ORIGINAL ARTICLE

Development of Digital Education in the Age of Digital Transformation: Citing China's Practice in Smart Education as a Case Study

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Abstract: Digital education has been catalyzing educational transition, transforming the educational views and instructional techniques while also providing opportunities for high-quality educational development. This is a subject that all nations throughout the world are concerned about. The worldwide practice of integrating digital technologies in teaching has yielded positive results. The Global Digital Education Conference, which was held in Beijing, China, in 2023, called for global collaboration on digital education development. This paper sought to illustrate the significance of digital education for educational reform and to investigate ways for digital education development in this context, using China's smart education practice as evidence.

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D IGITAL technologies are significantly altering not just education and teaching methods but also lifestyles (Lu & Zhou, 2020). "Digital learning and transformation" was made one of the five thematic action tracks for the UN's Transforming Education Summit in 2022, with the emphasis that "digital transformation requires harnessing technology as part of larger systemic efforts to transform education, making it more inclusive, equitable, effective, relevant, and sustainable." (United Nations, 2022). The World Digital Education Conference (WDEC) was co-hosted by the Chinese National Commission for UNESCO and the Chinese Ministry of Education on February 13-14, 2023. The conference's focus was on "digital education transformation, development and application of digital learning resources, improvement of teachers' and students' digital literacy, digital governance of education, and evaluation of digital education development in basic education, vocational education, higher education, and other fields." The conference's theme was "Digital Transformation and the Future of Education." (Huai, 2023). At this conference, China reaffirmed its commitment to developing high-quality digital education, advancing educational reforms, creating a society that values learning, and fostering international collaboration in the field of digital education.

The Significance of Digital Education for Educational Transformation

Education is an intricate human activity that includes a variety of components such as teachers, students, instructional content, teaching methods, and media. With an educational system's generally defined instructional content, teaching methods and media have become a major driving factor for educational improvements. Digital technology is driving the transformation of educational paradigms.

Digital Education Marks a New Stage in the History of Education

History has witnessed two revolutions in human education. Schools are the first mechanism that facilitates the purposeful, organized transmission of human culture. The second educational revolution was distinguished by the emergence of a contemporary education system dominated by class-based instruction. Class-based instruction makes mandatory education and talent training on a broad scale practicable, hence satisfying the needs of industrialization (Zhao & Bao, 2014). Currently, many individuals anticipate a new revolutionary shift and are prepared to dub it "the third educational revolu-

Table 1. Five Stages of the Evolution of Cognitive Intelligence.

Stages of Cognition Development	Description
Perception	The ability of the computer system to recognize and comprehend the audio and visual inputs and to abstract features and models from them.
Representation & Reasoning	The ability of the computer system to process language, knowledge, and concepts and perform reasoning and problem-solving.
Autonomous Learning	The ability of the computer system to learn from experience and constantly improve models and algorithms to enhance its cognitive capability.
Creative Thinking	The ability of the computer system to think and invent creatively like mankind to innovate concepts, models, and algorithms.
Nature Interaction & Socialization	The ability of the computer system to interact with human beings at the nature and intelligence level and to perform basic socialization functioning.

tion." Educational reform has been stimulated by technological progress. Digital technology will inevitably induce educational change (Yuan, 2023).

Today's world is experiencing a new wave of industrial transformation and a scientific and technological revolution. Digital transformation is transforming society, the labor market, and the future of work as it is propelled by technological advancement and innovation. A crucial factor in this process is education. The digital transformation of education is being accelerated by the proliferation of connectivity, the usage of digital tools and apps, and the rising demand for digital skills (Huai, 2023).

The latest release of ChatGPT represents a major development milestone in artificial intelligence (AI). According to **Table 1**, the creators of ChatGPT believe that the evolution of cognitive intelligence may be broken down into five stages: perception; representation and reasoning; autonomous learning; creative thought; nature interaction and socialization (Yang & Xiao, 2023).

Currently in its third stage, ChatGPT is only partially accomplishing autonomous learning, which has a significant effect on the growth of every sector. A few Chinese businesses are also investing heavily in AI research. Tech giants like Baidu and iFLYTEK have made significant advancements in this area. Through its AI application, iFLYTEK helps Chinese schools execute "teaching to students' aptitudes" in the education sector. More than 130 million teachers and students have utilized iFLYTEK's AI technology to increase the effectiveness of their teaching and learning in more than 50,000 schools to date (Yang & Xiao, 2023). In order to support educational reform and school teaching, a number of small and medium-sized high-tech enterprises have invested in the research and development of AI technology. For instance, Shanghai Moofen Technology Co., Ltd. has used AI to give precise

data analytics to schools in Sichuan, Guizhou, Chongqing, Jiangsu, and other provinces (Li, 2021; Huang, 2022).

Digital Education has Unique Advantages in Individualized Learning

In the past centuries, modern education has provided the industrialized society with an abundance of the talents it requires. Nonetheless, it has disadvantages, such as the passive learning of students and the lack of innovation in the class-based instructional style. Class-based training necessitates uniform teaching content, predetermined teaching progression, and standardized answers and solutions, so severely limiting the customized and free growth of people (Yuan, 2023).

Educators have tried a number of experiments in an effort to change the class-based instruction paradigm, including credit banks, elective course-based curricula, non-fixed class sizes, and flexible educational systems, all of which were designed to counteract the homogeneity of the class-based instruction paradigm. Their initiatives have not had much of an impact thus far. They now have the chance to address this problem because of the development of digital technologies like big data, AI, and internet technology. Teachers can gather data on students' everyday learning, monitor their learning progress using data analytics, and then provide them with individualized instructions and learning plans with the use of digital education technologies. As a result, teachers may deliver instruction with accuracy, meet the unique learning demands of each student, and so dramatically improve student learning effectiveness.

Digital Education is a Steppingstone to Universally Fair and Higher-Quality Education

The COVID-19 pandemic has posed significant obstacles to worldwide schooling. Since the year 2020, roughly 147 million students have been robbed of more than 50% of their in-person education, and more than 90% of youngsters worldwide have been struggling with learning. Approximately 244 million children and adolescents were out of school in 2021. The pandemic has created an unparalleled sense of urgency for large-scale online instruction, hence driving the digital transformation of education (Huai, 2023).

China has developed the largest and fastest-growing education system in the world and has made outstanding advancements in educational growth. By 2021, there were 529,500 schools around the nation, serving 291 million students, and 18.4437 million full-time instructors (Ministry of Edu-

cation of China, 2022). Notwithstanding these successes, it is important to keep in mind that imbalanced development is a key aspect of Chinese education, and a higher standard of quality is expected of the entire educational system (Xue & Li, 2022). The development of a top-notch, fair, and high-quality educational system is a crucial undertaking for the country that calls for the support of digital technology. Information, big data, and AI technologies can help create a successful educational system that is advantageous to everyone.

Leveraging Digital Technology to Drive Education Transformation has become a Global Consensus

The importance of digital transformation in education is widely acknowledged on a global scale. Many nations, particularly those that are developed, have placed a high value on digital technology in educational reform and have taken proactive steps to enhance digital education.

In 2017, the European Union published the Digital Competence Framework for Educators (DigCompEdu), which covers 22 digital competences such as digital resource selection, development and modification, management, security, and sharing (Redecker, 2017). Two strategic goals for school digitization were outlined in the Digital Education Action Plan 2021–2027, which the European Union unveiled in September 2020: (i) promoting the creation of an environment for high-performing digital education, and (ii) improving digital competencies for the digital transition (European Commission, 2020). The OECD published a report titled "Innovating Teachers' Professional Learning through Digital Technologies" that same year that outlines the requirements for improving teacher learning through new technologies. These requirements include ensuring that teachers have access to high-quality ICT, enhancing teachers' digital competence, and encouraging teachers to participate in technology-based learning activities such as MOOCs, online courses, and online learning communities (Minea-Pic, 2020).

Following the UN Transforming Education Summit, the majority of participating nations included digital education as a fundamental component in their national commitment statements (Liu & Gu, 2023). According to China's statement, it will continue to implement the National Strategic Action for Education Digitalization, increase the supply of digital educational resources, create a large and open learning environment, accelerate resource sharing among learning platforms of various types and levels, advance the integration of new technology into education and learning, and accelerate the digital transformation of education (Ministry of Education of China, 2023b).

China's Strategic Action for Digital Transformation in Education

The digital transformation of education is a comprehensive campaign that includes the modification of educational concepts, the deployment of network infrastructure, the construction of education platforms, the selection of educational resources, the use of digital tools, the evaluation of digital applications, and the training of teachers. In-depth integration of digital technology in education and instruction can only be achieved through complete, methodical, and scientific digitalization (Cheng, 2020).

Policy Support for Digital Transformation in Education

To promote digital transformation in education, it is required to educate key stakeholders on the importance and value of digitalization in education transformation, the possible applications of digital technology in education, and national plans for supporting digital education (Zhou et al., 2020). To advance the national strategic action of digital education and maximize the norms and standards of educational technology, the Chinese government has published a number of policies to guide the development of digital education.

To ensure the successful implementation of the national strategy of digital transformation and progressively realize the digitalization of education, government papers such as the *13th Five-Year Plan for Educational Informatization, the Education Informatization 2.0 Action Plan*, and the Modernization of China Education 2035 advocate integrating AI, big data, and other information technologies in education and teaching in depth, developing lifelong digital education, and accelerating the construction of high-quality personalized learning systems that everyone can access anywhere at any time.

Meanwhile, the Chinese government has issued a series of guidance documents for the implementation of digital education, such as *Basic Requirements for the Functions of the Smart Education Platform, Technical Requirements for Digital Education Resources on the Smart Education Platform, Basic Classification Codes for Digital Education Resources, Basic Data of Education, Basic Data o*f Personnel in the Education Sector, Basic Data of Primary and Secondary Schools, and Digital Literacy of Teachers.

Policy support and publicity in various forms have increased all stakeholders' engagement in digital education development in terms of teaching, learning, school governance, and educational innovation, as well as ensuring the successful execution of the "School is Out, But Class is On" program during the COVID-19 pandemic prevention and control and facilitating the "Double Reduction" work. As a result, educational equity and

quality have improved, and new paths for advancing digital education have opened up.

Setting Objectives for the Development of Digital Education

Digital education is a relatively new practice in educational history. When confronted with this new trend, it is vital to define directional goals. What should be the practical and achievable aims of digital education development is an issue shared by all governments throughout the world. To respond to this question, Huai (2023), China's minister of education, proposed the following goals at the WDEC:

Strengthening the National Center to Pool and Share Quality Resources

The National Digital Resources Construction Committee will be established to coordinate the development of high-quality resources and the delivery of public services, to evaluate digital resource management and application, to improve the quality of campus education and digital education empowerment, to coordinate policy and academic research and practical innovation, and to develop standards and specifications to ensure safe and efficient operation. The National Center will be divided into several sections, including a resource development and utilization center, a public service center, an application development center, a comprehensive research center, and a safety operation and maintenance center. At the same time, the center will serve as a model for the development of regional service centers for educational resources. The government will actualize resource sharing and mutual recognition, as well as build a national public service system on digital education with multi-level and multi-party collaboration, by improving the national center's hub capacity and connecting regional centers.

Strengthening Data Empowerment and Improving Educational Effectiveness

Enormous amounts of data will be employed to create learner profiles and generate educational schema that are better suited to the abilities of learners. Schools will support decentralized and diverse teaching and learning, conduct pedagogical research in digital education, increase teachers' digital literacy, as well as create and implement diverse education models and evaluation methodologies to enhance teaching quality. Administrators will develop education governance that is efficient and targeted. Through the application

of AI and big data technologies, corporate collaboration, process optimization, structural remodeling, and targeted management may be achieved to enhance the efficiency of education management and create a solid foundation for well-informed education decisions.

Improving Digital Literacy for Lifelong Learning for All

The extensive and in-depth application of Smart Education of China makes the "Learning for All" initiative feasible, which will not only provide curriculum resources for students but also a learning service environment for the elderly and other members of society, thereby constructing a learning support platform for learners around the world to ensure that everyone has equal learning opportunities.

Strengthening International Cooperation for the Prosperous Development of Civilizations

The advancement of digital education enables teenagers from different countries, with different skin colors and languages, to learn and grow together in a common digital space and enables people from different countries to engage in closer people-to-people and cultural exchanges, so as to deepen exchanges, tolerance, and trust, eliminate barriers and misunderstandings, and promote mutual understanding and the advancement of humanity.

Persistent Investment in the Construction of Digital Facilities in the Educational Community

The construction of ubiquitous digital infrastructure is the precondition for digital transformation in education. Continuously upgrading digital infrastructure is essential to the effective operation of digital education (Cheng, 2020). China has long been committed to the creation of infrastructure for digital education, focusing on:

Deploying Digital Network Infrastructure

Connectivity facilities serve as the cornerstone for digital education deployment. China launched the "Three Links and Two Platforms" program in early September 2012, with all higher education institutions and basic and secondary schools participating by 2013. The "Three Links," which refer to "the school links to a broadband-based network, the class links to good teaching resources, and the individual links to an online learning space," have ensured China's digital transformation in education. China's educational informatization has advanced dramatically as a result of the project,

Table 2. State-level Digital Education Cloud Platforms in China.	
Names of Platforms	**Developers**
Smart Education Gateways	Department of Science, Technology and Informatization, Ministry of Education
Smart Primary and Secondary Education of China	Department of Basic Education, Ministry of Education
Smart Vocational Education of China	Department of Vocational and Adult Education, Ministry of Education
Smart Higher Education of China	Department of Higher Education, Ministry of Education
Pilot Demonstration of Smart Education	Ministry of Education
Source: Official Website of the Ministry of Education of China	

with 100% internet connectivity on campus and 99.5% of primary and secondary schools equipped with multimedia classrooms (Ministry of Education of China, 2023a).

Developing Digital Education Cloud Platforms

The state-level cloud platforms that have been developed during the previous decade or so are presented in **Table 2**.

To satisfy the demands of local schools for digital education, provincial, city, and county-level cloud platforms have also been built. Furthermore, a few privileged schools have created their own smart cloud platforms for instruction. For instance, Shandong 271 Education Group created 271Bay to help the group's more than 8,000 teachers and more than 90,000 students in their digital teaching and learning (Sun, 2022).

The enhanced digital infrastructure facilitates the growth of digital education. During the lockdowns caused by the COVID-19 pandemic, the implementation of the "School is Out, But Class is On" program ran smoothly due to the deployment of rather complete digital facilities. More than 270 million Chinese students successfully completed learning assignments via online education (Lu & Zhou, 2020).

In China, digital technology and online education platforms are utilized not merely to support classroom instruction but also to aid in the moral and mental health education of students. For example, the Mental Health Cloud Platform in a city in Jiangsu has offered students psychological health care services such as evaluation, counseling, and therapy for mental health issues (Quan, 2020).

As well, by altering their teaching research methodologies, teachers have supported educational research through the use of increasingly common digital facilities in educational communities. Even instructors in border and

Table 3. State-level Digital Education Resource Banks.	
Names of Banks	**Builders**
National Smart Education Resources	Ministry of Education
College Graduate Employment Resources	Department of Vocational and Adult Education, Ministry of Education
MOOC Resources	Department of Higher Education, Ministry of Education
Curricular Teaching Module Resources	Ministry of Education
Source: Official Website of the Ministry of Education of China.	

minority areas have attempted to conduct educational research using the digital technology platform. For instance, teachers at a senior secondary school affiliated with Xingyi Normal University for Minorities successfully used the Intelligent Research and Training Platform to conduct instructional research (Gong, 2022).

Promoting the Construction of Digital Education Resource Banks

The most essential aspect of digital education development is the development of digital resources. The widespread use of digital technology has created potential to better balance educational resources and close gaps between regions, urban and rural locations, and schools. China has established a preliminary digital education resource system that serves all types of schools at all levels. The present state-level digital education resource banks are shown in **Table 3**.

High-quality digital resources for basic education are available through the "Smart Primary and Secondary Education of China" platform. These resources span 10 sections, 53 columns, and 44,000 individual entries, and they cover topics like moral education, curriculum teaching, physical education, aesthetic education, labor education, after-school services, teacher preparation, family education, teaching reform experience, and teaching materials. Children who live far away in border and rural areas can "share the same class" with those who live in big cities. In order to continue student learning despite the suspension of in-person classes caused by the pandemic, the platform supported online learning for close to 200 million Chinese primary and secondary school students. Around 13 million teachers nationwide received specialized training over the winter and summer breaks to enhance their teaching and research skills (Huai, 2023).

To satisfy the demands of local schools for digital education, resource centers at the provincial, city, county, and school levels have also

been constructed. For instance, the Jiangsu Province city of Suzhou established the Suzhou Online Education Center, which amassed enormous volumes of instructional information. This center, which is funded by the Suzhou Municipal Bureau of Education and is supported by information and AI technologies, offers personalized online learning services that combine online and offline instruction with digital resources for in-class and extracurricular learning that have been prepared by the city's anchor teachers. This center is free for all students and covers all disciplines at the basic education levels as well as the entire learning process. Since its launch in 2018, the platform has provided 1.83 million questions based on all knowledge points at all levels, 126,000 entries of video resources, including micro-lectures on various subjects, and 14,500 subject-based lessons taught by city-level anchor teachers (including 180 lessons taught by foreign teachers) across all disciplines in the 12 grades of basic education (Suzhou Online Education Center, 2023b). Almost 1.5016 million instructors and students from ten districts and counties in the city have access to the platform as of February 2023, with a total of 275 million log-in person-times and more than 517 million views. Suzhou Online Education Center has adhered to the principle of "giving application and service precedence in digital education" proposed by Jinpeng Huai, China's minister of education (Suzhou Online Education Center, 2023a).

Sichuan, a western province of China, introduced the "Sichuan Cloud Education" project in 2018, which provides open access to live broadcasts of excellent classroom education. The platform uses top-notch educational materials from those schools in developed areas to their fullest advantage through ongoing development and iterative upgrading to deliver synchronous learning services for more than 200,000 students and over 20,000 teachers. A total of 44 "Sichuan Cloud Education" teaching alliances have been established as part of this project, benefiting over 1,600 underprivileged schools, including 523 minority schools (with more than 100,000 students) in relatively underdeveloped areas. These alliances cover all disciplines for primary and secondary schools as well as teaching content for kindergartens (Cui, 2022).

Digital Literacy Training for Teachers

Digital education is a new paradigm in education, necessitating new thought patterns and digital competencies among teachers. Professional and systematic training is required to assist teachers in modifying their educational philosophies, equipping them with digital abilities, and so increasing their work productivity.

Chinese educational authorities give teachers' training in digital literacy a high priority. To direct teacher training in the context of digital educa-

tion, the Ministry of Education published Views on Comprehensively Deepening the Reform of Teacher Professional Development in the New Age in 2021. Based on the current digital proficiency of local teachers, all provinces, cities, counties, and schools offer various forms of teacher digital training (Ministry of Education of China, 2021).

Achievements of China's Digital Education

By altering instructional concepts, reforming pedagogies, and school administration, enhancing student learning strategies and outcomes, and boosting communication between the home, school, and community, digital education can drive educational transformation and encourage the high-quality development of education. Data that is relevant shows that China has achieved significant advancements in digital education.

  The "Smart Primary and Secondary Education of China" platform has given particular emphasis to the demand-driven expansion of its capabilities and applications while continuing to assemble and upgrade resources. This platform has improved user interaction, added features like live broadcasting, resource evaluation, and application data analytics, and developed its mobile App and user registration function with the help of *Regulatory Measures for the Operation of Smart Primary and Secondary Education Platform (Interim)*. The nine application scenarios it can now handle include autonomous learning, lesson planning, double-teacher classrooms, homework push, Q&A, after-school services, teacher training, home-school communication, and school district administration. It keeps gaining in intelligence. Additionally, it has conducted two rounds of platform application pilot projects, regularly summarized its findings, and showcased successful platform usage examples. The site has seen a tremendous increase in usage; as of January 31, 2023, there were 72.51 million registered users. It has developed into a sizable platform for educational services and a storehouse of educational resources. Primary and secondary school teachers in China apply digital technologies to a range of topics, including educational research, teaching, and assignments, as well as to a variety of scenarios, including synchronous classrooms, specialized classrooms for underprivileged schools, smart classrooms, smart homework, and online educational research, depending on their particular needs. As a result, there has been a large increase in the analysis and feedback of teaching and learning data, which has successfully improved teachers' instructional skills and boosted the efficiency of classroom instruction (Ministry of Education of China, 2023c).

  China's strategic initiative for smart vocational education has also advanced significantly. The management of digital resources was first standardized by the "Smart Vocational Education of China" platform, which also established requirements for resource inclusion. More than 510,000 video

resources and more than 150,000 graphic and textual materials are now listed in it. Students gain access to 6,757 top-notch open online courses and 1,173 teaching resource banks at the state and provincial levels through this platform. Also, online training on the usage of this platform was arranged for teachers from all vocational schools and colleges with the help of the National Vocational Education Informatization Steering Committee. The regular "Summer-Vacation Teacher Training" program was jointly established on the platform by the Department of Vocational Education and Adult Education and the Department of Teachers of the Ministry of Education. To date, it has been utilized by 7,200 schools and 692,000 teachers (Ministry of Education of China, 2023e).

The platform of "Smart Higher Education of China" was constructed to high standards in the higher education community, including 27,000 top-tier MOOCs and virtual simulation experiments, as well as more than 65,000 instructional materials, videos, and other learning resources. Almost all western Chinese colleges and universities have benefited from the MOOKs for Western China Initiative. In 2022 alone, it provided 45,000 MOOKs and on-demand courses to western universities and colleges, engaged 250 million person-times of students, and trained 355,000 person-times of teachers. Furthermore, the comprehensive integration of the next generation of digital technology with higher education has become the new norm. Chinese colleges and universities have successfully addressed the consequences of the COVID-19 pandemic using the internet and information technology. Rapidly emerging educational modalities and talent training paradigms include online and offline blended learning. Digital education-driven teaching reform has become a trend in China's higher education development (Ministry of Education of China, 2023d).

The national smart education platform system collects top-notch, diverse digital learning resources and offers students and the general public one-stop services constantly. This has aided in the equitable distribution of educational resources and the promotion of digitalization, while also addressing the individualized and selective learning needs of all students and strongly promoting lifelong learning (Huai, 2023).

References

Cheng, X. (2020). Challenges of "School's Out, But Class's On" to school education: Practical exploration of Chinese schools during the COVID-19 Pandemic. *Science*

Insights Education Frontiers, 5(2): 501–516. DOI: https://doi.org/10.15354/sief.20.ar043

Cui, C. H. (2022). Building "Sichuan Cloud Education" platform to promote high-quality and balanced education: Sichuan's practice of universal sharing of quality educational resources. *Sichuan Education*, 2022(1): 6-8.

European Commission. (2020). The Digital Education Action Plan 2021-2027. European Commission. 2020. Available at: https://education.ec.europa.eu/focus-topics/digital-education/action-plan

Gao, Q. S. (2013). Limitations of the class-based instruction system and countermeasures. *Examination Weekly*, 2013(15): 153-154.

Gong, J. (2022). Digital teaching research based on the Intelligent Research and Training Platform: Citing the practice of the Chinese teaching and research group of Senior Secondary School Affiliated to Xingyi Normal University for Minorities as a case study. *Science Insights Education Frontiers*, 12(2):1741-1748. DOI: https://doi.org/10.15354/sief.22.or065

Huai, J. P. (2023, February15). Deepening digital transformation, building a bright future of education. China Teacher Paper. pp.001

Huang, J. (2022). Improving Minority Education in China in the "Internet Plus" Era: A Case Study of Southwest Guizhou Autonomous Prefecture. *Science Insights Education Frontiers*, 12(2):1749-1757. DOI: https://doi.org/10.15354/sief.22.or063

Li, X. (2021). Research on micro-class resources in the PBL model. *Science Insights Education Frontiers*, 8(S1):7. DOI: https://doi.org/10.15354/sief.21.s1.ab018

Liu, B. C. & Gu, G. Y. (2023). Open the door for public digital learning: The initiatives of United Nations Transforming Education Summit, challenges, and countermeasures. *China Educational Technology*, 2023(1):16-24.

Lu, H. & Zhou, L. (2020). Epidemic prevention and teaching measures in Chinese elementary and middle schools under the background of COVID-19 Pandemic. *Science Insights Education Frontiers*, 6(2):669-690. DOI: https://doi.org/10.15354/sief.20.or027

Minea-Pic, A. (2020). Innovating teachers' professional learning through digital technologies. *OECDiLibrary*, 2020, DOI: https://dx.doi.org/10.1787/3329fae9-en

Ministry of Education of China. (2021). Promoting teacher professional development for better education in the new era: A series of newly issued government papers. Ministry of Education of China. (2021-01-27). Available at: http://www.moe.gov.cn/fbh/live/2021/52874/mtbd/202101/t20210127_511416.html

Ministry of Education of China. (2022). The Statistical Bulletin on the Development of Chinese Education in 2021. Ministry of Education of China. (2022-09-15). Available at: http://www.gov.cn/xinwen/2022-09/15/content_5710039.htm

Ministry of Education of China. (2023a). Building a country strong in education via digital transformation. Ministry of Education of China. (2023-02-11). Available at: http://www.moe.gov.cn/jyb_xwfb/xw_zt/moe_357/2023/2023_zt01/fzzs/202302/t20230211_1043749.html

Ministry of Education of China. (2023b). Introduction to World Digital Education Conference. Ministry of Education of China. (2023-02-12). Available at: http://en.moe.gov.cn/features/2023WorldDigitalEducationConference/Introduction/202302/t20230212_1043968.html

Ministry of Education of China. (2023c). Progress of basic education digitization. Ministry of Education of China. (2023-02-09). Available at: http://www.moe.gov.cn/jyb_xwfb/xw_fbh/moe_2606/2023/cfh_0209/cailiao/202302/t20230209_1043117.html

Ministry of Education of China. (2023d). Progress of higher education digitalization. Ministry of Education of China. (2023-02-09). Available at: http://www.moe.gov.cn/jyb_xwfb/xw_fbh/moe_2606/2023/cfh_0209/cailiao/202302/t20230209_1043112.html

Ministry of Education of China. (2023e). Progress of vocational education digitalization. Ministry of Education of China. (2023-02-09). Available at: http://www.moe.gov.cn/jyb_xwfb/xw_fbh/moe_2606/2023/cfh_0209/cailiao/202302/t20230209_1043114.html

Quan, L. (2020). Practical analysis of mental health assistance in elementary and middle schools under COVID-19 Pandemic: A case study of City A in Jiangsu, China. *Science Insights*, 34(3):183-193. DOI: https://doi.org/10.15354/si.20.or026

Redecker, C. (2017). European Framework for the Digital Competence of Educators:

DigCompEdu. Luxembourg: Publications Office of the European Union. 2017. DOI: https://doi.org/10.2760/178382(print),10.2760/159770

Sun, G. (2022). Application of educational technology in holistic module learning: Citing the practice of Shandong 271 Education Group as a Case Study. *Science Insights Education Frontiers*, 11(1):1499-1507. DOI: https://doi.org/10.15354/sief.22.or007

Suzhou Online Education Center. (2023a). Data Display. Suzhou Online Education Center. Available at: https://sjxs.suzhou.edu.cn

Suzhou Online Education Center (2023b). Suzhou Online Education Center data report 2022. Suzhou Online Education Center. (2023-01-19). Available at: https://sjxs.suzhou.edu.cn/pagesV2/home.html#/articleDetail?id=63f461009998ba55dc1baeb5&type=article

United Nations. (2022). Transforming Education Summit: Thematic Action Tracks. United Nations. 2022. Available at: https://www.un.org/en/transforming-education-summit/action-tracks

Xue, E. Y. & Li, J. (2022). Building a country with powerful basic education: An interpretation of the educational initiatives in the Report of the 20th CPC National Congress. *School Administration*, 2022(12):9-12.

Yang, J. & Xiao, X. (2023). Confidence in the leap of AI technology and the prospect of Chinese counterpart of ChatGPT: iFLYTEK's response. QbitAI. (2023-02-16). Available at: https://baijiahao.baidu.com/s?id=1757982724120660133&wfr=spider&for=pc

Yuan, Z. G. (2022). Education governance in the era of digital transformation. *Journal of the Chinese Society of Education*, 2022(8):1-6+18.

Zhou, H. Y. & Bao, C. Z. (2014). The approaching third educational revolution. *Liaoning Education*, 2014(16):10-12.

Zhou, L., Li, F., Wu, S., & Zhou, M. (2020). "School's Out, But Class's On", The largest online education in the world today: Taking China's practical exploration during the COVID-19 epidemic prevention and control as an Example. *Best Evidence in Chinese Education*, 4(2):501-519. DOI: https://doi.org/10.15354/bece.20.ar023