

# The Development Logic of Undergraduate Online Education in Colleges and Universities in the Post-Epidemic Era, Application Status and Practice Path

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## Abstract

The development of higher education has profound implications for a nation, and in recent years, innovative formats represented by MOOCs (Massive Open Online Courses) have had a transformative impact on higher education. The adoption of online education as an emergency measure during the COVID-19 not only reflects the party and government's emergency response to the crisis but also serves as a significant test for the digital construction of online education in Chinese higher education institutions in recent years. In the post-pandemic era, under the guidance of party and state ideologies and with the support of relevant government policy documents, online education in higher education institutions has achieved commendable results but also encountered real challenges. To better implement the development of online undergraduate education in higher education institutions, it is essential to enhance support through government policy refinement, promote educational reform with higher education institutions as the main body, and encourage multi-dimensional, comprehensive cooperation through societal collaborative participation. This multi-party collaborative involvement will effectively promote high-quality and sustainable development of online undergraduate education in higher education institutions.

**Keywords:** Higher Undergraduate Online Education, Post-epidemic Era, Development Logic, Application Status, Practice Paths

## Introduction

In recent years, online education has significantly transformed higher education globally, manifesting in innovations like MOOCs (Massive Open Online Courses) and flipped classrooms (Paudel, 2020). It not only augments the flexibility and convenience for higher education institutions (Muthuprasad et al., 2021), but also furnishes students with an abundance of resources and personalized learning avenues (Iyer et al., 2022).

Nonetheless, juxtaposed with traditional face-to-face education, online education falls short in fostering social interaction between students and teachers, and necessitates a heightened level of self-discipline and time management amidst overcoming network and technological hurdles (Baber, 2021). Consequently, the integration of online education in higher education has burgeoned into a salient discourse recently (Ouyang et al., 2022), aiding higher education institutions and students in delineating an efficacious learning trajectory.

In the early 2020s, the abrupt onset of the novel coronavirus pneumonia epidemic exerted a profound impact on the production paradigms and social fabric across the globe (Karabag, 2020), with the education sector being no exception. Concurrently, this exigency also unveiled a novel vista for the evolution of online education to a certain extent (Adedoyin & Soykan, 2023). Amidst the COVID-19 epoch, online education garnered widespread attention from various societal strata, and higher education institutions leveraged their extant resources and platforms to orchestrate online educational endeavors, thereby heralding an unprecedented large-scale foray into online education. This initiative further propelled pedagogical metamorphoses in higher education, aligning with the exigencies of the new epoch (Chakraborty et al., 2021).

The post-epidemic epoch presents a myriad of challenges to educational realms, yet concurrently unveils new opportunities, thereby accentuating the necessity and exigency of educational metamorphosis (Feng et al., 2022). In tandem with the advancement of computer network technology and the quest for high-caliber educational resources, the incorporation of online education within tertiary institutions is poised for an escalating proliferation (Zhou, 2021). Hence, this manuscript endeavors to delineate a pragmatic trajectory for the evolution of online education in Chinese undergraduate universities in the post-epidemic epoch. This endeavor is orchestrated through a meticulous examination of the developmental logic of online education within tertiary institutions, coupled with an analysis of the contemporary status of online education applications in elite undergraduate education.

### ***Literature review***

Since the advent of the Action Plan for Revitalization of Education in the 21st Century propounded by the Chinese Ministry of Education (Ministry of Education of China, 1999), the trajectory from the execution of the Modern Distance Education Project, to the edification of high-quality courses, and onto the burgeoning evolution of the MOOC (Massive Open Online Courses) epoch, research pertaining to online education within tertiary institutions has burgeoned into a significant academic trend. The scholarly discourse predominantly orbits around the exploration of online education in colleges and universities, delving into the developmental vein and real-world quandaries, the edification of pedagogical frameworks and ideologies, alongside the transformative opportunities and the pathways towards actualization thereof (Yuan et al., 2014). The research field involves higher education reform and development, digital transformation, educational governance, new constructionism and other related disciplines and industries.

In the realm of research concerning the developmental trajectory and real-world dilemmas of online education in higher education institutions, researchers contextualized within the backdrop of the COVID-19 pandemic, delineated the evolution of online education from modern distance learning to the construction of high-quality courses, and onto the burgeoning development dominated by MOOCs (Wang et al., 2020). Concurrently, by amalgamating the quintessential applications and current developmental status of online education in higher education institutions, they explored the value of online education and

its compatibility with the operational models of higher education institutions, while elucidating the forthcoming opportunities and challenges for online education in higher education institutions. Zhong Binglin and Nan Xiaopeng (2021) have engaged in a macroscopic contemplation on the development of higher education in China in the post-pandemic era, pointing out that under the new developmental paradigm, higher education institutions need to adapt to the advancements in emerging information technology, proactively respond to the shifts in educational governance models, and innovate internationalization models of education to address the challenges posed by "de-globalization". Professor Philip G. Altbach (2020), while envisioning the emerging trends in global higher education development in the post-pandemic era, highlighted that the crisis engendered by the novel coronavirus is substantial and adverse, exacerbating the educational disparities and inequities in educational development among learners, higher education institutions, and nations worldwide.

In the realm of research related to the pedagogical framework and ideological construction of online education in higher education institutions, in conjunction with the current three major "cognitive thresholds" within the educational sector, the researcher actively explores the construction of a futuristic new educational and teaching system through the alliance of online education enterprises, schools, and educational administrative departments (Wang, 2020). Chen Wei (2020), initiating from the perspective of ideological construction, analyzed the significance and pathways of mainstream ideological construction in online education within higher education institutions in the new era. He proposed adhering to the principles of mainstream ideological construction, actively nurturing and practicing socialist core values, and advancing holistic education encompassing all members, throughout the entire process, and across all dimensions. Wang Chuanyi (2020) and colleagues, utilizing Tsinghua University as a case study and approaching from the perspectives of multi-stream theory and sociological institutionalism, elucidated how the combined effects of competitive isomorphism and mimetic isomorphism have facilitated the global diffusion of online classroom instruction, manifesting convergent characteristics.

In the realm of research concerning the transformative opportunities and implementation pathways of online education in higher education institutions, Wu Di and colleagues, through remote interviews and assessments of information literacy among teachers and students in China, proposed strategies for enhancing information literacy for large-scale, long-term online teaching (Wu et al., 2020). These strategies encompass the construction of online teaching support service systems, conducting online teacher training, innovating online teaching models, and promoting collaboration between home and school, thereby co-creating an external support environment. Yang Bin and Huang Cheng (2020) delve into the paradigm shift of online education in the era of Internet Education 3.0, facilitating a breakthrough from the shackles of solely emphasizing knowledge transmission. They commence the exploration of methodological pathways to achieve more fundamental educational objectives and philosophies such as capability enhancement, community construction, identity recognition, and value shaping. Li Minhui (2022) and colleagues, in light of challenges such as educational resource imbalances and a lack of digital capabilities among teachers encountered during the digital transformation of higher education in developing countries, explore the diversified pathways for digital transformation in higher education in developing countries in the post-pandemic era.

In summary, since the onset of the COVID-19 pandemic, the development of online education in higher education institutions has burgeoned into a focal hotbed of extensive scholarly attention. Scholars, intertwining the developmental trends and practical applications of online education in higher education institutions during the pandemic, have systematically elucidated various facets including the developmental trajectory and real-world dilemmas, pedagogical framework and ideological construction, as well as transformative opportunities and implementation pathways of online education.

Despite some accomplishments in the scholarly investigation of online education development within higher education institutions, there remain some limitations: firstly, although there is a phased delineation in the research on the development of online education in higher education institutions, existing studies predominantly focus on the achievements and deficiencies of online education during the pandemic, with scant attention to the post-pandemic era; secondly, current research mainly centers on the developmental trajectory and real-world challenges of online education, lacking a thorough analysis of the underlying logic pertaining to its development; thirdly, the 20th National Congress of the Communist Party has ushered in a new journey towards the second centenary goal, emphasizing "providing satisfactory education for the people," with a focus on constructing a high-quality education system, thus there is an urgent need to enrich and refine the practical pathways of policy implementation. Based on these, this article attempts to unravel the developmental logic of online education in undergraduate institutions, while amalgamating the current application and developmental status of online education in elite undergraduate education, aiming to explore the practical pathways for the development of online education in Chinese undergraduate institutions in the post-pandemic era.

### ***Theoretical Basis for the Development of Online Education in Higher Education***

#### ***Student-Centered Theory***

The "Student-Centered Theory," represented by Rousseau, Dewey, and others, initially views the development of students as a natural process, believing that teachers cannot dominate this process but are merely "servants of nature." The role of teachers lies only in guiding students' learning interests and satisfying their individual needs, rather than directly intervening in students' learning (Lee & Hannafin, 2016). The educational process should not be conducted directly by teachers, but rather, students should be allowed to experience or undergo it themselves.

Therefore, online education in higher education institutions should emphasize a student-centered learning approach, developing courses and implementing teaching specifically aimed at students acquiring knowledge and skills. It is particularly important to ensure proper assessment of students' learning outcomes. Utilizing multimedia and internet technologies for design will enhance the learning experience for students. Teachers should actively play a guiding role, acting as learning coaches to assist students in completing their learning from both psychological and knowledge transmission perspectives.

#### ***Multiple Intelligences Theory (MI Theory)***

The theory of Multiple Intelligences was proposed by American educator and psychologist Dr. Howard Gardner, presenting a novel structure of human intelligence. This theory posits that human thinking and cognition are multifaceted. It advocates for a flexible, multi-factorial view of intelligence, a comprehensive and diversified view of talent, a positive and egalitarian view

of students, a personalized teaching perspective that emphasizes teaching according to individual differences, an assessment perspective that promotes development through evaluation, and a future school perspective that adapts to the evolving trends in talent cultivation (Hasanuddin, 2022).

During the pandemic prevention period, higher education institutions should leverage various online teaching tool platforms to design teaching activities driven by problem-solving, addressing the issue of scarce learning resources during online learning. Additionally, online platforms effectively establish cloud-based shared spaces, thereby creating realistic scenarios for online teaching. Through the design of reasonable assessment methods, and by employing multi-channel, multi-dimensional, and multi-situational evaluation approaches, students are provided with multifaceted guidance, with assessments promoting the comprehensive self-growth of students.

### *Constructivist Education Theory*

The Constructivist learning theory, initially proposed by Swiss educationalist Jean Piaget, posits that the learning environment is composed of four major elements: "scenario," "collaboration," "conversation," and "meaning construction." This theory aligns with the developmental logic and direction of online education, effectively and fully unleashing creativity in learning, and truly achieving the objectives of construction (Deepa et al., 2022).

Therefore, online education in higher education institutions should make full and effective use of online learning resources, and fully leverage the convenience of internet cloud services, especially with the recent applications of artificial intelligence and virtual reality in the education sector. It's imperative to engage in a broader cooperative and interactive learning model, guiding students towards exploratory learning.

### ***The Logic of Online Education in Higher Education in the Post-Epidemic Era***

#### *Ideological Guidelines of the Communist Party of China on Online Education in Higher Education*

Since the official proposition of the strategy of reinvigorating the country through science and education by the Central Committee of the Communist Party in 1995, the significance of education and technological development is self-evident. The guidance provided by the Party and the state in thought and policy has also propelled the growth and development of online education. The result of educational equity is to ensure that the fruits of these developments are enjoyed by the masses. A crucial foundation for social equity is educational equity, striving to enable everyone to equally exercise the right to education, and acquire the capability to develop oneself, contribute to society, and benefit the populace (Cao & He, 2016).

The report of the 20th National Congress of the Communist Party orchestrated a comprehensive arrangement and overall deployment concerning the "triad" of education, science, and talent, elucidating the essence and mission of the strategy of reinvigorating the country through science and education in the new phase. Concurrently, China has established the largest scale education system globally, encompassing various stages including preschool, basic education, higher education, and adult education. The advancement of education is indissolubly linked with policy guidance and is intimately related to socio-economic development. Ensuring continuous financial investment in the education sector and economic assurance for educational research is imperative. The Party and the state government need

to ensure the implementation of educational financial allocations and relevant financial subsidies for higher education institutions.

More significantly, for education to play an increasingly pivotal role in social development, the integration of public resources is indispensable. Particularly, the enhancement of online education platforms in higher education institutions necessitates the concerted efforts of the government, universities, and social enterprises. Collaborations between academia and industry will fully leverage the advantages of online services in higher education institutions, dismantle the substantial barrier between universities and society, lower the cost and threshold of accessing quality education, and enable an increasing number of individuals to reap the benefits of knowledge and education.

Educational equity is not only a crucial aspect of social fairness but also a significant driving force. Over the 70 years since the founding of the People's Republic of China, the Party and government have advocated for "opening education to workers and peasants" from the outset. Being the most populous country in the world, China encounters numerous obstacles in achieving educational equity. However, under the guidance of the Party and government, the country has thus far successfully implemented nine years of free compulsory education, which is nothing short of a miracle on a global scale.

The high-quality development of basic education has exerted a strong impetus on the advancement of higher education. Data indicates that by 2018, compulsory education in China had essentially achieved full coverage, with a consolidation rate reaching 94.2% (Bai & Xu, 2019). Although the development of higher education in China commenced later compared to Western countries, encountering substantial resistance and challenges in the process, in recent years, under the guidance of the Party and state, Chinese higher education is on the verge of entering a stage of popularization. This marks a milestone significant for the development of higher education in China, with the average years of higher education per capita escalating from 1.6 years at the founding of the People's Republic of China to 10.6 years in 2018 (Wu, 2022).

Since the onset of the new century, the emphasis on educational equity has been particularly pronounced in higher education institutions. With the proliferation of the internet and the robust development of mobile internet technology, online education has finally ushered in a new breakthrough, actualizing educational equity. Serving as a mode of learning mediated by the internet, online education has witnessed rapid growth in recent years. Even in remote rural areas, students now have the opportunity to access courses taught by renowned instructors from prestigious institutions through network sharing.

#### *Analysis and Interpretation of Government Policy Documents on Online Education*

In December 1998, the Ministry of Education issued the "Action Plan for Revitalizing Education for the 21st Century," advocating the implementation of the "Modern Distance Education Project," and highlighted modern distance education as a strategic measure to provide quality education amidst the conditions of educational resource scarcity in China (Zhou, 1999). However, at the turn of the century, due to the nascent stages of computer hardware and Internet technology, which were in the era of Internet Web1.0, China's information infrastructure was lagging, making the implementation of the "Modern Distance Education Project" exceedingly challenging. During the Web 2.0 era, online education became more enriched in form. It was not only possible for teachers to deliver lectures to students via computer networks and hardware, but it also enabled personalized learning for students, truly allowing students to take charge of their own learning.



The development during the initial decade of this century has further narrowed the gap between online education in Chinese higher education institutions and those in educationally advanced countries, aligning China smoothly with the global trend and momentum of MOOCs (Massive Open Online Courses) development. In 2011, the Ministry of Education released the "Implementation Opinions on the Construction of National Quality Open Courses," breaking the rigid model of seclusion and non-circulation of quality courses in higher education institutions, thereby fully entering the phase of national-level quality open course construction. During this period, 992 video open courses and 2,882 quality resource-sharing courses took the lead in breaking the scenario of scarce and low-quality resources in China's online quality courses (Qin, 2017).

Leading domestic universities, represented by Peking University, have played a commendable pioneering and exemplary role. Starting from 2012, which is regarded as the inaugural year of MOOCs in China, these universities have progressively launched MOOCs on internationally renowned platforms, filling the void of Chinese higher education institutions on international exchange platforms (Wang & Feng, 2017). With the rapid global development of MOOCs, the nationwide endeavor to construct high-quality online education course platforms has become an inevitable trend. In 2015, the Ministry of Education officially proposed to enhance the construction and application of online course platforms across the nation, designating higher education institutions as the primary entities for construction, with the support of national and local governments as a solid guarantee, and the collaborative participation of societal forces as a driving factor, all of which are conducive to the reform and development of online education platforms in China. In 2016, the Online Education Research Center of the Ministry of Education released the "2016 China MOOC Industry White Paper."

The significant policy document "Educational Informatization 2.0 Action Plan" was officially released in April 2018, marking China's entry into a new era of educational informatization (Zheng, 2018). Having undergone development in the previous period, China has garnered valuable practical experience in the field of educational informatization, while also identifying many shortcomings. The development of education in this new era, along with the construction of a strong educational nation, necessitates innovation-driven momentum.

In October 2019, the Ministry of Education set higher standards for the construction of first-class undergraduate courses, indicating a further emphasis on undergraduate education in higher education institutions. The national-level quality online course system should focus on the development, refinement, and innovation of courses at the undergraduate level, enriching the content while also making the structure more rational (Liu et al., 2022). The future development of online education in higher institutions has become more clear, with a focus on closely integrating online and offline resources, and promoting teaching and course reforms in a blended direction. In less than a year, data shows that the number of MOOCs launched in China has exceeded 34,000, with a total of 540 million enrollments (Wu & Yang, 2022).

With the Ministry of Education officially improving the construction of the online education platform system and launching the National Higher Education Smart Education Platform, the development of MOOCs in China has been promoted in all aspects. By the end of 2022, the number of MOOCs on various online education platforms exceeded 61,900, with the number of registered users on the platforms reaching 402 million. China ranks first in the world in terms of the number of MOOCs and the number of learners, achieving a leapfrog over developed countries in both quantity and quality (He, 2007).

The enduring impact of the COVID-19 pandemic did not slow down the development of informatization in China's higher education, but rather, it reinforced the determination to construct digital campuses in Chinese universities. In March 2021, the Ministry of Education set forth construction standards for digital campuses in higher education institutions, promoting a deep integration of information technology with education and teaching. This has significant guiding significance for the development of higher education.

During the COVID-19 pandemic, the numerous and cluttered online education platforms in higher education institutions were unable to unify, which to some extent inhibited the development of smart education. Therefore, the national smart education platform was significantly launched on March 28, 2022. This marks the establishment of China's epoch-making first online education development platform for higher education, not only perfecting the online education system at various educational stages in China, integrating various high-quality resources, and filling the void of a national-level platform, but also playing a significant role in the informatization construction of China's higher education.

### ***The Status of the Use of Online Education for Undergraduate Students in the Post-Epidemic Era***

#### *Morphological shifts and innovations in Higher Education*

Compared to traditional classroom instruction which often involves a didactic teaching approach, the efficient integration of information technology and multimedia technology in online teaching within higher education institutions has brought about substantial changes in the elements of higher education and their interrelationships. The roles of entities such as educators, learners, and educational intermediaries have undergone significant changes across various dimensions.

The venue for teaching is no longer confined to the traditional university classrooms. With the development of online education in higher institutions, the teaching scenario has become borderless. There has been a fundamental transformation in the role of educational intermediaries, transitioning from traditional classroom settings to virtual spaces on the Internet. In traditional didactic classroom teaching, teachers and students interact face-to-face within the same teaching environment, with the teaching activities primarily led by the instructors. However, in the online education model, the communication between teachers and students is no longer conducted face-to-face. Instead, it's facilitated remotely through computer internet technology and multimedia technology, utilizing hardware like computers for interactive exchanges.

The shift to online education has not only expanded the scope and accessibility of educational resources but also redefined the dynamics between educators and learners. The traditional hierarchy where educators solely dictate the learning process has been reshaped to accommodate more collaborative and interactive learning experiences. Online platforms enable a variety of teaching methods, including synchronous and asynchronous learning, interactive discussions, and peer-to-peer collaborations, which can cater to diverse learning preferences and needs. Moreover, the online education model allows for a more learner-centered approach, where students can have more control over their learning pace, content, and assessment. The flexibility and adaptability of online education can potentially foster a more personalized and engaging learning experience, aligning with modern pedagogical theories like constructivism and learner-centered education.



Furthermore, the integration of advanced technologies such as Artificial Intelligence (AI) and Virtual Reality (VR) in online education can further enhance the teaching and learning experience. These technologies can provide immersive and interactive learning environments, real-time feedback, and personalized learning paths, which can significantly contribute to the effectiveness and quality of online education. In summary, the evolution from traditional classroom teaching to online education in higher institutions has significantly altered the teaching and learning landscape, promoting more flexible, interactive, and learner-centered educational experiences.

Having undergone the trials and tribulations of the pandemic, numerous facets of higher education are undergoing transformations and innovations, with integration becoming a significant characteristic of higher education institutions and classrooms. The fusion in online higher education manifests through multiple dimensions including teaching models, educational management, and learning environments. Under the auspices and impact of technology, blended learning has been comprehensively adopted in the educational practices of Chinese higher education institutions in the post-pandemic era. By presenting a synchronous format of online and offline classrooms, it transcends the boundaries of time and space, effectively integrating in-class and out-of-class learning experiences, thereby enhancing the overall quality of teaching in higher education.

The integration within higher education classrooms has another layer of impact, as it no longer remains confined to a single institution. Instead, through the utilization of internet and multimedia technologies, it achieves cross-regional and even cross-border integration. In China, there exists a reality of imbalanced educational resource development, with higher education institutions in the western regions being at a disadvantage in terms of teacher resources and basic infrastructure. Since the introduction of the "MOOCs Go West" policy, there has been a significant improvement in the phenomenon of lagging higher education development in the central and western regions of China, which is conducive to the advancement of educational informatization in higher education institutions in the western regions. As of now, blended learning has become an important development trend in the global higher education domain.

#### *The Construction of Online Education Platforms in Higher Education Continues to Improve*

Achieving equitable and quality education is the fundamental pursuit of modern education. Theoretically, the vigorous promotion of online education, underpinned by internet and artificial intelligence technologies, can realize educational balance and foster equitable, quality education. However, due to the disparities in the construction of informational environments across regions, and the varying degrees of support for online education from societies and schools, issues of regional imbalance and low application efficacy in the development of educational informatization are increasingly evident. Particularly, the growing "digital education divide" between the central-western regions and the eastern coastal regions is impacting the balanced development of education.

During the pandemic, due to the lack of online educational resources, higher education institutions primarily adopted live streaming modes for online teaching. In the long-term perspective of online education development, the recorded mode, which allows for post-production and editing, significantly surpasses the live streaming mode in terms of teaching quality, and will be the predominant method for online education in the future. This poses higher demands for universities to establish extensive online educational resource libraries, which not only requires substantial investments in human, financial, and material resources, but also leads to issues of redundant and low-quality construction among different

institutions. Therefore, the Ministry of Education has thoroughly implemented the Party's explicit requirement of "promoting educational digitalization," executed the strategic action deployment of educational digitalization, and led the modernization of Chinese-style higher education through digitalization and intelligentization in higher education, providing support for the high-quality development of higher education, and achieving remarkable accomplishments.

During the COVID-19 pandemic, the unprecedented large-scale practice of online teaching not only timely resolved the teaching crisis but also strongly propelled the reform of informatization and modernization in Chinese higher education. In March 2022, the National Higher Education Smart Education Platform was launched, addressing many shortcomings experienced during the pandemic such as scattered and disorganized online education platforms, single-functionality, inadequate technical maintenance, and insufficient course resources, marking an important milestone in the informatization construction of Chinese higher education. Additionally, various sectors of society actively integrated resources for the construction and development of online platforms, especially initiating extensive collaborations between schools and enterprises. With the support of high-quality technical enterprises, various practical online platforms have served as excellent supplements to the development of online education in higher education institutions.

The unprecedented ordeal of the COVID-19 pandemic has ushered in significant transformations in the pedagogical models of higher education institutions. Across the nation, these institutions are actively exploring and advancing a new paradigm of blended learning, aligning with the evolving demands of the era and seeking a proactive transition in their developmental trajectory. The forthcoming *modus operandi* for higher education necessitates a seamless integration of online and offline educational realms, an extensive popularization of digital learning spaces, a reconfiguration of instructional frameworks, an optimization of educational processes, and an enhancement of interactive pedagogy. Leveraging the advantages of online educational platforms, there's a concerted effort to harness modern informational technologies such as Artificial Intelligence and 5G to bolster the entire spectrum of online education.

The developmental transition in higher education, from central to local levels, has been continuously implemented and, through proactive reforms and practices, an effective pathway for the online development of Chinese higher education institutions has been explored. Shanghai, a significant city for China's economic development, has been at the forefront of educational reform and transformation. In 2021, the Shanghai Municipal Education Commission proposed a digital transformation plan for education, standardizing the requirements for digital transformation in education. Shanghai Jiao Tong University (SJTU) emphasizes teaching computational thinking to students of all majors during the undergraduate phase. By implementing cross-disciplinary training models in cloud computing, high-performance computing, and AI computing, the aim is to nurture undergraduates into composite talents with capabilities in both academic research and engineering applications. Particularly notable is the self-developed "Jiao Wo Suan" platform by SJTU, which serves as a quintessential case of digital transformation, shifting digitalization from traditional empowerment to core driving force. Since its inception in 2013, the platform has served 20+ primary disciplines, contributed to 400+ high-level papers, 45 papers in CNS and its sub-journals, and 600+ research projects, providing robust storage capabilities for research teams and excellent code-level service capabilities for computing teams.

*Higher Education Institutions Teachers Actively Participate but Information Technology Literacy Needs to be Improved*

Most faculty members in Chinese higher education institutions lack practical experience with various online education platforms, with only a minority having previously recorded micro-lectures or MOOCs, and lacking experience in front of cameras and screens. This leads to suboptimal user experience in actual teaching applications on educational platforms. In traditional educational models, many teachers have persisted with teacher-centered teaching methods over the years, viewing teaching as a transfer of professional knowledge from teacher to student. Additionally, the lack of basic computer knowledge among teachers often requires more time for them to adapt. When encountering unexpected situations in the classroom due to technical or network issues, they are unable to address and resolve the issues promptly, which adversely affects the classroom experience in online education at higher education institutions.

The educational sector has entered the era of Informationization 2.0, witnessing significant transformations in teaching philosophies, environments, and models. Enhancing teachers' informational literacy has become a crucial part of educational reform. In the post-pandemic era, as university teachers deepen their understanding of future educational informationization, they are continuously improving their informational literacy and digital intelligence through participation in various online teaching skill training organized by universities, guidance on various functions through different online teaching platforms, and the online teaching experience accumulated over recent years. During the pandemic, the Ministry of Education actively carried out the informatization construction of the teaching staff, piloting projects in multiple units, which received positive responses from higher education institutions and university teachers, achieving remarkable results. By creating intelligent educational environments, developing smart laboratories for teacher development, and providing training to enhance the digital intelligence of university teachers, new models that suit the needs of the times and effectively promote the construction of university teaching staff have been explored.

***Practical Paths to Online Undergraduate Education in Colleges and Universities in the Post-Epidemic Era***

Since the proposition of the strategy of rejuvenating the country through science and education, the Party and the state have always been committed to applying technological advancements to enhance educational quality, fundamentally reflecting the continuous focus on the integration of technology and education. From the implementation of modern distance education projects to the construction of high-quality courses, and onto the thriving development of Massive Open Online Courses (MOOCs) era, although higher education online learning has achieved certain results, new challenges have emerged post the rigorous test of the COVID-19 pandemic. This indicates that the journey of online education development in higher institutions is still long and arduous, requiring concerted efforts from all parties involved. Based on a thorough review of online education policies issued from 1995 to the present, a deep analysis of the measures mentioned in these documents, and summarization in conjunction with the theoretical basis and the developmental achievements and real challenges displayed by the current state of development, it is deduced that the advancement of online education in higher institutions mainly relies on the collaborative efforts across government, universities, and societal levels. Therefore, based on the summarization and reflection of the experiences in online education development in higher institutions during

the COVID-19 pandemic, it is essential to persist in government-led coordinated promotion of policy implementation, enrichment and perfection of various platforms, with robust government support, universities as the main bodies, and active societal participation, to foster high-quality and sustainable development of online education in higher institutions.

#### *Government to Improve Policies and Increase Support for Support*

Firstly, the government should establish specialized departments to coordinate the development of online education in higher institutions, and gradually refine various policy documents. Particularly, it is crucial to adhere to the guidance of the thoughts presented in the Party's Twentieth Report, orchestrating a holistic arrangement and deployment for education, technology, and talent, which are considered as a "trinity". This is essential for further clarifying the essence and mission of the strategy of rejuvenating the country through science and education in the new phase. Secondly, the development of high-quality online educational resources is imperative, with a special emphasis on the connectivity, interoperability, and openness of existing resource platforms. This will perfect the national digital educational resources public service system, further narrowing the regional disparities in education. The National Smart Education Platform was significantly launched on March 28, 2022, marking the establishment of China's epoch-making first online education development platform for higher education. This not only completes the online education system across various educational stages in China, integrating a variety of high-quality resources and filling the void of a national-level platform, but also plays a significant role in the informatization construction of higher education in China. Lastly, it is essential to increase the investment in digital hardware for universities, teaching support service systems, and talent team construction, continuously deepening the integration of online and offline education in higher institutions.

#### *Institutions of Higher Education as the Subject Promoting Changes in the Way Education is Delivered*

Firstly, higher education institutions should actively respond to the government's call, strengthen institutional construction, and actively explore adjustments in internal governance structures and innovations in management system mechanisms within higher education schools. Utilizing online management platforms can facilitate efficient collaborative management across various functional departments. Secondly, institutions should actively guide university teachers to transform their teaching concepts in the new era. By providing a variety of training programs that combine theory with practice for university teachers, and fully leveraging information technology and multimedia technology, they can meet the requirements of personalized and diversified higher education teaching. This approach comprehensively enhances the digital literacy of university teachers and their ability to integrate online and offline teaching. Lastly, higher education institutions should also inject continuous vitality into the construction and development of online education platforms. By developing and designing high-quality courses to perfect the online course system, initiating explorations into online education degree programs, and improving the compatibility of university operation models, they can significantly contribute to the advancement of online education.

*Synergistic Social Participation for Multidimensional and All-encompassing Cooperation*

Firstly, it is essential to enhance the promotion of online education in higher education institutions and actively advocate for the application of online education within the higher education system in society. Utilizing modern information technology to improve the capability of serving higher education governance is conducive to achieving inclusivity and open sharing of information resources, thereby promoting high-quality development in higher education. Secondly, establishing a mechanism for societal participation in governing higher education is beneficial. It fully leverages the supervisory and advisory roles of third-party societal institutions, professional organizations, and social enterprises. Lastly, making full use of the technical advantages of social enterprises in fields such as information technology, while extensively engaging in school-enterprise cooperation, can increase societal enthusiasm and investment intensity towards online education in higher education institutions. This approach meets the practical needs of higher education teaching in the post-pandemic era.

**Conclusion**

This research elucidates a comprehensive theoretical framework delineating the developmental logic of undergraduate online education in post-pandemic higher education institutions. Through an extensive review and critical analysis of policies governing online education since 1995, juxtaposed with a meticulous examination of the current successes and challenges in this domain, the study highlights the indispensability of synergistic collaborations among government bodies, academic institutions, and societal entities in propelling the evolution of online higher education. Theoretically, this inquiry contributes a nuanced analytical lens, foregrounding pivotal aspects such as policy architecture, the caliber and accessibility of educational resources, and the seamless amalgamation of online and offline pedagogical approaches.

From a pragmatic standpoint, this research articulates a cogent trajectory for the elevation of online educational practices within higher education institutions. It delineates the government's strategic role in orchestrating the development of online education, underscores the transformative agency of universities in redefining educational delivery, and accentuates the multifaceted engagement of societal participants in fostering a collaborative educational ecosystem. Additionally, the study underscores the imperative of leveraging contemporary information technologies to augment the governance capabilities in higher education, while advocating for the formulation of societal mechanisms adept at addressing the exigencies of higher education pedagogy in a post-pandemic context.

In essence, this scholarly endeavor not only advances the discourse on the digitization of higher education but also offers invaluable insights for policy formulation and pedagogical innovation, especially against the backdrop of global educational shifts and emerging challenges.

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