A New World of Open Space - Reflections and Perspectives of Chinese Scholars on the Digital Transformation of Education and Future Education Research

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Abstract

There is an urgent need to advance theoretical research and broaden the academic conversation in relevant domains in order to undertake strategic initiatives for the digitalization of education. The topics of the metaverse and educational ecological reconstruction, artificial intelligence (AI) and future educational development, big data and educational governance, and future educational research paradigm change are thoroughly discussed through interviews with 16 experts in the field of educational information technology. The study found that: (1) The metaverse represents one potential avenue for modern educational evolution; (2) Artificial intelligence is an all-round challenge to education, which has a significant impact on talent training, both in teaching and learning, as well as the restructuring of the entire education system; (3) Under the background of artificial intelligence, the future education will mainly lead to changes in educational values and objectives, and changes in the means of educational scenarios will also lead to changes in traditional educational forms;(4) The duplexing empowerment between education research and new technology: the rapid development of data science and AI technology have become the main object of educational research and utilization.In turn, education feed into AI technology and drive the development of the technology;(5)In the future, education will be gradually moving from an industrialized education system to an intelligent education system, AI technology will enable the future of education to become more personal, diversify and human-computer cooperation; (6) In the context of new technologies, such as AI and the Metaverse, science fiction could be used as a new method for educational research.

Keywords: Artificial Intelligence; Virtual Reality; Digital Transformation; Big Data; Educational Restructuring

Introduction

At present, the new technological revolution represented by artificial intelligence (AI), virtual reality (VR), cloud computing, and big data is booming, and human society has entered the era of intelligence. Education is the core driving force of the current AI technology revolution, and it is also the most important application scenario and development direction of AI. Education technology can improve the effectiveness of decision-making and work efficiency of educational subjects, realize personalized teaching and break through the barriers of time and space to traditional education models [1]. This has come to the fore in the global educational response to COVID-19 and has pushed the global digital transformation of education to a new wave. The use of information technology to drive educational change has become an international consensus and has been incorporated into the education-related policies of various countries, such as the National Education Technology Plan of the United States and the Mast Plan of Singapore, all of which have plans

A New World of Open Space - Reflections and Perspectives of Chinese Scholars on the Digital Transformation of Education and Future Education Research

11

on how to use technology to promote innovation and ecological restructuring in education. It can be said that education, as a core area of technology use and reform and innovation, has also become a sector that has not been reshaped by technology so far. The issues of "how artificial intelligence technology will reshape the future education ecosystem" and "how new technologies can contribute to the future development of education" have become the focus of discussion in education and society as a whole [2].

The assertion that "technology is transforming education" is indisputable, but in the face of this "dark horse" artificial intelligence technology, especially as more and more schools realize the great potential of smart technology and begin to introduce it, relying too much on emotional alienation resulting from smart technology, knowledge of cocoon, the digital divide, gender discrimination, as well as to the issues of education fairness concerns are increasingly apparent [3]. The uncertainty brought by the new technological revolution to education, especially the increased risk of technology abuse, has brought different degrees of anxiety and worry to all stakeholders in the field of education [4]. Although there have been studies exploring the potential of digital tools such as artificial intelligence, cloud computing, and big data in shaping the future of education, scholars have discussed the current status, application, benefits, potential challenges, and future trends of artificial intelligence in education; the following issues are still worthy of in-depth discussion: what new ideas, technologies and challenges will the digital transformation of education bring to the field of education? What new opportunities and new space will there be for education and research in the field of education in the future?

In order to answer these questions, the research team conducted in-depth interviews with 16 experts from the field of educational information technology on topics such as "metaverse and future education," "Artificial intelligence and machine learning," "The development of computational social science" and "Prospects for future education research". Specific topics of discussion and main progress were as follows: (1) From the concept and idea of "metaverse," we explored whether "metaverse" is a concept that must be incorporated to characterize the new impact of new technologies on education or a novel but transient concept. If the concept of "metaverse" is incorporated into the field of educational research, what will be the impact on educational research, and how can we cope with it; (2) Starting from the large-scale education reform caused by artificial intelligence, the knowledge concept reshaped by artificial intelligence, and the development of future teachers enabled by artificial intelligence, we deeply analyzed the problems of how to carry out teaching and learning under the technological conditions created by artificial intelligence, and how to feed back the development of artificial intelligence technology in education; (3) From the perspective of the systematic reform of education in the era of artificial intelligence, we discussed the general picture and trend of the future education system and education form;(4) From the perspective of the influence of artificial intelligence and metaverse on educational research methods and paradigms, we discussed how science fiction can be used as a future educational research paradigm and how to realize it. For the discussion of the above issues, we can share the research contents of talent strategy and theoretical frontier in the intelligent era, intelligent application scenarios and educational governance, intelligent learning and teaching innovation, and the reshaping of educational ecology driven by artificial intelligence, so as to outline the future picture of educational ecology.

This literature explores the potential of AI in shaping the future of education development. It discusses the current state of AI in education, its applications and benefits, potential challenges, and future trends. The review also highlights the importance of collaboration between educators, researchers, and policymakers to ensure AI's effective and ethical integration into educational practices.

Digital transformation of education in China

At present, China is in an important stage of digital transformation and upgrading of traditional industries, and the driving force for the development of digital trade is strong. In October 2021, I research (a data research institute) published the "global digital trade white Paper" pointed out that in 2020, the scale of China's digital economy reached 39.2 trillion yuan, accounting for 38.6% of GDP, ranked the world's second, with a year-on-year growth of 2.4 percentage points, the world's first growth rate [5].

In recent years, China has developed the education informationization as a strategic high ground, taken the initiative to meet and adapt to the change in information technology, and technology education to promote education reform, improve the efficiency of education, reshape the education ecology, especially the outbreak of COVID-19 in 2020, makes the rapid development of online education, accelerated the pace of education informatization. According to the 2022 China Internet Statistics Report released by the China In-

A New World of Open Space - Reflections and Perspectives of Chinese Scholars on the Digital Transformation of Education and Future Education Research

12

ternet Network Center, the country's Internet penetration rate has reached 74.4%, and this figure is also reached 58.8%in rural areas (Fig. 1) [6].
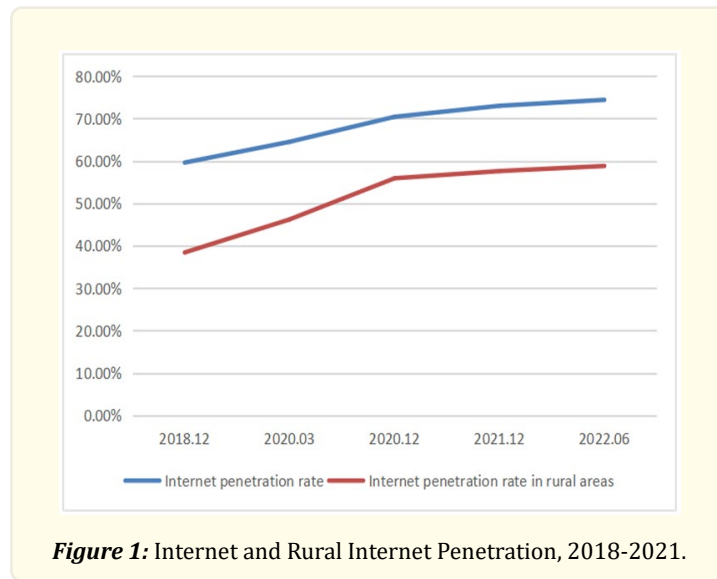

Figure 1: Internet and Rural Internet Penetration, 2018-2021.

According to the statistics of Foresight Industrial Research Institute, the number of online education users in China reached 342 million in 2020, 81.25 million less than in March 2020, accounting for 34.6% of the total Internet users; The number of mobile online education users reached 341 million, down 79.5 million from March 2020, accounting for 34.6% of mobile Internet users [7]. In the second half of 2020, with positive progress in epidemic prevention and control, universities, primary, and secondary schools basically restored normal teaching order, and the scale of online education users further dropped, but it still increased by 109 million compared with that before the COVID-19(Fig. 2).
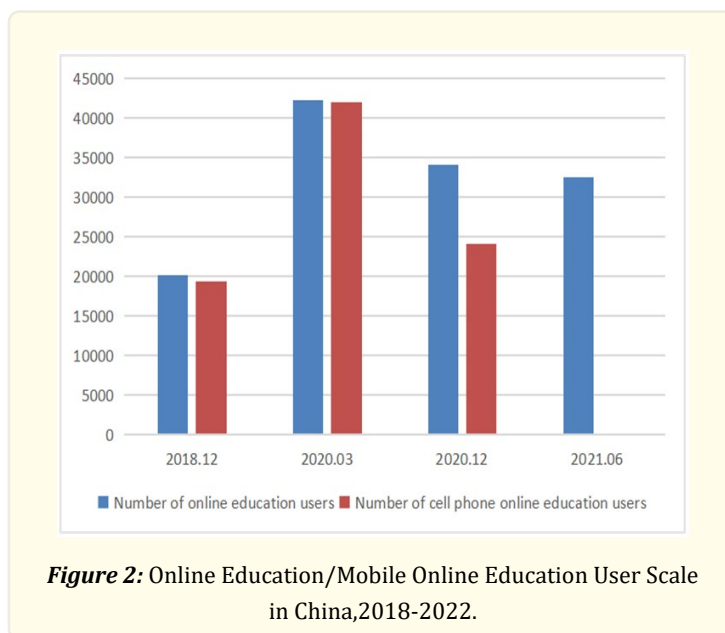

Figure 2: Online Education/Mobile Online Education User Scale in China,2018-2022.

A New World of Open Space - Reflections and Perspectives of Chinese Scholars on the Digital Transformation of Education and Future Education Research

13

Digital transformation of education refers to the use of modern information technology to support education in the education mode, mode of running a school and management system and guarantee mechanism innovation, promote the education process re-engineering, restructuring, and cultural reconstruction, change the dynamics of the development of education structure, accelerate the research and practice of educational paradigm change, finally realize the all-round, free and personalized development of people. The strategic action to digitize education has been included in the priorities of the Ministry of Education in 2022. The national Smart education public service platform is an important starting point to promote the strategic action of education digitization. Officially launched in March 2022, the platform provides basic education, vocational education, and higher education. Adhering to the principles of demand-oriented, application is king; service is Paramount, economy, and efficiency; it has gathered 34,000 basic education course resources, 6,628 high-quality online vocational education courses, and 27,000 high-quality higher education courses. According to data released by the Ministry of Education, 111 live courses of "Internet plus career guidance" have been launched on the platform, with 310 million viewers [8].

While promoting the digital transformation of education, the Chinese government has issued a series of regulations and policies to guide and regulate this process. Since 2018, the Chinese government has issued a series of related documents on the key of the education informationization, on the one hand, attention and encourages the development of the education of information technology; on the other hand, it strengthens the management of the use of the information technology education and guidance, establish and improve the mechanism of sustainable development of education informationization, construction of the network, digital, intelligent, personalized, the lifelong education system. Table 1 lists several key documents and their main contents (Table 1).

File	*Release Time*	*Content about Education Informationization*
Education Information Technology2.0 Action Plan	April 13, 2018	Actively promote "Internet+Education", adhere to the core concept of deep integration of information technology and education teaching, adhere to the basic policy of application-driven and mechanism innovation, establish a sound mechanism for sustainable development of education informatization, and build a networked, digital, intelligent, personalized and lifelong education system.
China Education Modernization 2035	February 23, 2019	Accelerate the transformation of education in the information age. Build an intelligent campus and coordinate the construction of an integrated intelligent teaching, management and service platform.
Opinions on Deep-ening Educational Teaching Reform to Comprehensively Improve the Quality of Compulsory Education	June 23, 2019	Promote the integration of information technology and education teaching applications. Accelerate the construction of digital campus and actively explore Internet-based teaching.
Guiding Opinions of the Ministry of Education and Other Eleven Departments on Promoting the Healthy Development of Online Education	September 25, 2019	Follow the law of education development, fully use modern information technology means, provide online education services, increase the effective supply of educational resources, innovate the organizational form of education, enrich modern learning methods, and accelerate the construction of a learning society.
Guidance from the Ministry of Education on strengthening the application of the "three classrooms"	March 5, 2020	Promote the deep integration of information technology and education teaching practice, promote the classroom revolution, innovate education teaching mode, promote the transformation of education, support the construction of a new ecology of "Internet + education", develop a more equitable and better quality education, and accelerate the modernization of education.

A New World of Open Space - Reflections and Perspectives of Chinese Scholars on the Digital Transformation of Education and Future Education Research

14

Notice of the Min-istry of Education on Strengthening Information Technology in Education Management in the New Era	March 15, 2021	Strengthen the coordination of education management informatization; optimize information system supply mode; improve education data management; promote management service process reengineering; and improve infrastructure support capability.
Notice of the Min-istry of Education on the Issuance of Specifications for the Construction of Digital Campus of Higher Education Institutions (for Trial Implementation)	March 16, 2021	The Code specifies the general requirements of digital campus construction in higher education institutions, and proposes to focus on the fundamental task of establishing moral education, combine with business needs, make full use of information technology, especially intelligent technology, to achieve innovative exploration of education methods, systematic construction of network security, intelligent connection of information resources, digital transformation of campus environment, adaptive development of users' information literacy and digital transformation of core business in higher education institutions under the conditions of informationization.
Highlights of the Department of Higher Education of the Ministry of Education for 2022	February 23, 2022	Comprehensively promote the digitalization of higher education teaching. Proactively adapt to the needs of quality diversification, lifelong learning, personalization of training and modernization of governance at the stage of popularization of higher education, and accelerate the construction of a new form of higher education characterized by digitalization.
Notice of the Gen-eral Office of the Ministry of Education on the Issuance of the Access Management Specification for the National Public Service Platform for Intelligent Education (for Trial Implementation)	28 July 2022	In accordance with the unified deployment of the National Education Digitalization Strategy Initiative, in order to accelerate the digital transformation of education and promote high-quality development of education, the management of platforms at all levels that access the National Public Service Platform for Smart Education is strengthened to form a national smart education platform system with the National Smart Education Portal as the core.

Table 1: China's Policy on Education Informatization (2018-2022).

At present, the integration of artificial intelligence, 5G, big data, and education is accelerating, promoting the rapid evolution of education informatization into education digitalization. The smart education industry has been developing during the epidemic. The Chinese government has realized that smart education is of great help to China's sustainable development strategy and policy, and the application of smart technology in education still has great potential, but at the same time, the uncertainty brought by the new technological revolution to education also brings different degrees of anxiety to people. Based on the current situation of educational digital transformation in China, how should we understand the impact of technological change on education in the future? In section one, we have stated the purpose and intention of this research. Next, we will elaborate the research proposal.

Data collection and analysis
Interviews

Interviews are the main source of material for analysis in the descriptive analysis of phenomena in order to clarify the structure of participants' conceptions of particular phenomena. This interview was conducted in a semi-open-ended questioning session with the aim of obtaining information on (1) the understanding of and attitudes towards the concept of metaverse; (2) the new problems and challenges that new technologies bring to education; (3) what new requirements AI poses for modern education; (4) how education feeds into the development of AI technology; (5) future trends in education in the context of AI; (6) the impact of AI on educational re-

A New World of Open Space - Reflections and Perspectives of Chinese Scholars on the Digital Transformation of Education and Future Education Research

15

search methods and What are the implications of AI for educational research methods and paradigms? The interviews were conducted in the form of face-to-face talks, which lasted from 20 to 40 minutes, with an average length of 30 minutes.

The interviewees included 16 faculty members from universities in Beijing, Shanghai, and Guangzhou, working in 12 different universities. The interviewee has not only been engaged in teaching and research in universities for more than ten years, but some of them also hold administrative positions (e.g., dean of teaching, department head, etc.). They are involved in teaching, research, or management of information technology in education and have a broad theoretical knowledge and practical experience of information technology-assisted teaching. Participation in this study was voluntary, and after consulting the respondents, whose real names are not presented in the text (replaced by codings), the basic information of the respondents is listed in Table 2.

Serial Number	Coding	Gender	Identity	Title	Interview Time
01	M01	Male	Director of MIS/educational researcher	Professor	40 min
02	M02	Male	dean/educational researcher	Professor	20min
03	M03	Male	dean/educational researcher	Professor	30min
04	M04	Male	educational researcher	Professor	20min
05	M05	Male	educational researcher	Professor	40min
06	W01	Female	educational researcher	Professor	25min
07	M06	Male	educational researcher	Professor	30min
08	M07	Male	Dean/educational researcher	Professor	20min
09	M08	Male	dean/educational researcher	Professor	30min
10	M09	Male	educational researcher	Professor	30min
11	M10	Male	educational researcher	Professor	30min
12	M11	Male	educational researcher	Professor	20min
13	M12	Male	dean/educational researcher	Professor	30min
14	M13	Male	educational researcher	Professor	30min
15	M14	Male	educational researcher	Researcher	40min
16	M15	Male	educational researcher	Researcher	35min

Table 2: Basic Information About the Interviewees.

Data analysis

To ensure the authenticity of the data, the interviews were recorded throughout. After the interviews were completed, the researcher transcribed the audio recordings into text and analyzed them. First, the researcher repeatedly read the narratives of the speakers to ensure that the information and details provided by each participant had been noticed. The researcher then sorted through the participants' statements and categorized them. In this process, the focus was on the respondents' perceptions of the digital transformation of education and their vision of the future of education in this context.

At the same time, an analysis of relevant literature, including Chinese government policy documents and articles published by scholars on education digital transformation strategies, was used to sort out the government strategies for education digital transformation in China. Data from respondents and documents were analyzed through the development and application of codes, and the researchers categorized all new ideas relevant to the study into themes. For example, the General Office of the Central Committee of the Communist Party of China and the General Office of the State Council issued Opinions on Promoting the Development of "Internet + Education" at the end of 2021. The Ministry of Education included the digital transformation of education as a critical task in 2022, reflecting the importance of this change at the national level. Combining the above two aspects of textual analysis, the conclusions of this paper are drawn.

A New World of Open Space - Reflections and Perspectives of Chinese Scholars on the Digital Transformation of Education and Future Education Research

16

Findings

Understanding and attitudes towards of Metaverse

"Metaverse" is one of the major emerging global buzzwords in 2021. The Oxford English Dictionary defined it as "a virtual reality space in which users can interact with computer-generated environments and other people". Wikipedia defined a Metaverse as a physical reality that is convergent and physically persistent through virtual reality, a 3D virtual space based on the future Internet with connectivity perception and sharing characteristics". Semantically, Metaverse refers to the creation of an immersive, virtual, invisible, immense, permanent, evolving, 24-hour-a-day online artificial electronic space that enables a virtual mapped version of the human real world - one in which people in the real world can break the boundaries of space and time and live in a variety of digital avatars. in which people in the real world can break the boundaries of time and space and live in a variety of digital forms, thus achieving a perfectly immersive experience that transcends reality [9-10].

For educational researchers and practitioners, is the "metaverse" a fireworks-like but fleeting concept, or is it a concept that has new implications for education due to the incorporation of new technologies to which we have to respond? Different scholars have different understandings of the concept of "metaverse" and what it means for education. From the results of the interviews, respondents' attitudes can be broadly divided into two parts: one is positive towards the new concept and practice of "metaverse", believing that "metaverse" develops along with educational theory and is empowered by it in both directions. As educational researchers, they should take the initiative to meet the challenges of this new technology for education. Secondly, there is a cautious attitude towards this new concept, believing that the use of the term "metaverse" is inappropriate in terms of doctrine, that virtual space is not the main direction for the future development of education and educational technology, and that the gap between the virtual and the real is too wide and not fully interoperable. There are also those in between who are open and tolerant and cautiously optimistic.

Here are some of the responses from the participants, explaining briefly how they understand the concept of "metaverse" and their attitude towards this new concept and practice:

 "metaverse is a real and virtual world that will come to this day whether we want it to or not. Our attitude should be to unleash our imagination while embracing reality".

He also added that, *"the concept of metaverse is an ultimate goal of digital transformation in education, and the changes it brings are to facilitate the reorganization of the entire educational ecology". (M01)*

"*Thanks to the development of the metaverse, the vision of education is to create another virtual space, or a world that is a combination of the real and the imaginary, touchable, recognizable and understandable. We can reshape education by unlocking its greater potential through a high degree of integration between the physical world of information and human society, and by promoting greater equity and personaliation through immersive teaching and learning". (M04)*

The responses of the two interviewees above show that they have a positive and open attitude towards the concept of "metaverse". However, there are also scholars who believe that metaverse can be judged as a typical research question, without drawing definite conclusions for the time being, and are generally optimistic about moving forward. For example, An interviewer made the following statement:

"Metaverse is a landmark phenomenon in the development of a society that is fostering its growth with innovation and innovative communication. New practices of education will emerge from the push of technology, and we need new terms and concepts to express a new social practice and a new educational practice". (W01)

In addition, some scholars are also cautious about the concept of "metaverse". It is believed that the use of metaverse is theoretically inappropriate, as the original meaning of metaverse refers to the virtual reality, while the current human knowledge of the universe is very limited, and it is impossible for humans to virtually predict and transcend what they do not yet know, and it is impossible to transcend the universe. At the same time, the future development of educational technology is not just about virtual space, or at least

A New World of Open Space - Reflections and Perspectives of Chinese Scholars on the Digital Transformation of Education and Future Education Research

17

it is not the only direction of development. Therefore, we should treat this thing seriously and calmly.

"At present, human beings have very limited knowledge of the universe, so it is impossible for them to virtually predict and surpass what they do not yet know. What cannot be done in real space may not be possible in the virtual. The more advanced the technology, the greater the risk. The future development of educational technology must be more than just virtual space, or at least it is not the only direction of development; we have to be realistic and not expect too much". (M05)

New issues and challenges in the field of education brought about by the Metaverse

There is a certain consensus that artificial intelligence and Metaverse will deeply extend the space of human life, expand human perception and enrich the human existence experience. However, humans' digital or virtual existence cannot replace modern reality, and the Metaverse must also follow the legal and ethical bottom line. Is the Metaverse a technological utopia, or is it the inevitable result of the development of information technology? In this regard, the researcher conducted in-depth interviews with the interviewees on the theme of "What challenges does the Metaverse bring to the development of education," focusing on the following questions: (1) what existing problems the Metaverse as a new technology has the potential to solve for education? (2) what new problems the Metaverse, as a new technology and a new way of practice, has the potential to bring to education? (3) what new directions may the Metaverse as a research topic bring to innovation in teaching and learning? The findings of the study are as follows:

Firstly, what are the effects of the Metaverse as a new technology and a new way of education practice nowadays? On a technological level, through the reshaping of the economy and society, to create a new world that approaches the infinite openness of space. And on the level of education, in terms of pedagogy, it can promote the all-round development of students. It can empower teaching methods in pedagogical practice, help teachers and students engage in deep dialogue, improve audiovisual effects and allow students to subvert the experience.

Secondly, what new issues might Metaverse bring to education as a new technology and a new way of practicing? As a technology, the development of Metaverse is still facing the following challenges: Technology risk, the technology related to Metaverse is still in its infancy, and technical limitations are the biggest bottleneck for development. Market risk, the current software and hardware ecology in the Metaverse track has yet to mature, whether the scenario application has actual market demand is still controversial, and the commercial value is uncertain. Policy risk, i.e., the policy of the Metaverse, is uncertain.

The third is policy risk, i.e., the free trading and decentralization of the Metaverse (e.g., digital system, NFT trading, games, news), which faces threats in terms of policy regulation. So what new issues does the Metaverse pose in the context of the educational arena? The results of the study found that:

One is the overlap between "digital identity" and "value systems". Digital identity is the condensation of accurate identity information into a digital code, forming a public secret key that can be queried and identified through the Internet and related devices. At the same time, the value system is the superposition of the Metaverse's value system and the whole value system. For example, There were questions that the interviewees felt confused.

"The question of digital identity and value systems, is the authentication obtained in the Metaverse recognized in reality? Then again, experimenting in the virtual world does not change the reality of education, but is only a forward-looking concept". (M01)

Thirdly, there is the issue of addictiveness. Some interviewees felt that the problem of addictiveness is more prominent in 3D immersion experiences as young students, even over time, who cannot distinguish the difference between virtual and reality, which hurts the psychological growth of young students. There is the issue of personalized resources for education.

Fourthly is the issue of humanistic interactivity. While educational technology opens up possibilities for pedagogical innovation, it may also face the following challenges: terminal friendliness, transmission capacity and computing power, modeling speed for the cost of developing massive amounts of content, and security and corroboration, as one participant said:

A New World of Open Space - Reflections and Perspectives of Chinese Scholars on the Digital Transformation of Education and Future Education Research

18

"Those that cannot be realized in the real world, or those that cannot be seen or touched in nature, including some experiments according to the risk, carry out a virtual experiment of the whole process, which brings the possibility of teaching innovation, but may also face some typical challenges such as terminal friendliness, computing, and transport capabilities, fast large-scale modeling, and security". *(M02)*

AI poses new requirements for modern education

AI is an all-around challenge for education, with a significant impact on talent training, teachers' teaching, and students' learning, as well as the reconfiguration of the entire education system.

Firstly, AI+ education places higher demands on talent development goals. For example, as one participant said:

"The judgment of a person's knowledge is now not about being talented or rich in learning, but that talents in the AI era place more emphasis on creativity, communication skills, cooperation skills, and the ability to empathize with society. The PISA emotional literacy test also serves as a critical area of assessment". *(M06)*

Secondly, AI is changing teaching. AI+ education places new demands on teacher literacy. At the same time, the use of AI can break the limitations of teachers in terms of teaching time, space, and language. Last but not least, it changes the way in which educational teaching resources are selected. With the help of extensive data analysis, the inter-matching of students with teaching materials can be made more precise and appropriate, as the interviewee said:

"The most important thing is that through big data analysis, using smart classrooms and machine translation, to the right teacher, it also allows the teacher to match the right student". *(M07)*

Thirdly, AI is transforming students' learning. Human learning has to learn from machine learning, but more importantly, it has to go beyond machine learning. It is important to break away from rote learning and 'fill the classroom' approaches in teaching and learning, and to engage students in hands-on participation and experience, moving from "learning to use" to "using to learn". For example, one interviewee said:

"We are building machines to be more and more like people, and human learning has to go beyond machine learning. So in teaching, we have to break away from rote learning and 'filling the classroom' and let students learn through hands-on participation and experience, learning by doing, so I think that's where we must go beyond machine learning in human learning". *(M07)*

However, at the practical level, it is only sometimes the case that new technologies and strategies for using them (including the devices developed with them), such as artificial intelligence, can be used well in our education and teaching. National and local funding for related facilities is significant, but the results could be better. The fundamental problems lie in the following areas:

Firstly, in AI technology for education, the core issue is talent cultivation. However, this process cannot be achieved simply by relying on AI but also by building educational models and using intelligent technologies to build scenarios, create conditions, and provide support and assistance; as one interviewee said.

"We need to be clear about exactly what problem we are trying to solve. Replacing people with machines is not the goal; it is instead a failure of education. What is one of the most difficult things to do, from the teaching of teachers to the learning of students? It is answering the question of what is meant by the best education". *(M08)*

Secondly, the use of artificial intelligence technology to build a whole system of learning pathways. The Modernization of Education in China 2035 states that education's transformation in the information technology age should be accelerated. This means that artificial intelligence can be excellent for teachers' teaching wisdom and iterative optimization for mining, given the different types of teaching contents, to select the best teaching and research staff, the various possible teaching path through the extensive data, artificial intelligence techniques such as iteration, and then according to the different way of teaching wisdom, to build a set of the network

A New World of Open Space - Reflections and Perspectives of Chinese Scholars on the Digital Transformation of Education and Future Education Research

19

learning system.

Thirdly, using AI technology to provide students with the scenarios and processes to deeply understand knowledge, experience it and effectively apply the entity so that they can deepen their connotation understanding and mastery of various applications, as one interviewee said:

"With the help of technologies such as artificial intelligence, can students be allowed to deeply understand knowledge, experience it, and use physical scenarios and processes to deepen their connotative understanding and mastery of various applications?" (M07)

In the future, if we are to achieve proper innovative education, we should build a new education ecosystem empowered by artificial intelligence. But at the same time, we should be aware that the digital transformation of education is not only driven by technology but is also a necessary choice for society. Therefore, in the digital transformation of education, technology to drive teaching and learning deeper must follow the natural laws of education itself.

Duplexing Empowerment Between Education (Research) and AI, big Data Technology

Data has become the main object of educational research and utilization with the rapid development of data-intensive science. Correlation analysis based on the theorem of large numbers, big data technology provides new thinking for finding high correlation factors inside and outside educational activities and for educational decision-making, educational management, and educational research. Combining big data technology and computational sociology can provide a new idea for our academic research.

Firstly, big data technology provides complete sample data for educational research. Big data technology provides full-sample data for academic research, enabling researchers to obtain conclusions through full-sample information mining and analysis, covering all academic and educational issues and thus accurately revealing and reflecting educational laws for the entire complex education system. According to an expert in this field (also an interviewee in this research):

"At present, there is an urgent need for education research with big data from the whole education system, which can process all variables and all data related to a certain educational phenomenon".(M15)

Secondly, big data technology provides polymorphism data for educational research. The data of traditional education research is based on surveys and interviews, and the data dimension is relatively single and sometimes is not objective. Based on big data, it emphasizes the discovery of all forms and multiple sizes of data and related relationships. The expert said:

"For example, using polymorphic data analysis, it is possible to investigate not only the cognitions directly related to learning, but also the factors that influence learning. Through the polymorphism data, comparative analysis can be carried out to avoid the mutual cancellation of errors. It is emphasized to find out problems from the correlation, explore the law and predict the trend".(M15)

Thirdly, big data technology provides a theoretical basis for educational reform and implementation of practical activities. Big data can help people find the dominant factors inside the education system and the external social factors that have a high correlation with the education system. Thus, it will seek a breakthrough for promoting educational reform, provide academic support for educational decision-making and management, and provide a theoretical basis for supporting educational reform and implementing practical activities.

Fourthly, AI and computer simulation provide a lot of support for complex educational experiment research. Because educational experiment research differs from the actual activity, the factors that affect education are numerous and intricate, and the research conclusions often inevitably have errors with reality. Humans are uncertain, irreversible, and uncontrollable, so it is difficult to carry out highly intrusive experiments. It is more and more challenging to meet the needs of reality to seek the local change of education through single-factor strict variable control and to pursue the accuracy and purity of experimental results. AI and computer simulation can provide new ideas for these problems.

A New World of Open Space - Reflections and Perspectives of Chinese Scholars on the Digital Transformation of Education and Future Education Research

20

AI is a massive boost to education. In turn, can education feed into AI technology and drive the development of the technology? How does education feed back the development of artificial intelligence technology?

Firstly, sorting out human learning mechanisms and skills in the education process would greatly boost AI machine learning. Human learning is not about the simplistic, mechanical parameters of making models for a single category but has many mechanisms that inspire association. Secondly, applying human recognition mechanisms to machine learning systems would significantly reduce energy consumption. Most human target recognition originates from the human visual system. The human optical system has only a very short consumption relative to a computer to enable the construction of a computer system as a whole. According to an expert in this field (also an interviewee in this research):

"Not only can people associate, but people are efficient and compact. If we can figure out how people go about doing recognition, it helps us tremendously, which has a feedback effect". (M10)

Future trends in education in the context of AI

In the context of AI, the future of education will mainly undergo relatively significant changes and transformations in two aspects: on the one hand, a large number of heavy and mechanical human tasks will be replaced by machines, which will lead to changes in educational values and goals; on the other hand, the means of educational scenarios, which will lead to changes in the traditional form of education. Specifically, the future of education is likely to see the following development trends.

Firstly, education will change from serving the known to serving the unknown. The uncertainty and unpredictability of the future require a shift in the content of learning from definitive conclusions to process-oriented content, a change in the learning process from comprehension to more bottomless construction, a shift in the consolidation of learning from knowledge reinforcement to cross-application of methods, a change in the assessment of learning from summative identification to process growth, and a shift in the practical activities from disciplinary inquiry to new interdisciplinary integration.

Secondly, the school form will transform from a temporal and spatial homogeneity to a scattered step-by-step transformation. In future education, technologies such as big data, artificial intelligence, and the Internet will break the existing temporal and spatial limitations of education, and with the large capacity of data and manual deep mining technology, will make the analysis of educational content, data resource construction, and individual learning data more three-dimensional and precise.

Thirdly, teaching and learning will shift from a predominantly manual to a collaborative human-machine approach. In future education, only some teachers will be teachers, not necessarily full-time teachers. Still, there will be human-computer collaboration and a good division of labor. One is the interpreter and designer based on curriculum standards and review of teaching materials, with greater emphasis on discipline-specific professional interpretation skills. The second is to produce teaching or activity programs as multimodal media courses suitable for asynchronous temporal learning. The third is the person who will guide students to personalize their knowledge effectively. As an interviewee said:

"I think that teachers as learning guides mainly carry out guidance on learning methods, cultivate excellence and strengthen home-school communication, etc". (M07)

Fourthly, knowledge acquisition will shift from knowledge storage to linking information. The future of education will change from an emphasis on the purchase of knowledge and competencies to a focus on the acquisition of data, the establishment of news links, a greater emphasis on imaginative and divergent thinking based on the clues provided by knowledge, and also learning to share experiences and knowledge, collaborative innovation, strengthening links to knowledge, etc.

Fifthly, there will be a shift in human shaping from an average level to polarization. One is the pursuit of professionalism, to achieve excellence in a specific point of a project in a specific professional field, to become expert-level competent, and to maintain the frontier and authority of research; the other is the pursuit of cross-border integration, with general knowledge and competence in multiple

A New World of Open Space - Reflections and Perspectives of Chinese Scholars on the Digital Transformation of Education and Future Education Research

21

professional fields and industries, dedicated to breaking through the limitations of a single area and pursuing interdisciplinary and cross-industry. The other pole is the pursuit of integration and innovation across disciplines and industries. In short, the former is the pursuit of vertical depth, and the latter is the pursuit of horizontal links. At the same time, the level of general competence in a particular field will probably lose its dominant value.

Finally, learning strategies will shift from comprehensive learning to "directed public relations". In the face of new fields, new technologies, and new situations, after the actual change of orientation, learning is an important initiative of strain; orientation learning is not a reserve of prior learning but targeted emergency learning.

In conclusion, machine learning will profoundly affect the development of education in the context of the deep story of artificial intelligence. Exploring the future of education is conducive to our profound and multi-faceted understanding of the future of education and our future-oriented education and exemplary education in the present.

The impact of AI and Metaverse on educational research methods and paradigms

AI education originates from the application of education, and educational research is also largely future-oriented, predicting and analyzing the future of education. At the methodological level, the paradigm change in education research brought about by the AI metaverse is multifaceted and there are many possibilities and paths, far beyond the path of computational pedagogy. Beyond the fourth paradigm, there are indeterminate predictions, non-deterministic ones that do not rely on data, predicting the future from the future and looking at the present from the future, etc.

Some researchers have suggested that *"science fiction can be used as a method and tool for studying the future, drawing on the narrative method of science fiction to intersect the two temporalities of the future and the present, pulling thinking about the future into the present, thinking about reality based on a vision of the future, and thus developing non-deterministic ideas or theories about the possibilities of the future and the present". (M13)*

Firstly, in terms of research stance, science fiction with its great inclusiveness has ventured into several disciplines and become an applied literary genre with scientific research value. In education, some educational researchers are already using it, consciously or unconsciously, intentionally or unintentionally [11].

Secondly, on an epistemological level, science fiction is a lens through which to view reality, and this way of looking at reality through the future is called "future archaeology", which sees science fiction as an archaeological tool of the future that looks at the present from the past, at the self from the "other".

Thirdly, on a methodological level, science fiction is a thought experiment in thinking about the future by way of "what if ...... would .....".", for example. "Will teachers be replaced in the age of artificial intelligence which jobs will be replaced?" These derivations are a kind of deduction based on a hypothesis of the arrival of some technological starting point in the future.

The use of science fiction as a paradigm for future educational research follows three logics. Firstly, the subject of educational research is the human being, and it is the human logic that is fundamental in the evolutionary paradigm of educational research. The science fiction paradigm draws the human research experience, virtual, imaginary, and other such methods originating from the humanities into educational research, and will open up some new problem domains, as well as some expansions and extensions in ways that care for reality.

"The science fiction research paradigm is one in which people are used as research tools, by people. The extension of the media to the human being, from the linguistic media, the print media, and the electronic media, all extend the neurological system of the human being at different levels, and it extends different research methods and research paradigms, and now the electronic media, especially artificial intelligence and metaverse, may evolve into a new and different kind of research paradigm".

A New World of Open Space - Reflections and Perspectives of Chinese Scholars on the Digital Transformation of Education and Future Education Research

22

Secondly, it follows a technological logic in which the real world, which is the object of educational research, is evolved into a virtual reality, a virtual object without an original form.

Thirdly, to follow the logic of cross-border, this cross-border has two aspects, one is direct to science fiction as a new perspective and method, on the other hand, is direct to science fiction stories to use as research materials, data support.

"The most typical example is the issue of the educational metaverse, I still agree with this kind of research on the concept of the metaverse. It is a science fiction concept from science fiction, a science fiction story told, and now it is being used as a resource, object, or question for educational research". (M12)

Regarding the innovation of the research methodology, there are three main areas: an analysis of future archaeology, a science fiction narrative approach, and a virtual approach to educational reality.

Future archaeology from the dimension of time, research tense can be divided into past tense, present perfect tense, present progressive tense, and future tense. Looking at the present from the future, the present is converted into the past, making the present, which was a cognitive blind spot, into some kind of known experience that we can think about more easily. Through this time traversal, a new situation of our awareness of education is created, so it is an intentional structuring of the idea of the future.

The objective narrative research method moves from an empirical, weighty, verification-oriented scientific narrative to a predictive, conjectural one that is imbued with forethought, close to the narrative, narrative, and writing of a science fiction work. The virtual study of educational reality, in effect, draws on the postmodern science of the transformation of virtuality and the transformation of improvised science in some ways, with the reproduction of reality, the shaping or construction of reality, and the analytical observation of educational reality in an objective age, moving towards the creation of a reality that does not yet exist.

How AI will drive the future of education

In the future, education will be gradually moving from an industrialized education system to an intelligent education system. How can artificial intelligence drive the future of education? It can be summarized by three keywords: personalization, diversification, and human-computer cooperation. First of all, the future of education should realize the organic combination of large-scale education and personalized training. Diversity includes not only the education model, and the content of education, but also the interaction of teaching and learning, especially the revolutionary restructuring of educational thinking. Secondly, in terms of the evaluation system of education, a more flexible and diversified teaching and evaluation integration system should be constructed. Thirdly, in the teaching process, human-machine cooperation means that machines and teachers collaborate to achieve a more efficient way of learning. For example, three interviewees made the following statement:

"In terms of the evaluation system of education, it should be a process of teaching and learning, a process in which the learning ability and nature of each person is fully developed, without using a uniform evaluation scale to evaluate it". (M11)

"The class is a virtual reality class where students are brought in to wear a headset, and the virtual human classroom allows all students who take the class to break the space barrier, so that students can appear in the same "classroom" anywhere they put on a VR headset, and have hundreds of people in a new, virtual, interactive environment through an immersive experience. teaching and learning in a new, virtual, interactive environment". (M14)

Conclusion

Through interviews with 16 experts from the field of educational information technology, this paper has conducted in-depth discussions on topics such as Metaverse and education ecological reconstruction, artificial intelligence and future education development, big data, and education governance, and future education research paradigm change.

A New World of Open Space - Reflections and Perspectives of Chinese Scholars on the Digital Transformation of Education and Future Education Research

23

The research results show that 1/3 of the scholars have a positive and open attitude towards the concept of "metaverse". The "Metaverse" bring new problems to the development of education, and at the same time put forward new requirements for modern education. However, the digital or virtual survival of human beings cannot replace modern survival. This is because the metaverse also has to follow the legal bottom line and the human ethical bottom line.

AI is an all-around challenge for education, with major implications for talent development, teachers' teaching and students' learning, and the reconfiguration of the entire education system. In the context of AI, the future of education will mainly change and change in two aspects: on the one hand, a large number of heavy mechanical human work is replaced by machines, so that the value and objectives of education will change; on the other hand, the means of educational scenarios, so that the traditional form of education will change. To realize these changes and transformations, the future of education will also require an organic combination of large-scale education and personalized training. A revolutionary reorganization of educational content, teaching processes, and above all, educational thinking will take place.

The duplexing empowerment between education research and new technology: the rapid development of data science and AI technology has become the main object of educational research and utilization. In turn, education feeds into AI technology and drives the development of the technology. In the context of new technologies such as artificial intelligence and Metaverse, science fiction can be used as a method and tool for educational research. It is a method and tool for indeterminate prediction outside the fourth paradigm, non-deterministic without relying on data, predicting the future from the future and looking at the present from the future.

Overall, The project on artificial intelligence for the future of education involves cutting-edge technology, social economy, and industrial development, as well as humanities such as the education system and even morality and ethics, and is an intersectional research across technology, society, and humanities. In this context, there is an urgent need to build an interdisciplinary research framework, analyze the impact of AI on learning, knowledge innovation, and teachers according to the demands of society on education in the era of AI, study the role of AI in reconstructing the education ecosystem, and ultimately outline the blueprint of future education reshaped by AI as a whole, to provide a basis for national policy formulation in the areas of AI, ethics and education regulations.

Perspectives

From a practical point of view, the digital strategy of higher education has become an important part of the national development strategy, a key control to improve the development of higher education, and a new feature of higher education development. The experts in this study discuss topics such as metaverse and artificial intelligence, and the ideas they present, as well as new perspectives on educational development, are important for the future of education, dissecting educational reform and innovation, and serving national educational policy-making. From a theoretical perspective, the research explored the current situation and future development trends in important topics such as metaverse and education ecological reconstruction, artificial intelligence and future education development, big data, and education governance, and future education research paradigm change, and came up with a series of new perspectives. The application and integration of the above perspectives are important for the enrichment of theories related to education digitalization, and can also better guide digital education The application and integration of the above ideas are important for the enrichment of theories related to education digitalization, and can better guide the practice and innovation of digital education.

In summary, the research on the digital transformation of education has very significant practical significance and theoretical value. Facing the era of rapid development of digital technology, is conducive to further improving the theoretical framework and comprehensively enhancing the quality and effectiveness of digital education. However, it is also necessary to pay attention to the problems and challenges of metaverse and other technologies in practice. Looking ahead, the key to the digital transformation of education is only to pay attention to the educational innovation and changes brought by digital technology and to form a learning-centered education model.

A New World of Open Space - Reflections and Perspectives of Chinese Scholars on the Digital Transformation of Education and Future Education Research

24

Acknowledgements

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