Educational Reform and Prospects in the Post-pandemic Era

Xin Tian *

Beijing Language and Culture University, Beijing, China

* Corresponding Author Email: 34829449@qq.com

Abstract. The outbreak of COVID-19 pandemic has profoundly impacted global education, leading to a surge in online education, a pressing need for global online educational resources, a balanced focus on K12 and higher education, widespread adoption of new technologies in education, and rapid development of specialized education platforms. These changes have posed numerous challenges and triggered multidimensional transformations in educational philosophies, models, assessment methods, teaching resources, and the integration of education with new technologies. Additionally, the formation of an international educational community and the reconstruction of educational ecosystems have become key considerations. To address these challenges, this paper proposes the rapid transformation of educational concepts, from traditional views to a future-oriented perspective that caters to the unique learning needs of each individual, enabling education that is accessible, continuous, and personalized through leveraging advanced technologies like the Internet, big data, cloud computing, and artificial intelligence. The paper also suggests increasing investment in educational resources, enhancing network infrastructure and facilities, improving top-level designs for educational resources, promoting international exchanges and resource sharing, and establishing a comprehensive policy and guarantee system to tackle the structural insufficiency of high-quality educational resources. Furthermore, diversified teaching methods, such as blended learning and flipped classrooms, are proposed to meet the diverse learning needs. The paper emphasizes the importance of enhancing teachers' information technology application capabilities to align with the developmental needs of schools. It also advocates for increased participation of China in global education governance and the promotion and implementation of innovative Chinese educational ideas on a global scale. Initiatives such as leading post-pandemic global education and education informatisation plans are suggested to drive the formulation of relevant standards, international conventions, and the advancement of domestic education governance, thus enhancing China's contributions and influence in global education governance.

Keywords: Post-pandemic era, Educational reform, Prospects, Strategies for addressing challenges.

1. Introduction

The COVID-19 pandemic has led to profound adjustments and restructuring in the global economic landscape and social development. It has also significantly impacted normal educational activities in various countries, influencing educational philosophies and learning approaches. Therefore, transforming and reforming educational methods have become crucial choices for the world as it enters an unprecedented period of great changes, and the global economy enters a new stage of development. Accelerating the digital development of education has become a common consensus and concerted action for the international community to transform educational methods, cope with pandemic-related changes, and promote comprehensive educational iteration and transformation.

1.1. Explosive Growth of Online Education in China

According to the "Research Report on China's Online Education Market in the First Quarter of 2020," the pandemic's influence resulted in a surge of online education in China. As of April 3, 2020, a total of 1,454 regular colleges and universities in China switched to online education, with over 950,000 teachers offering 942,000 courses and 7.133 million course instances online, reaching approximately 265 million students. The Ministry of Education organized 37 online course platforms and technical platforms to provide free access to online courses for universities across the country,

leading to more than 110 social and university platforms actively participating. The user base of online education in China reached 423 million, with an increase of 221.73 million people since the end of 2018, showcasing explosive growth in the application of online education [1].

1.2. Pressing Global Demand for Online Education

According to data from UNESCO, the COVID-19 pandemic had a massive impact, especially in March 2020, when school closures affected 91.3% of students globally. Over 1.5 billion students in 193 countries and regions were affected during the period from February to June. By July, the number of affected countries and regions decreased to 107, with approximately 1 billion students affected, accounting for 60.9% of the global student population.

2. Analysis of Educational Demands during the Pandemic

2.1. Coexistence of K12 and Higher Education

Based on the "Research Report on China's Online Education Market in the First Quarter of 2020," the market shares of K12 education and higher education accounted for over 70% of China's online education market in the first quarter of 2020. Among them, K12 education held the highest market share at 39.1%, and higher education accounted for 35.1%. Language learning constituted 6.8% of the market share. The rapid development of K12 education is attributed to multiple factors, including the impact of the pandemic, national education policies, increased attention to early-age education, strengthened awareness of lifelong learning, and the growing pressure on primary and secondary students regarding academic advancement. Consequently, there is a more urgent demand for high-quality education in areas such as language, critical thinking, arts, and scientific disciplines like programming. Additionally, the market share of higher education has gradually expanded, reaching as high as 35% due to the pandemic's influence [2].

2.2. Aggregation of Educational Content

According to the "Research Report on China's Online Education Market in the First Quarter of 2020," online education currently covers seven major categories: early childhood education, K12 education, higher education, vocational/qualification training, corporate training, language learning, and others. Content-based and tool-based products are currently the most popular. Overall, the most sought-after products in the market are knowledge/information-based courses, live-streaming classrooms with real-time interaction, and practical tool-based courses such as question-solving, dictionaries, and language practice. Presently, there is an increasing user interest in quality education and interest-based education. Among quality education products, children's programming and critical thinking courses are experiencing the fastest growth. In higher education, programs such as overseas universities, domestic universities, and Sino-foreign joint-degree programs for bachelor's, master's, and doctoral degrees have become a new trend [3].

Research conducted by the Evergrande Research Institute indicates that among unicorn companies in the fields of financial technology, e-commerce, and internet software and services, artificial intelligence and medical health have seen rapid growth, with the education sector accounting for 3.0%. Sixteen companies, including BYJU'S in India, Coursera and Age of Learning in the United States, and VIPKID, Yuanfudao, and Zuoyebang in China, made it to the top 500, accounting for an impressive 84% share. According to the data from the Evergrande Research Institute, the global unicorn industry has a 3% share in education, while in China, the education sector holds a higher proportion, reaching 6.8%, ranking fifth.

2.3. Ubiquitous Application of New Technologies

With the development of information technology, new technologies such as big data, facial recognition, and artificial intelligence (AI) have become increasingly prevalent in online education.

The rapid development of "AI + Education" is evident, with numerous technology education companies, such as VIPKID and Squirrel AI, leading the AI education industry. The transformation of traditional education systems has already begun. According to the "Global Report on Intelligent Development in Education," as of the first quarter of 2019, the distribution of "AI + Education" industry in China is dominated by K12 education, accounting for 50%, while information technology education, language learning, and quality education account for 24%-28%. In overseas markets, the distribution varies. For instance, in the United States, the proportion of AI education dedicated to language tutoring is not very high. Both higher education and K12 education account for 25%, totaling 50%, followed by the quality education sector [4].

2.4. Specialization of Educational Platforms

The "2.0 Action Plan for Educational Informatisation" proposes to introduce internet learning platforms and market service mechanisms, creating a unified educational service personal online learning space and a converged education management and service portal centered around user services. The goal is to integrate various learning resources, educational services, and access to educational information, building an intelligent "Internet + Education" mega-platform for the digital era. Under policy guidance and the impact of the pandemic, online education platforms have matured. Technologies such as facial recognition, AI teachers, personalized recommendations powered by cloud computing, big data analytics, VR, and other AI technologies have gradually been incorporated into online education scenarios. As a result, teaching efficiency has improved, user profiling has become more accurate, and educational platforms are gradually evolving towards smart, personalized, and precise iterations and upgrades. The development of personalized teaching centered on students has improved, leading to enhanced user experiences that are more user-friendly and convenient.

3. Educational Transformation in the Post-Pandemic Era

The global pandemic has brought significant challenges to education but has also triggered multidimensional transformations in educational philosophies, models, assessment methods, teaching resources, and the integration of education with new technologies. It has led to the formation of an international educational community and the reconstruction of the educational ecosystem.

3.1. Changing Educational Paradigms

Firstly, there is a rapid transformation from traditional educational paradigms to future-oriented ones. Online teaching during the pandemic has placed students in a more open space where knowledge is ubiquitous. Students now have the freedom to choose courses, organize study groups, and track their learning progress and knowledge mastery in real-time, and engage in learning and exchanges with students from different cultural backgrounds across time and space. The learner's role has been highlighted, and teaching concepts such as "student-center", "exploratory learning" and "self-directed learning" are gradually being established. The Internet, big data, and artificial intelligence have created personalized learning methods for each learner, promoting the idea of "education for all, anytime, anywhere." This new future-oriented educational perspective and learning organization form are rapidly gaining recognition and adoption. Secondly, there is a reevaluation of the value of online education. The pandemic has brought unprecedented attention to the value of online education, leading society to reevaluate its social, cultural, and instructional significance. Socially, online education actively integrates education with information technology and artificial intelligence, accelerating the transition from the information age to the intelligent age. It enables cross-national, cross-regional, and cross-lingual sharing of educational resources, playing an indispensable role in promoting educational equity and meeting diverse and personalized educational needs in the new era. Culturally, online education is not merely a utilization of modern technological devices and tools; it represents a new cultural mode integrating digital culture, interactive culture, sharing culture, and information culture. It plays a unique role in promoting the openness, cooperation,

and sharing of school education and culture. [5-6] In terms of instructional value, online education based on modern information technology such as the Internet and big data has accumulated a wealth of structured or semi-structured data from the educational process. It provides essential guarantees and data support for educational practices to transition from generalized to personalize and from ubiquitous to precise during the pandemic era.

3.2. Diversification of Educational Models

The suspension of traditional classes and the continuation of learning during the pandemic have spurred the enrichment and diversification of educational models. Firstly, regarding teaching models, online education includes various forms such as one-on-one tutoring, training systems, live-streaming classes, blended learning (combining online and offline instruction), and flipped classroom models. These diverse models have helped teachers and students break through spatial and temporal limitations, enabling real-time interactions between teachers and students as well as peer-to-peer interactions, catering to the diverse learning needs of users. Secondly, looking at learning models, there are several modes: inquiry-based learning under the "learning tasks + resource support" approach, fragmentary learning through various media anytime and anywhere, self-directed learning, sharing, communication, and collaborative learning based on shared interests and tasks. Additionally, personalized learning is supported by artificial intelligence through the use of "knowledge graphs + user profiling + analysis and diagnosis + personalized recommendations". Thirdly, in terms of educational collaboration models, traditional educational collaborations have become more open, blurring the boundaries and concepts between physical and virtual campuses. Various global educational collaborations have emerged, such as the UNESCO Global Education Coalition, Canada's Learning "Home Alliance," and domestic Chinese language education alliances. New educational models, such as "Two Cities, One Classroom," course sharing, credit recognition, joint education, Sino-foreign cooperative education, and other forms of cooperation, continue to emerge and strengthen. Fourthly, there has been a shift in the roles of teachers and students. Students take on a more active role as the main learners, while teachers serve as organizers, coordinators, assistants, service providers, and mentors [7-9].

3.3. Multi-level Application of Artificial Intelligence in Education

With the advancement of educational informatisation, the arrival of the pandemic has accelerated the deep integration of new technologies such as artificial intelligence and big data with education, driving their application in multiple fields and levels of education. In terms of education categories, artificial intelligence has been applied in various areas, including school education, quality education, language and vocational training, exchange-based education such as summer camps and study abroad programs, and more. In terms of the definition of educational subjects, artificial intelligence has also sparked a redefinition of schools and students. The future of teaching and learning will not be limited to traditional schools; any place can become a learning environment. From an educational model perspective, the Parallel Education new paradigm for personalized and accurate education services has been proposed by the team at the State Key Laboratory of Management and Control for Complex Systems at the Chinese Academy of Sciences, based on the Parallel Intelligence theory and ACP method. Education platforms supported by artificial intelligence will develop towards fine-grained iteration, human-machine interactive teaching, and the direction of the Parallel Education new paradigm. From an educational scene perspective, it includes intelligent adaptive education, innovative learning virtual spaces, as well as data analysis and data privacy.Intelligent adaptive education provides precise user profiles for educational administrators and teachers, optimizing teaching processes and methods tailored to the needs of each learner, providing instant and customized guidance or feedback to each learner. While achieving precise and personalized educational support, it also engages in human-machine collaborative iteration, enabling self-improvement of the intelligent adaptive education system. In terms of educational resource allocation, artificial intelligence enables information flow within campuses and resource sharing across regions,

breaking down barriers for information and resource exchange, facilitating information integration, providing data-based foundations for optimizing educational resource allocation and risk response in management decision-making, facilitating the flow of excellent educational resources, and promoting the construction of educational equity.

3.4. Transformation of Teaching Evaluation Methods

Traditional teaching evaluation methods have often focused on outcome-based assessment. However, the integration of "Artificial Intelligence + Education" is changing the way teaching is conducted, influencing the form of educational evaluation, and promoting a shift from evaluating "teacher-led teaching" to "student-centered learning." The new technologies have enriched educational evaluation methods and possibilities, placing greater emphasis on assessing the learning process and comprehensive development to evaluate the overall quality of education. Leveraging technologies such as big data, cloud computing, the Internet of Things, virtual and augmented reality, educators can access diverse data, information, and knowledge from teaching and educational management processes. This allows for the analysis of cognitive processes in both learning and teaching behaviors. Additionally, through real-time interaction and parallel execution with artificial educational systems, it becomes possible to assess the performance of teaching processes, visualize the effects of various teaching strategies, and analyze and predict their outcomes. This transformative shift in educational evaluation will create a better educational ecosystem, facilitating more precise and intelligent instructional guidance and process-based evaluation. Ultimately, it will promote personalized and sustainable development for individuals [10-11].

3.5. Formation of a Global Education Community

As UNESCO's Assistant Director-General for Education, Stefania Giannini, stated, "Education is changing in real time, and global collaboration is the only way to respond to the crisis. Innovative cooperation among universities opens up new paths, allowing us to deal with crises more confidently and promote the construction of a sustainable human community." In response to the challenges brought about by the pandemic, UNESCO promptly established the Global Education Coalition. This coalition includes 10 multilateral cooperation partners, such as the International Labour Organization, UNICEF, the World Health Organization, and the International Telecommunication Union, as well as seven companies, including WeiDong Cloud Education Group, Microsoft, Google, Amazon, Facebook, Coursera, and Zoom. Six social/non-profit organizations, such as Khan Academy, media collaboration organizations like BBC, and French-speaking international organizations, are also part of this network. The coalition aims to use high-tech, low-tech, and no-tech approaches to help countries implement innovative and context-specific solutions, provide remote education, offer resources and expertise in technology, access, and capacity building, mitigate the adverse impacts of school closures, meet the urgent demand for online education, and monitor global school closures and affected student numbers [12].With the proliferation of online education across countries, regions, and educational institutions, the rise of online higher education and vocational training programs, as well as continuous innovations in various education platforms, many domestic universities have introduced online degree programs and educational offerings in collaboration with overseas institutions. These developments accelerate the interconnection, universality, and sharing of cross-national, cross-regional, cross-industry, and cross-lingual courses and resources, gradually giving shape to a global education community.

3.6. Construction of a New Educational Ecosystem

In the post-pandemic era, with the deep integration of new technologies such as artificial intelligence and big data with education, along with changes in educational models, ideologies, and demands, the educational ecosystem is undergoing new adjustments and constructions. Formation of a Virtual Educational Ecosystem: The rapid development of online education, the emergence of new virtual education modes involving the entire educational community during the pandemic, and the

application of technologies like artificial intelligence, virtual reality (VR), and augmented reality (AR) have given rise to the formation of a virtual educational ecosystem. Interactive Teaching New Ecosystem: Supported by information technology, optimized resource allocation, and improved management efficiency, a multi-dimensional organization that integrates online and offline, in-class and out-of-class, home-based and school-based education has been established. This ecosystem enables multi-level, real-time interactions among teachers, students, and technology, fostering interactions between individuals across time, space, and languages. Restructuring of School Educational Ecosystem: The pandemic has accelerated the construction of an information-based and smart educational ecosystem, where teachers and students are the core, teaching is the center, and services play a crucial role. Deep integration of information technology with teaching, research, and campus culture has facilitated the exchange, sharing, communication, and collaboration of information among students, teachers, and staff, greatly eliminating information silos. As a result, school operation and management efficiency have significantly improved, and the governance capacity of informatisation education has been strengthened. Convergence of Higher Education, Information Technology, Enterprises, and New Media: A new educational ecosystem that integrates production, learning, research, and education is emerging. This convergence involves collaborations between universities, information technology companies, enterprises, and new media platforms, fostering innovative education models and exploring cutting-edge educational practices [13-15].

4. Challenges and Strategies for Education in the Post-Pandemic Era

Even though the pandemic has largely subsided, the impact of online teaching on traditional education will continue, and "blended" hybrid teaching may become one of the main modes of education in the post-pandemic era and the future. While education undergoes innovation and transformation, it also faces several challenges.

4.1. Insufficient Platform Development and Infrastructure

During the pandemic, both domestic and international universities and schools encountered various challenges related to teaching platforms, such as lags, disruptions in live streaming, limited bandwidth for downloading resources, and even complete network failures. Some households faced issues due to weak internet connectivity and lack of sufficient learning devices, making it difficult for students to engage in online learning. Additionally, the existing video conferencing systems may not fully meet the needs of classroom interactions, assignment submissions, observation and analysis of students' learning behaviors throughout the process, or diverse forms of testing and evaluation. As online education is an outcome of the integration of modern information technology with school education, it should be developed into a normalized educational model. This requires strengthening the top-level design of online education, improving school informatisation and educational platform construction, and achieving a high degree of integration between information technology and education to promote the development of smart schools and smart education.

4.2. Structural Insufficiency of High-Quality Educational Resources

The coverage of high-quality educational resources not only reflects the efficiency of educational resource allocation but is also a key indicator of educational equity. During the pandemic, due to various factors such as network conditions, equipment facilities, and students' learning environments, ensuring educational equity and providing every child with fair and quality education became a global challenge. To address this, the following measures can be implemented to promote the allocation of high-quality educational resources: Increase investment in education and enhance network and equipment facilities. Strengthen the top-level design of educational resource allocation, collaborate between schools, society, and businesses, and establish a sound policy and guarantee system to ensure the implementation of plans and work. Enhance international exchange and resource sharing in education. The National Education Congress has emphasized the need for education opening up to

the outside world, and the formation of a global educational community is underway. This provides a broader platform and opportunities for China's education internationalization. It is necessary to strengthen the interconnection, intercommunication, sharing, and co-construction of Chinese education with the world and share China's high-quality educational achievements and resources globally [16-17].

4.3. Need to Improve Teachers' Information Technology Competence

During the initial phase of the online education battle, some teachers encountered various issues due to their lack of information technology skills and unfamiliarity with online education systems and methods. However, it is even more concerning that many teachers still adhere to traditional teaching concepts and methods, simply moving the classroom online, without understanding or practicing new concepts and models such as flipped classrooms. Teachers' information technology competence directly affects the development and quality of education in the post-pandemic era. To address this, the following measures can be taken to enhance teachers' information technology competence:Include information technology competence in teachers' professional competency evaluations, ensuring that teachers' information technology skills are improved from a systemic level.Schools should establish new models to enhance teachers' information technology application abilities that align with the development needs of the school, based on educational information technology development plans and teachers' training programs. This will stimulate teachers' intrinsic motivation to improve their information technology application capabilities.Establish innovation teams for information technology teaching, providing leading training for key teachers, and exploring interdisciplinary teaching, intelligent education, and other educational innovations to fully utilize the achievements of new technologies such as artificial intelligence to assist teachers in educational innovation for future education development [18].

4.4. Challenges in Education Governance

The pandemic has brought challenges to global governance, especially in global education governance, including how to ensure educational equity, promote education and educational informatisation through new ideas, methods, and solutions, synchronize adjustments and innovations in teaching and learning methods, and cultivate international talents to meet global development needs. To address these challenges, the following suggestions are proposed:Actively promote the global dissemination and practice of new educational ideas. Global education governance involves a variety of stakeholders, including various organizations and private sectors. International organizations play a significant role in global education governance. Therefore, it is essential to strengthen cooperation and partnership with UNESCO and other international organizations, participate in critical global education alliances in various ways, and enhance China's participation and contribution in global education governance.Take the initiative to initiate global education programs and educational informatization plans during the pandemic era and promote the formulation of relevant standards and international conventions. This will enhance China's voice in global education governance.Improve domestic education governance. Enhance pandemic education management, teaching quality control, teacher management, student assessment, and online teaching evaluation systems. Establish connections between subject learning and the real world, using everything as teaching materials, and the world as a classroom. Encourage students to actively think about common problems faced by humanity and take action, using their knowledge to make the world a better place. Cultivate new era talents with an international perspective and a sense of modern citizenship.

5. Conclusion

In the post-pandemic era, as China continues to take center stage on the world platform, the changes in international relations, deepening economic and trade cooperation, expanding cultural

exchanges, and the continuous opening-up of Chinese education have brought enormous opportunities and challenges to its development. The integration of 5G, cloud computing, artificial intelligence, and big data has facilitated the transformation of education into a more intelligent form, with seamless integration between online and offline education. Rapid advancements in machine translation technology have also contributed to the future development of Chinese education's new technological landscape. The globalization of education and the formation of a global educational community will become the new model for China's international education development. The adoption of new technologies and innovations in teaching methods, materials, and approaches, as well as the sharing and customization of cross-border and cross-regional courses and resources, will give rise to a new educational ecosystem in China, characterized by the fusion of physical, virtual, and intelligent learning spaces. We firmly believe that through continuous learning, reflection, and progress, China's education will usher in a new era of significant transformation and development.

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