

Education Informatization 2.0 in China: Motivation, Framework, and Vision

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Abstract

Purpose: This article aims to shed light on a latest education informatization policy blueprint in China, titled *Education Informatization 2.0 Action Plan*, which was promulgated by the Ministry of Education in China on April 18, 2018.

Design/Approach/Methods: The study is an analytical policy review based on the policy documents, theoretical discussion, and development of practice.

Findings: This new Chinese education informatization policy was driven by three factors: the promotion of education informatization 1.0 in China, the requirement of education modernization toward 2035, and the response to “Wisdom Education.” The framework for action can be summarized as “One Goal, Three Tasks, and Eight Actions.” The main features involve innovation-driven development rather than technology-driven development, committing to the expansion of digital educational resources rather than the digital presentation of textbooks, and aiming at improving teachers and students’ information literacy rather than the applied skills of information technology. The future vision of the plan involves building new models on talent cultivation, education service, and education governance. The new models on talent cultivation involve establishing “Wisdom Teaching” mode, learning mode, and intelligent learning

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environment supported by artificial intelligence technology. The new education service models entail building the admission and sharing mechanism of quality educational resources based on National Network for Education and the public service platform and system for educational resources by means of the cloud computing and artificial intelligence. The new education governance models involve achieving precise, flat, and humanized education governance.

Originality/Value: This article entails expounding the motivation, framework for action, main features, and vision of the education informatization 2.0 in China, which will be helpful for learning and understanding the current background, stage, and future path of China's education informatization.

Keywords

Artificial intelligence, education informatization 2.0, information literacy, Wisdom Education

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Released on April 18, 2018, the *Education Informatization 2.0 Action Plan* proposed clearly that “the education informatization has entered the 2.0 era from the 1.0 era,” marking that China's education informatization has entered a new historical stage. The education informatization 2.0 in China is believed to need to take the road of innovation-driven development and “to improve the development level of education informatization comprehensively, resulting in China's education informatization entering the advanced ranks in the world, promoting education modernization comprehensively through education informatization, and starting the new journey of education in intelligent era” (Du, 2018a). During the period of 12th Five-Year Plan, China has completed the education informatization 1.0 based on application-driven development. Breakthrough progress had been made in various tasks, including the basic universalization of conditions for informatization, the initial sharing of quality educational resources, the significant improvement of teachers' application ability, and the increasingly prominent role of technology in education. At present, China has entered education informatization 2.0 era originated from innovation-driven development, which is no longer limited to the supporting role of information technology in the education system. The role of information technology needs to be shifted from exogenous variables to endogenous variables. The rapid development of artificial intelligence, 5G network, and big data profoundly changes the demands for talents, which promotes the talents cultivation, education services, and education governance in the education informatization 2.0 era in China.

Motivation of the education informatization 2.0 in China

The education informatization 2.0 in China is the achievement of China's education informatization development in the past 40 years. It is the urgent requirements of China's education

modernization strategy. Moreover, it is also the response to the education revolution in artificial intelligence era.

The promotion of the education informatization 1.0 in China

During early stages of reform and opening up, China has formally taken the initial step in building educational informatization. At the national conference on education in April 1978, Deng Xiaoping pointed out:

measure should be formulated to accelerate the development of modern educational means such as television and radio, which is the essential approach to develop education by the principle of achieving greater, faster, better and more economical results, and must be given full attention. (Deng, 2001, p. 108)

The combination of modern educational technology and education first appeared in China in the form of “audio-visual education.” “Audio-visual education” is “the precursor of education informatization in the new stage of reform and opening up” (Ministry of Education of the People’s Republic of China [MOE], 2012a). In the following 30 years, China’s education informatization has achieved remarkable achievements. They include:

the initial formation of a nationwide education information infrastructure system, the construction and connection of campus networks in the schools of all levels and types in cities and economically developed areas, the continuous enrichment of digital educational resources, the effective expansion of information teaching, the initial improvement of education informatization management, and the steady development of online distance education. (MOE, 2012b)

These achievements show that the level of education informatization in China has been greatly improved. They have played a crucial role in promoting educational fairness, realizing the sharing of quality educational resources, building a learning society, and cultivating innovative talents with international competitiveness.

On the basis of the well-round development of China’s education informatization in the past 30 years, the *Ten-Year Plan for Education Informatization (2011–2020)* was issued by the Ministry of Education of China in 2012. It established a “two-step” strategy for the development of China’s education informatization. The first step involves focusing on construction and application. The second step entails achieving integration and innovation. By 2017, the first step had been completed, which means the goal of China’s education informatization 1.0 has been accomplished. The education informatization 1.0 has achieved “Five Major Advances” and “Three Major Break-throughs.” Specifically, “Five Major Advances” include the construction and application of “three links and two platforms,” the significant improvement of teachers’ application ability of information technology, the substantial improvement in the level of information technology, the great

promotion of informatization to education reform, and the significantly enhanced international influence of education informatization. “Three Major Breakthroughs” involve achieving the application mode of educational informatization, the promotion mechanism of social participation, and the exploration of education informatization with Chinese characteristics (Du, 2017a). After the first step is completed, the second step begins. Thereby China has successfully entered the education informatization 2.0 phase, which places significant emphasis on integration and innovation.

The requirement of education modernization toward 2035

The realization of the education informatization 1.0 in China is enough to prove that China has made remarkable achievements in the development of the Internet and informatization. The network has entered thousands of households. The number of netizens is the largest in the world. China has become a major network country in the world. However, it must be admitted that, at present, China is still relatively backward in independent innovation of core technologies, resulting in a large gap with the international advanced level, thus is still difficult to be called a powerful network country. Information technology determines the level of informatization. The low level of informatization not only limits the country’s soft power and competitiveness but also hinders the construction of socialist modernization. China proposed early in its constitution that “the fundamental task of China is to concentrate on building socialist modernization” (National People’s Congress, 1954). In different historical periods, socialist modernization has diverse connotations. In the 21st century, with the rapid development of information technology, China’s socialist modernization involves improving the innovation ability of core technology, providing excellent information technology facilities and services, creating healthy, civilized, and safe network culture, fostering a team of professional and innovative teachers, and building a nation with powerful network. “There is no modernization without informatization” (Xi, 2014). Therefore, informatization is an indispensable way to modernization.

In February of 2019, the central government of China issued *China’s Education Modernization 2035*. The eighth strategic task, “accelerating education reform in the information age,” pointed out the development direction of education informatization in 2035 from a policy perspective. The reform includes upgrading the level of campus intelligence, exploring new teaching forms, innovating educational service format, and promoting education governance. This means that to achieve the changes in the four aspects in the new era, the education modernization toward 2035 requires higher level education informatization. Specifically, the education modernization toward 2035 requires China’s education informatization 2.0. In China’s education informatization 1.0 era,

the main indicators of China’s education informatization have doubled. The Internet access rate in primary and secondary schools nationwide has increased from 25% to 90%, the proportion of

multimedia classrooms has increased from less than 40% to 83%, and the number of online learning space for teachers and students has soared from 600,000 to more than 63 million. (Du, 2017b)

Although China's education informatization has developed rapidly and achieved remarkable results, on the whole, information technology mainly remains simple application at the tool level. The revolutionary impact of information technology on education modernization has not been fully demonstrated. The low level of education informatization is difficult to realize the education modernization toward 2035. In the next 15 years, the education information 2.0 in China will definitely become a new national initiative to achieve the education modernization toward 2035. "We must attribute priority to education, speed its modernization, and develop education that people are satisfied with" (Yuan, 2018, p. 33). As a vital content of prioritizing education development in China, the education informatization 2.0 is an inevitable requirement of the education modernization toward 2035.

The response to Wisdom Education

"Wisdom Education" is no longer a new concept. In the 1990s, Xuesen Qian put forward "*Dacheng* Wisdom (Theory of Metasynthetic Wisdom)." According to Qian, human intelligence is the unity of quantitative intelligence and qualitative intelligence, and the talents cultivation with intelligence and innovative ability is the hot topic and important task of education in the world today (Qian, 2012, p. 23). It is actually a kind of knowledge that integrates intelligence into education to cultivate talents, which can be considered as a philosophical concept of "Wisdom Education." From the perspective of educational technology, intelligent education is a new form of education based on the deep integration of modern information technology and education. This kind of integration has improved the efficiency and intelligence of traditional education, thereby giving birth to a new form of education informatization that promotes individualized teaching and learning. "Information technology means helping to realize the intellectualization, informatization and individuation of classroom teaching, to build a classroom teaching environment with wisdom, and to promote the transformation from traditional knowledge classroom to modern wisdom classroom" (Chen & Li, 2020, p. 106). In the past, due to the slow development of information technology, it is mainly used as a tool in the field of education, playing a role of "icing on the cake" not yet a revolutionary impact on education. Therefore, "Wisdom Education" is only a kind of expectation within this context, the pursuit of education for wisdom in an intelligent way is just a vision, and the embedding of information technology has not really promoted the internal unity of educational purpose and educational method.

With the rapid development of big data and artificial intelligence, "Wisdom Education" becomes a reality. Du Zhanyuan, Vice Minister of Education believes that "artificial intelligence

will accelerate the profound changes in education in the future” (Du, 2018b). To seize the great strategic opportunity of artificial intelligence that involves building China into an innovative country and a powerful country in science and technology in the world, in 2017, the State Council issued the *Development Plan for New Generation of Artificial Intelligence*, which marked “the development of artificial intelligence has entered a new stage.” Big data-driven knowledge learning is characterized by deep learning. Human–computer cooperation is conducive to enhancing intelligence. Teachers with wisdom can effectively promote the wisdom development of students. “Wisdom Education” based on deep integration of big data, artificial intelligence, and education has emerged. In January of 2019, the Ministry of Education launched the construction project of “Wisdom Education Demonstration Zone,” which opened the practice exploration of the new form of “Wisdom Education” (Wang et al., 2019, p. 27). “Wisdom Education” once considered to be far away has come and thrives on China’s land. “Wisdom Education” urgently needs education informatization 2.0 in China. The education informatization 2.0 in China is the response to the emergence of “Wisdom Education” in the new era. Through the embedding of modern information technology, the pursuit of wisdom in intelligent way has become the motivation of the education informatization 2.0 in China.

Framework for action and its characteristics of the education informatization 2.0 in China

To speed up the education modernization, promote the development of education informatization in the new era, and foster a new engine of innovation-driven development, in 2018, the Ministry of Education issued the *Education Informatization 2.0 Action Plan* in combination with the tasks related to the major strategies of national “internet+”, big data, and the new generation of artificial intelligence. It thus proposed the framework for action, thereby resulting in China entering the education informatization 2.0 era.

Framework for action

A goal and its essence. The *Education Informatization 2.0 Action Plan* proclaiming an objective to basically achieve that, by 2022, teaching application covers all teachers, learning application covers all school-age students, digital campus construction covers all schools, the application level of informatization and the information literacy of teachers and students are generally improved, and the platform of “internet+education” will be built up (MOE, 2018).

Compared with the education informatization 1.0 in China, the goal of the education informatization 2.0 in China has essential differences. The goal of the education informatization 1.0 in China emphasizes that each school’s accesses to the broadband network, each class’s accesses to

quality resource, each person's accesses to network learning space, and the public service platforms of education resource and management are constructed and applied. However,

In the 2.0 phase, education informatization needs to exceed the 'application drive' of the 1.0 phase and devote itself to 'innovation guidance.' That is, information technology supports the innovation of teaching and learning methods to lead the transformation and upgrading of educational production methods in the information age. (Yang et al., 2018, p. 18)

The goal of the education informatization 2.0 in China has transcended the goal of the education informatization 1.0 in China. The essence of transcendence is the transformation from a focus on "things" to caring for "human," from a focus on quantitative expansion to emphasizing on quality improvement, and from connectivity rate to efficiency.

Three major tasks and the connotation. Three major tasks are outlined by the *Education Informatization 2.0 Action Plan*, including continuously advancing "three links and two platforms," further promoting the deep integration of information technology and education, and building an integrated platform of "Internet + Education."

It is worth noting that the three major tasks have special connotation. The education informatization 2.0 in China is the inheritance and development of the education informatization 1.0 in China. The initial intention of education informatization to serve the reform of education is the same, but the education informatization 2.0 in China upholds the core concept of deep integration of information technology and education.

At present, the Internet access rate of primary and secondary schools in China has reached 93%. The proportion of multimedia classrooms has also reached 86%. The number of online learning spaces for teachers and students is 71 million. For a country hosting the largest education in the world, such achievements should be acknowledged. However, when entering the 2.0 phase, we may not be able to evaluate education informatization with such a 1.0 perspective. (Ren, 2018b, p. 3)

Important as it is to continue to strengthen the construction and application of "three links and two platforms," the concept of innovation-driven development is followed fundamentally by the education informatization 2.0 in China. From the perspective of education informatization promoting education modernization, the education informatization 2.0 in China seeks to realize the transformation from application-driven development to innovation-driven development and from exogenous variables to endogenous variables.

Eight actions and the levels. The *Education Informatization 2.0 Action Plan* propounds eight actions including the universalization of digital resources services, the coverage of network learning space, the storming of network fostering wisdom, the optimization of educational governance capability, the guidance of hundreds of districts, thousands of schools, and millions of courses, the

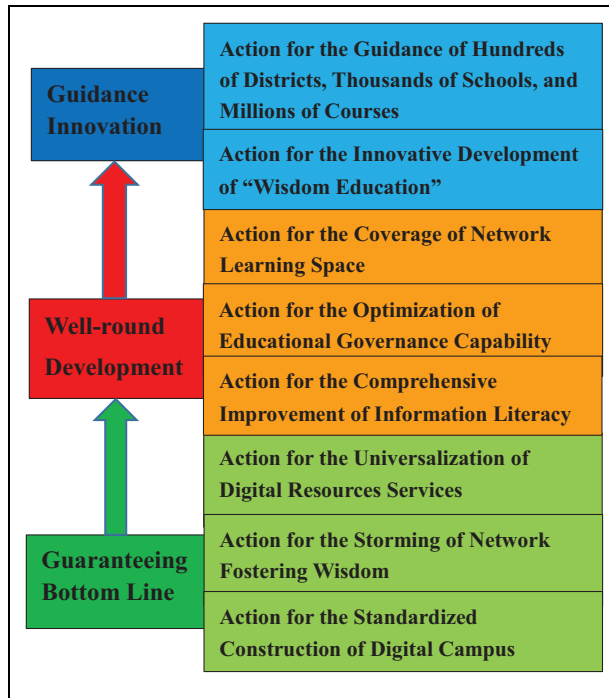


Figure 1. Three-level distribution of eight actions.

standardized construction of digital campus, the innovative development of "Wisdom Education," and the comprehensive improvement of information literacy.

As a whole, "eight actions" can be divided into three levels of "guaranteeing bottom line, well-round development and guidance innovation" (Wu et al., 2018, p. 33) (see Figure 1).

Specifically, first, the action for the universalization of digital resources services is intended to build a national public service system for educational resources, to connect the national hub, the national public service platform for educational resources and 32 provincial systems, and to fully form the mechanism for the development and utilization of educational resources. The action for the storming of network fostering wisdom aims to strongly support the development of educational informatization in deep poverty-stricken areas with the focus on "three regions and three states," to promote educational equity, and to effectively improve educational quality. The action for standardized construction of digital campus aims at exploring effective ways to achieve Internet access in remote schools through broadband satellites and to expand the coverage of quality educational resources by means of informatization means in the pilot.

Based on the practical case analysis of 71 pilot schools of wisdom schools in Guangzhou, at present, the innovative application of wisdom campus is mainly reflected in five aspects: creating ecological

environment, reconstructing digital resources, integrating innovative teaching, reshaping the teaching team, and innovating governance services. (Xie et al., 2019, p. 66)

The “three actions” are all for “guaranteeing the bottom line.”

Second, the action for the coverage of network learning space is meant to standardize the construction and application of network learning space, to ensure that all teachers and school-age students “have space for all,” and to popularize the application of network learning space. The action for the optimization of educational governance capability aims at improving the top-level design of educational management and comprehensively improving the ability of educational management, decision, and public services with big data. The action for the comprehensive improvement of information literacy is designed to fully understand the important role of promoting information literacy in the implementation of the moral cultivation and innovative talents cultivation and to establish an evaluation index system of information literacy. The “three actions” place significant emphasis on “all-round development.”

Third, the action for the guidance of hundreds of districts, thousands of schools, and millions of courses aims at identifying hundreds of typical regions, thousands of benchmark schools, and millions of demonstration courses, thus gathering excellent cases and promoting typical experience. The action for the innovative development of “Wisdom Education” seeks to actively carry out innovative research and demonstration of “Wisdom Education” based on the emerging technologies such as artificial intelligence and big data, to further promote the ecological reconstruction of education. Thus, the “two actions” further emphasize “guidance innovation.”

Main features

Originating from innovation-driven development rather than technology-driven development. What problem will be brought about by the rapid development of artificial intelligence is the theme faced by the education informatization 2.0 in China. People generally pay attention to such problems: Will artificial intelligence bring about the second machine revolution or the fourth industrial revolution? Will artificial intelligence replace teachers? What impact does artificial intelligence have on learning mode? The key to answering these questions lies in how to view information technology, which determines the relationship between technology and education. Can information technology solve all the problems facing mankind? Some scientists have proposed the “singularity” hypothesis brought about by science and technology. They believe that all the problems faced by human beings can be solved by the utilization of ever-increasing intelligent computing power (Kurzweil, 2011, p. 96). However, there is one thing that cannot be denied. Technology cannot be free from defects. The defect of technology lies in that it cannot have the self-consciousness, reflective ability, emotion, creativity,

critical thinking, and creative thinking as human beings. Thereby it is impossible to solve all related problems. Technology is not everything. Its imperfection will be made up by the way of human beings using and thinking technology. The essence of artificial intelligence technology should not be regarded as an external tool applied to education but rather to be regarded as an internal concept that guides artificial intelligence technology to reconstruct educational ecology based on human self-consciousness, reflective ability, emotion, creativity, critical thinking, creative thinking, and so on.

The education informatization 2.0 in China is driven by innovative ideas to further coordinate the relationship between artificial intelligence technology and education. Compared with the education informatization 1.0 in China, the education informatization 2.0 in China is obviously not an upgrade of technology, but an upgrade of concept. The fundamental reason is that the revolution in science and technology has triggered profound reforms in politics, economy, and culture. This kind of change has created new requirements for talents cultivation, which can be fulfilled only when the development of education is driven by innovation instead of technology application. “Innovation-driven” has special connotation. It means “reconstructing the concept, theory, mechanism and system of education informatization, innovating the way of education informatization supporting educational reform, and cultivating innovative and creative talents” (Chen et al., 2018, p. 18). The education informatization 1.0 in China is mainly committed to the construction of information technology infrastructure and environment, as well as the normal application of information technology in education and teaching, which is determined by the national conditions that informatization is at the primary level. In the new era, it is the national strategic deployment to build a nation with strong network and powerful education. The education informatization 2.0 in China shoulders the new mission of the new era.

It completely gets rid of the developing idea based on technology application, takes the education innovation as the starting point and end result, effectively demonstrates the power of technology in education reform, and continuously creates a new form of education in the future through the innovative application of information technology. (Yang et al., 2018, p. 17)

Committing to the expansion of digital educational resources rather than the digital presentation of textbooks. Educational resources are the essential elements of education, which determine the form of education. For a long time, educational resources based on paper textbooks have shaped modern schools and modern education. Entering the 21st century, information technology has penetrated into all aspects of economic development and social life. Profound changes are occurring in educational methods. For example, the emergence of digital educational resources represented by network resources has made education for all, quality education, personalized learning, and lifelong learning the crucial features of education information. In China’s education informatization 1.0 era, the digital education resources mainly focused on paper textbooks. Thereby the offline

education resources are presented online in digital form through information technology, showing strong dependence and specificity. It inevitably brings about the problem that classrooms and textbooks are moved online, which severely limits the broad space that digital education resources can exert.

In China's education informatization 2.0 era, the connotation and function of digital educational resources have undergone tremendous changes that involve shifting from dependence and specificity to openness and universality, which provide infinite possibilities for the reconstruction of the information education. First of all, the openness of digital educational resources break through the limitations of textbooks, giving new meaning to digital educational resources. Secondly, digital educational resources provide advantages for breaking the isolation of disciplines. When the function of digital educational resources is regarded as the digital presentation of textbooks, it only means the change of the carrier form of educational content. However, when the openness and universality of digital educational resources are emphasized, there are new opportunities to disintegrate the separation of knowledge among various disciplines. Finally, when students study online, they will generate a lot of behavioral data that can reflect learning progress and thinking characteristics.

Aiming at improving teachers' and students' information literacy rather than the applied skills of information technology. The education informatization 1.0 in China emphasizes how information technology is applied to education to realize the initial combination of information technology and education. The requirement for teachers is to pay attention to the operational skills of information technology in the teaching process, aiming at urging teachers to skillfully apply information technology to education. With the rapid development of 5G network and artificial intelligence, we are entering a highly developed information society. In this society, it is a great challenge for people to become qualified digital citizens only by mastering the application skills of information technology. The education informatization 2.0 in China is in such a highly developed information society. The requirements for teachers have shifted from the application of information technology to teaching innovation based on information technology, enabling teachers to realize the transformation from the application skills to the information literacy. Information literacy is the essential key competency for teachers in the intelligent era, which includes computational thinking, programming ability, and the corresponding "moral literacy, emotional literacy, innovative literacy based on critical thinking, philosophy and aesthetic literacy" (Xiang, 2018, p. 79). The computational thinking is an increasingly important key competency in the future. In the newly revised *Information Technology Curriculum Standard for Ordinary Senior High Schools (2017 Edition)*, the "information awareness," "computational thinking," "digital learning and innovation," and

“information society responsibility” are taken as the core competencies in senior high school (Li et al., 2017, p. 28).

The education informatization 2.0 in China not only requires “significant improvement of teachers’ information literacy” but also emphasizes “strengthening the cultivation of students’ information literacy” (MOE, 2018). The cultivation of students’ information literacy is not simply to impart information technology knowledge but rather to emphasize improving digital competence. The cultivation of digital competence cannot ignore students’ critical consciousness and reflective ability. They are the important guarantee for students to have digital competence. Critical thinking is helpful for students to analyze and judge network information, thus to identify and screen complicated information according to correct value. Reflective ability enables students to understand the subjective responsibility and communicative ethics they should bear when studying in the virtual world. The education informatization 2.0 pays attention to cultivating students’ essential character of using information technology in a reasonable and legal way, which involves understanding and respecting intellectual property rights, abiding by network ethics, protecting personal privacy, and maintaining network security (Yang et al., 2016, p. 10). In a highly developed information society, the bottom-line character is the vital guarantee for students to become qualified digital citizens.

Vision of the education informatization 2.0 in china

The *Education Informatization 2.0 Action Plan* clearly identifies three requirements for striving to construct new mode of talents cultivation under the condition of “Internet+,” developing new mode of education service based on the Internet, and exploring new mode of education governance in the information age so as to achieve its goal (MOE, 2018). The education informatization 2.0 in China insists on innovating talents cultivation mode, education service mode, and education governance mode, which become the vision in the future. Richard Mayer believes that “whenever a new technology is introduced into educational practice, great expectations are often placed” (Mayer, 2014, p. 89). What matters is that “the fundamental purpose of educational reform is to promote the all-round development of human beings, and the application of technology is to liberate human beings” (Chen, 2018, p. 6). Therefore, the vision of the education informatization 2.0 in China follows the educational concept of “people-oriented.”

Striving to build new models on talents cultivation under the support of “artificial intelligence+”

The education informatization 2.0 in China is relative to the development of the education informatization over the past 40 years. The education informatization in the first 40 years focused on the construction and application of “things” (Ren, 2018a, p. 1). The *Education Informatization 2.0*

Action Plan shows its concern for “people,” which involves “focusing on the new demand for talents cultivation in the new era and strengthening the talents cultivation concept of putting ability first.” At present, “artificial intelligence+” provides unlimited opportunities and possibilities for the kind of talents cultivation in the new era.

Establishing “Wisdom Teaching” mode under the artificial intelligence technology. In the artificial intelligence era, “Wisdom Education” has become a hot topic. “Wisdom Education” cannot be separated from “Wisdom Teaching,” which is an important teaching mode of the education informatization 2.0 in China. First of all, exploring teaching modes such as synchronous classroom, flip classroom, MOOC, online learning to enhance the innovative ability of teachers integrating information technology and teaching. Since 2019, the Science and Technology Department of MOE has set up 20 projects to support network learning space, online open courses, interdisciplinary learning (STEAM education), and intelligent education. The National Center for Educational Technology has carried out 38 teaching and research activities to promote the level of informatization in Wei County of Hebei Province, Pingyuan County of Shandong Province, Pizhou City of Jiangsu Province, and so on (Science and Technology Department of the Ministry of Education of the People’s Republic of China, 2020). This has promoted the innovation of teaching mode based on information technology in the practical development. Secondly, each student’s network behavior will leave traces in the system. Teachers can efficiently acquire students’ learning habits, learning interests, and problems existing in the learning process according to the big data. They can thus adjust and design teaching mode to achieve personalization and synergy of “Wisdom Teaching.” At present, many places in China have implemented “Wisdom Teaching.” Seven schools in Xixia District of Yinchuan City, capital of Ningxia Hui Autonomous Region, including No. 10 Primary School and Zhongguancun Middle School, have carried out the national pilot work to boost the construction of teaching staff with artificial intelligence. WISROOM classroom, big data application and analysis platform, artificial intelligence laboratory, VR classroom, and other informatization teaching forms have been effectively implemented, which has played a major role in “Wisdom Teaching” (Ningxia Education TV Station, 2019).

Building learning mode supported by “artificial intelligence+”. “Artificial intelligence technology can support inclusive and ubiquitous learning visits, help ensure fair and inclusive educational opportunities, promote personalized learning, and enhance learning outcomes” (Ren et al., 2019, p. 4). Personalized learning is the learning mode that conforms to human nature. Confucius, China’s most famous teacher and a great educator, was the first to propose “teaching students according to their aptitudes” so that everyone can receive a matching education according to their abilities and characteristics. Artificial intelligence technology provides advantages for “teaching students according to their aptitude.” China’s earliest massive open online course platform “Xuetang

Online” has an AI “Xiao Mu.” When a learner chooses a course, “Xiao Mu” will prompt whether it is necessary to make a learning plan and make different prompts at different learning stages. After the course, it will also recommend some courses and papers for the learners according to their preferences. The distinctive feature of personalized learning mode brought by artificial intelligence is that “everyone can learn, everywhere can learn, and always can learn,” which is conducive to students to establish the concept of lifelong learning, thereby to cope with changes in work, learning, and life in the artificial intelligence era. Its advantage is the accurate and fast analysis of students’ online learning. Artificial intelligence technology “encourages personalized analysis of students based on big data, formulates personalized nurturing programs that meet the development needs of students, and organically combines large-scale education with personalized fostering in the form of intelligent collaboration and virtual teaching” (Sun et al., 2019, p. 4).

Constructing intelligent learning environment. Intelligent learning environment includes online and offline learning places, platforms, and environments, such as intelligent machines, intelligent classrooms, intelligent education cloud platforms, intelligent mobile terminal devices, and App services. In the artificial intelligence era, “educational robot” has attracted much attention because it will become the key point in constructing an intelligent learning environment. “Educational robot” is the representatives of robots applied in the field of education. It is the typical applications of artificial intelligence, speech recognition, and bionic technology in education. Its goal is to foster students’ analytical ability, creative ability, and practical ability. It is worth noting that VR/AR technology can help build an immersive learning environment. Learning in the immersive learning environment is conducive to the development of space thinking and creativity, thereby is helpful for achieving deep learning.

Developing new education service models based on the Internet

The education informatization 2.0 in China escorts education services through the latest network and emerging technologies. First, it constructs the co-construction and shares mechanism of quality education resources based on National Network for Education to further realize education fairness. The year of 2020 is an extraordinary year. Under the new crown pneumonia epidemic situation, telecommuting and online teaching through the network have become the main working methods in a special period. CERNET, the special education network, adheres to the aim of network service education and shoulders the important mission of supporting and serving the national education system. “China has achieved breakthroughs in key technologies of IPv6, leading China’s education and research network to the forefront of the world’s Internet construction: CERNET has become the world’s largest academic network” (Shen et al., 2020, p. 6). At present, CERNET is building the “China’s Supercomputing Internet System.” The next step will complete 100G network

interconnection of several national high-speed supercomputing centers (Wu & Bi, 2008, p. 10). Obviously, improvement of National Network for Education will effectively escort education service. The National Network for Education can provide safe and high-speed network support for education resource service platforms at all levels. The education department can use the National Network for Education to obtain independent jurisdiction, to ensure that quality teaching resources can be accurately pushed to the “three Western regions and three Western prefectures,” and to further promote the coordinated development of education in the East and West, thus promoting education fairness.

Second, it establishes the public service platform and system for educational resources by means of the cloud computing and artificial intelligence to promote personalized learning. Cloud computing technology has inherent advantages in the construction of cloud platforms. By the end of March 2020, China’s public service platform for educational resources has opened 13.46 million teacher space, 6.49 million student space, 5.92 million parent space, and 410,000 school space. China’s public service system for digital education resources has been connected to one provincial, one municipal, and one county-level platform, respectively. The total number of system space logins has reached 9.656 million (Science and Technology Department of the Ministry of Education of the People’s Republic of China, 2020). China’s public service platform and system for digital education resources have expanded their coverage to more schools, teachers, students, and parents. In recent years, artificial intelligence technology has attracted much attention. The learning environment created by the man–machine symbiotic intelligent learning system will no longer be confined to the traditional classroom but will expand the network learning space and provide students with resources and space for autonomous learning anytime and anywhere. Digital learning resources will break discipline barriers and be pushed accurately based on learners’ behavior data analysis. Personalized learning based on information technology will be truly guaranteed.

Exploring new educational governance models in the information age

Educational governance is a process in which the governance subjects openly manage educational affairs with the help of external technologies. It pursues “good governance” to maximize the protection of public educational benefits (Wang, 2017, p. 46). In China’s education informatization 2.0 era, 5G network, artificial intelligence, and big data have provided conditions and possibilities for innovative education governance models. First, precise education governance is to be explored. Education management platform supported by 5G and artificial intelligence will be useful to register and record students’ information to provide accurate and comprehensive data. Each student’s electronic portfolio supported by big data technology can continuously record the details of students’ growth, which is conducive to the evaluation of students’ comprehensive quality and the personalization of education governance. Intelligent solutions generated on the basis of artificial intelligence technology are conducive to the elimination of personal emotions and prejudices,

thus improving the scientific decision-making in education. The Second Experimental Primary School in Dehua County, Quanzhou City, Fujian Province, has implemented intelligent management mode. Supervision and evaluation, teacher management, and student management realize intelligent management through one intelligent platform (Cheng et al., 2019). In the process of intelligent management, the principals, directors, teachers, students, and parents have realized mutual communication in time, thereby improving the coordination and accuracy of education governance between schools and families.

Second, flat education governance is to be achieved. For a long time, verticalization and stratification have been the main features of education governance. In China's education informatization 2.0 era, "artificial intelligence processing problems is integrated and cross-border, which indicates that the stratified and hierarchical model of educational governance in industrial society has not adapted to or even hindered the efficiency and effect of education governance" (Sun et al., 2019, p. 5). The main problems of hierarchical education governance are the low efficiency of governance caused by hierarchical forms and operational processes only completed by people. The greatest advantages of artificial intelligence technology are intelligence, convenience, and efficiency, which provide opportunities to weaken the hierarchical educational governance. Therefore, it is necessary to establish the artificial intelligence management system and form an education management and monitoring system covering all schools and learners. It is helpful to directly link various departments and subjects, enhance the ability of communication and cooperation at different levels, and improve the efficiency of education governance, thereby achieving flat education governance.

Third, humanized education governance is to be explored. The role of human cannot disappear in the process of education governance supported by artificial intelligence technology. The important feature of education governance supported by artificial intelligence is rationalization and de-emotionalization. In order that the role of human is not neglected, the humanization of education governance supported by artificial intelligence must be highlighted. Therefore, it is necessary to confirm the premise that artificial intelligence technology serves human beings, which should be agreed upon when formulating education governance systems and norms supported by artificial intelligence. Moreover, it is worth guarding against the leakage of information between teachers and students in the process of education governance by artificial intelligence. Education governance "should construct strict anti-theft system, monitoring system and safety guarantee system to avoid more advanced and more dangerous situations" (Sun et al., 2019, p. 5). In the process of humanized education governance, human should be the main body of education governance, while artificial intelligence is only the auxiliary of education governance. Artificial intelligence does not possess self-awareness, emotion, reflective ability and creativity, and so on. If artificial intelligence is taken as the main body of decision-making, it is inevitable to ignore humanized factors. The

education governance mode with human as the main body and artificial intelligence as the auxiliary is conducive to the combination of rationality and humanity.

Contributorship

Shouxuan Yan was responsible for determining the title of the thesis, strictly grasping the objectivity and comprehensiveness of the content in the whole thesis writing process, carefully guiding the accuracy and rigor of argumentation, and finalizing the paper. Yun Yang was responsible for writing the abstract and the bulk of the main body, responding to reviewers' comments, and collecting, sorting, and analyzing the policy documents of Education Informatization 2.0 in China and related documents. He covered various aspects of the paper including theorizing and analyzing how the latest Chinese education informatization policy is driven by the three factors, what are the core elements, contents and three typical characteristics of the policy action framework, how to further promote education informatization 2.0 in China from three levels, thus implementing the new goals and requirements put forward by the policy, and then realizing the vision of education in the informatization 2.0 era in China.

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References

- Chen, K., & Li, J. (2020). Wisdom education boosts individualized development of students [in Chinese]. *Journal of The Chinese Society of Education*, (3), 106.
- Chen, L. (2018). Education informatization 2.0: Trends and directions of internet promoting education reform [in Chinese]. *Distance Education in China*, (9), 6–8.
- Chen, L., Liu, X., Feng, X., & Chen, L. (2018). Transformation and upgrading of educational informatization: Motivation, characteristic direction and essential connotation [in Chinese]. *e-Education Research*, (8), 15–20.
- Cheng, Z., Li, H., & Xu, H. (2019). Management communication, teacher-student interaction and home-school interconnection are easily realized on a smart platform [in Chinese]. *Fujian Daily*.
- Deng, X. (2001). *Selected works of Deng Xiaoping* [in Chinese]. People's Education Press.
- Du, Z. (2017a). *Breakthrough progress in China's educational informatization* [in Chinese]. <http://www.chinamde.com/?p=1478>
- Du, Z. (2017b). *Promote the modernization of education in an all-round way with education informatization* [in Chinese]. http://edu.china.com.cn/2017-10/24/content_41782598.htm
- Du, Z. (2018a). Accelerating the development of integration and innovation to make education informatization 2.0 reality [in Chinese]. *China Education News*, 4–25.

- Du, Z. (2018b). *Deputy Minister of Education Du Zhanyuan: Artificial intelligence and future educational reform* [in Chinese]. http://www.360doc.com/content/18/0527/10/30898787_757374036.shtml
- Kurzweil, R. (2011). *The singularity is near: When humans transcend biology* (Z. Dong & Q. Li, Trans.) [in Chinese]. Mechanical Industry Press.
- Li, F., Xiong, Z., & Ren, Y. (2017). Focusing on digital competitiveness and developing students' core competency-viewing information technology education in primary and secondary schools in Shanghai from international and domestic curriculum reform [in Chinese]. *e-Education Research*, (7), 26–31.
- Mayer, R. E. (2014). *The Cambridge handbook of multimedia learning*. Cambridge University Press.
- Ministry of Education of the People's Republic of China. (2012a). *Seize the opportunity to accelerate and create a newsituation in education informatization work-speech by Vice Premier Liu Yandong at the National Video Conference on Education Informatization Work* [in Chinese]. http://www.ict.edu.cn/laws/jianghua/liuyandong/n20121120_4805.shtml
- Ministry of Education of the People's Republic of China. (2012b). *Ten-year development plan for education informatization (2011–2020)* [in Chinese]. <http://old.moe.gov.cn/publicfiles/business/htmlfiles/moe/s5892/201203/133322.html>
- Ministry of Education of the People's Republic of China. (2018). *Education Informatization 2.0 Action Plan* [in Chinese]. http://www.moe.gov.cn/srcsite/A16/s3342/201804/t20180425_334188.html
- National People's Congress. (1954). *The Constitution of the People's Republic of China* [in Chinese]. http://www.npc.gov.cn/wxzl/wxzl/2000-12/26/content_4264.htm
- Ningxia Education TV Station. (2019). *Artificial intelligence to build wisdom education highlands* [in Chinese]. https://www.nxnews.net/nxrbzk/jsmlnxn/201905/t20190510_6285781.html
- Qian, X. (2012). Qian Xuesen's exploration of "Dacheng wisdom science"—Commemorating Qian Xuesen's centennial birthday [in Chinese]. *Studies in Science of Science*, (1), 14–27.
- Ren, Y. (2018a). Entering the new era of China's education informatization—One of the interpretations of education informatization 2.0 action plan [in Chinese]. *e-Education Research*, (6), 1–2.
- Ren, Y. (2018b). How should we discuss "Education Informatization 2.0" [in Chinese]. *Journal of Distance Education*, (4), 3.
- Ren, Y., Wan, K., & Feng, Y. (2019). Promoting the sustainable development of artificial intelligence education-interpretation and enlightenment of UN's "artificial intelligence in education: challenges and opportunities for sustainable development" [in Chinese]. *Modern Distance Education Research*, (5), 3–10.
- Science and Technology Department of the Ministry of Education of the People's Republic of China. (2020, April 22). *March 2020 monthly report on education informatization and network security* [in Chinese]. http://www.moe.gov.cn/s78/A16/s5886/s6381/202004/t20200422_445508.html
- Shen, Y., Tian, Y., & Zeng, H. (2020). Education private network: Helping china's education informatization to a new stage-interview with Professor Wu Jianping, academician of the Chinese Academy of Engineering [in Chinese]. *e-Education Research*, (3), 5–9.
- Sun, L., Liu, S., & Li, M. (2019). Prospect of China's educational informatization development for 2035—Based on description of *China's Educational Modernization 2035* [in Chinese]. *China Educational Technology*, (8), 1–8.

- Wang, Y. (2017). Construction and path selection of modernization of educational governance ability in big data era [in Chinese]. *e-Education Research*, (8), 44–49.
- Wang, Y., Li, Y., & Li, D. (2019). Current situation, contents and countermeasures of construction of wisdom education demonstration zone [in Chinese]. *Modern Educational Technology*, (11), 26–32.
- Wu, D., Xing, C., & Jiang, L. (2018). Taking the road of education informatization with Chinese characteristics—Interpretation III of *Education Informatization 2.0 Action Plan* [in Chinese]. *Shanxi e-Education*, (4), 32–34.
- Wu, J., & Bi, J. (2008). Trusted next generation internet and its development [in Chinese]. *ZTE Technology Journal*, (1), 8–12.
- Xi, J. (2014). *No modernization without informatization* [in Chinese]. <http://it.people.com.cn/n/2014/0228/c1009-24495308.html>
- Xiang, X. (2018). How to learn to be a teacher in the age of artificial intelligence [in Chinese]. *Journal of the Chinese Society of Education*, (3), 76–80.
- Xie, Y., Li, J., Qiu, Y., & Huang, Y. (2019). Construction and new development of wisdom campus in the era of education informatization 2.0 [in Chinese]. *China Educational Technology* (5), 6–69.
- Yang, H., Xu, J., & Zheng, X. (2016). Digital citizenship education in the information age [in Chinese]. *China Educational Technology*, (1), 9–16.
- Yang, Z., Wu, D., & Zheng, X. (2018). Education informatization 2.0: Key historical transition of education in the new era of information technology transformation [in Chinese]. *Educational Research*, (4), 16–22.
- Yuan, Z. (2018). Dual priority agenda: China's model for modernizing education. *ECNU Review of Education*, 1(1), 5–33.