decision theory and random learning models, presetting all teaching information in the courseware. Once the courseware was formed, any changes in teaching would greatly inconvenience system maintenance. Mainly lacking intelligence, existing CAI courseware cannot provide effective guidance for students at different levels. Teachers cannot actively participate in teaching and cannot select the most suitable teaching mode, learning content, and methods according to the cognitive model provided by the system. Additionally, there is a lack of interactivity between teachers and learners. Learners can independently study based on the courseware provided by teachers, but teachers have no understanding of the learners' learning status. There is no interaction between teachers and students, and there is no way to communicate and discuss knowledge content through the network space. As a result, human-computer interaction is not well realized, and the data is non-intelligent. By incorporating artificial intelligence into teaching, learners can utilize intelligent microcomputer systems combined with the big data environment in the network to analyze, integrate, and extract large amounts of information related to educational knowledge, and then make effective selections and process them. Based on this, teachers analyze learners' individual characteristics and adopt the most effective methods and strategies to construct intelligent expert-assisted learning systems. The most obvious application of artificial intelligence in the education field is educational robots, which can replace teachers in grading assignments, answering learners' difficult questions, assessing learners, and providing personalized guidance strategies based on the assessment results. With the rapid development of artificial intelligence technology, fields such as expert systems, pattern recognition, and machine learning are

becoming more perfect. Their application in computer-assisted instruction is becoming more widespread and will continue to drive the reform of the education industry.[5]

Artificial Intelligence Education: Artificial intelligence education is generally defined as the use of artificial intelligence technology to improve teaching effectiveness.[8] It is a superficial achievement of teaching goals, and at this stage, it only plays a partial role in auxiliary teaching and evaluation, showing a significant improvement compared to traditional teaching models. [3] Artificial intelligence education is the implementation of certain things in the education field according to preset programs. It lacks self-awareness, emotional cultivation, as well as the cultivation of values and moral consciousness. It lacks communication and interaction between teachers and students or among students, resulting in the phenomenon of "education without human presence." There is no emotional exchange process between teachers and students. During this period, it is difficult for artificial intelligence education to achieve learners' emotional, attitudinal, and value-oriented cultivation. With the further integration of artificial intelligence technology and education, some people lack a comprehensive understanding of artificial intelligence and believe that robots will replace teachers in the future, and classroom teaching will disappear. They exaggerate the role of artificial intelligence, especially in promoting educational reform, ignoring teaching contexts and student needs, and excessively relying on technology in teaching activities. In fact, the educational process is completely a human activity. Humans have emotions, morals, and thoughts. No matter how artificial intelligence develops, it will not replace education or humans. Moreover, it cannot replace humans. Therefore, adjusting the contradiction between technology and humans and achieving human-machine cooperation and coexistence is a prerequisite for further integration of artificial intelligence and education.[8]

Educational Artificial Intelligence: Educational artificial intelligence (EAI) is defined as going beyond technological limitations, returning to the essence of education, guided by collaborative concepts, and using artificial intelligence technology to understand how learning occurs, how it is influenced by various external factors, and then create conditions for learners to learn efficiently.[2] During this stage, educators need to adjust their thinking, change their mindset, focus on people-oriented collaborative concepts, deeply integrate artificial intelligence and education, and grasp the rules of educational activities for machines and humans. Fully utilizing educational resources to meet the needs of personalized learning, using intelligent education platforms, and intelligent education evaluation systems to ensure two-way interaction between teachers and learners. This promotes and drives the reform and innovation of teaching models, enriches educational resources, and diversifies teaching methods and means.

3. Conclusion

In the era of artificial intelligence (AI) and digitalization, the future of education lies in embracing the opportunities presented by the big data environment. Whether it's the government, businesses, research institutions, administrative bodies, or educational departments, all should seize the opportunity and prepare adequately for the advent of the intelligent era. As the regulatory authority in education, it is crucial to prioritize the application of AI in the education sector and recognize its significant significance and role in the development of education in our country.

Firstly, it is essential to increase investment and formulate relevant policies and regulations to identify the intersection between AI and education better, thereby promoting better collaboration and innovation between teachers and AI technology professionals. The deep integration of AI and education is a complex, long-term, and arduous task that requires confidence and determination to yield results. Secondly, it is necessary to promptly establish and improve the legal and ethical norms and policy systems of AI to ensure its legitimate use in the field of education.[9]

In the future, efforts should be strengthened in the following three aspects to enhance research on AI in the field of education: Firstly, creating AI resource sharing platforms technically to establish long-term partnerships between enterprises and schools, create and maintain an AI-friendly

ecosystem in education, and comprehensively improve the research and innovation capabilities and service quality of AI products (such as intelligent robots, etc.). Secondly, developing robots that serve the education field, focusing on auditory, visual, facial recognition, speech, emotional detection, and long-term interaction capabilities. Thirdly, integrating fragmented resources to achieve deep learning, allowing teachers and students to access desired information seamlessly as needed.

Facing the wave of educational reform under the big data environment, it is crucial to seize the opportunity, deepen AI education, make education in our country more balanced, personalized, and intelligent, and comprehensively improve the quality of education and the application level of AI in the education field. This will contribute to accelerating education modernization and creating a better future for education.

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