

Digital Transformation to Advance High-Quality Development of Higher Education

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Abstract: *Digitization will bring unlimited potential and a new vision for education, and the digitization of education is a historical process and an inevitable trend of education reform. This paper first addresses the connotation, foundation, core of education digital transformation and the typical stages of development. Then, extracts of practices launched in China to cope with the demand in digital transformation from four aspects are given: platform construction, curriculum supply, teaching methods and evaluation methods. Finally, the exploration and practice carried out by three universities are presented where the author has served as president, namely Central China Normal University, Xidian University and Wuhan University of Technology. The purpose is to summarize development patterns and characteristics to provide reference for the subsequent comprehensive transformation of higher education digitalization. Overall, digital transformation can promote paradigmatic changes in higher education research and practice, build a high-quality higher education system, and promote human-centered development caring for comprehensive, holistic and personalized needs.*

Keywords: digital transformation, higher education

At present, the world is going through momentous changes unseen in a century, with digital technology at its core. The rapid development of artificial intelligence and other innovative technologies has greatly transformed the modes of production and ways of life. Furthermore, digital technology is reconstructing the ways of living, learning and thinking, and changing the relationship between humans and the world. The digital economy, represented by industrial digitization and digital industrialization, has become a breakthrough point for industrial upgrading. As a new engine to drive economic growth, new requirements are put forward for talent training, with more emphasis laid on key competencies and core literacy (Yang, Wu, & Zheng, 2018) and the cultivation of “8C” skills, including Creativity, Computational Thinking, Critical Thinking, Communication, Cross-Domain Profession, Collaboration, Complex Problem Solving, and Carbon Neutrality. The digital transformation of education is an inevitable choice to meet the challenges of talent cultivation in the new era. There is a concomitant relationship between higher education and socioeconomic development, and the arrival of the digital economy is bound to promote the reform of higher education. With the promotion of a digital economy, the digital transformation of education, as a historical process, has become an inevitable trend of education reform, calling for exploration of its maturity and challenges (Marks et al., 2020). Higher education is to cultivate people needed for tomorrow, and digital higher education, as the essential requirement of the development of the digital economy, has become an important strategy.

The Connotative Development of Digital Transformation

The key to the digitalization of education lies in the “transformation.” Education process

re-engineering, structural reorganization, and cultural reconstruction will be gradually achieved through the innovation of education methods, schooling models, management systems, and guarantee mechanisms (Yang, 2022). A data-driven, human-technology integrated, appropriate, open, equitable, and sustainable lifelong education system that provides a more comprehensive learning experience to all learners will be established. The foundation of digital education transformation is to obtain educational data through scenario perception to promote effective and collaborative innovation. The core is to achieve effective inter-connectivity and inter-operability of platforms and systems, and to meet the goal of systematic transformation of higher education in the digital age and the construction of a new ecological system.

The digital development of education has gone through three typical phases: the conversion phase, the transformation phase, and the comprehensive transformation phase. **The conversion phase** is the process of integrating digital technology into all elements of the education system. The rapid improvement in technology accelerates the construction and upgrading of infrastructures, such as broadband networks, teaching facilities, public service platforms, and innovative applications, expanding the coverage of digital construction on all university campuses. **The transformation phase** is realizing the self-transformation, upgrading, structural reorganization, and process re-engineering of education through the empowerment of technology. Information technologies such as cloud computing, big data, the Internet of Things, 5G and mobile communication, block-chain, AI, and the metaverse bring new opportunities for higher education reform and development. Against the historical backdrop of this new

information era, the teaching and talent cultivation concepts, teaching resources construction and application methods, teaching and learning patterns, knowledge sharing and dissemination, assessment and evaluation approaches of higher education are all undergoing new changes, and the form of higher education is undergoing a new change.

The comprehensive transformation phase, on an even higher level, is an all-factor, all-business, all-process, and all-field deep change, ultimately building a new ecology of higher education. The future world would witness the realization of human-machine collaborative teaching, the construction of educational metaverse scenarios, and educational development will be steered towards a more intelligent, more human-centered, and more sustainable one.

Digital transformation can help to enhance the quality of higher education, make full use of the same resources to run better and more equitable universities, provide high-quality higher education resources for more students and the public, and create conditions for practicing quality connotative development. The international community attaches great importance to the digital development of higher education. The Third World Congress on Higher Education, held by UNESCO in Barcelona in 2022, proposed six areas of change in the world's higher education, charting the course for the sustainable development of higher education in the world, which is highly in line with the vision of digital development of education.

China's digital transformation strategies and actions

In response to the demand for digital transformation, China has continuously enhanced its strategic understanding. It has consistently strengthened top-level design

and carried out a series of practical actions in digital strategic planning. These involve identifying key areas of education strategy and various special efforts in higher education to boost the digital transformation of higher education.

In terms of policy planning, China attaches great importance to the digitalization of education, and actively issues relevant policies to coordinate the overall development of the digitalization of higher education. In 2012, China has already released the *Ten-Year Development Plan for ICT in Education (2011-2020)*, which proposed to drive the modernization of education with ICT in education and determine the strategic position of ICT in education to support and lead the modernization of education. This development plan has far-reaching significance and broad influence. On the basis of it, China has successively released the *Action Plan for Education Informatization 2.0* and the *2035 Modernization of China's Education* and other important guiding documents, further defining the future development direction while progressing with the work at all stages. For example, the Ministry of Education pointed out key work points of 2022 that the strategic action of digital education should be implemented, which set the course for the development of education in the digital era. The report of the 20th National Congress of the Communist Party of China identified that education, science and technology, and talents are the fundamental and strategic support for building a socialist modern country in an all-round way. It proposed to speed up the "promotion of digital education," comprehensively improve the ability to nurture talent at home, and strive to cultivate top innovative talents.

In terms of platform construction, The Smart Education of China platform has been built, pooling high-quality resources

and enhancing the supply of high-quality education resources (Yang, 2022). The Smart Education of China was officially launched in March 2022. The platform takes basic education, vocational education, and higher education as the “three horizontal,” and moral education, intellectual education, and physical, artistic, and labor education as the “three longitudinal,” to build a resource framework that integrates various education and teaching elements in accordance with their schooling stages. As of September 2022, the portal and its four platforms have attracted over 4 billion viewers, and the total number of visitors has reached 600 million. Since the Ministry of Education launched the pilot work of the national smart education platform in April 2022, 15 provincial smart education platforms in Beijing, Shanghai, and other provinces have been successfully connected to the national smart education portal. At the same time, the active participation of the pilot schools has played an important role in optimizing the resource stock and expanding the resource increment of the national smart education platform.

In terms of curriculum supply, China vigorously promotes the “building, sharing, and using” of online open courses, and carries out structural reform on the supply side of higher education courses. With the vigorous development of Massive Open Online Courses (MOOCs), by the end of August 2022, over 61,900 open online courses were launched in China, with 402 million registered users and 979 million learners. An ally organization represented by the China University MOOCs Alliance and the World MOOCs Alliance has formed, aiming at promoting the development of MOOCs. During the epidemic, China implemented the “MOOCs Going Overseas” program. At present, nearly 1, 000 online courses in 14 languages have been opened, with a cumulative number of learners reaching

670,000. The program “MOOCs Going Western China” has helped the western region carry out 3.2724 million blended teaching sessions, and 376 million students participated in it.

In terms of teaching methods, the epidemic has accelerated the reforms of online education, thus online-and-offline blended teaching has become the “New Normal.” Teacher guidance and assistance have a positive impact on student engagement, and we need to further explore and enrich the role of teachers in the blended teaching model (Ma, Han, Yang, & Cheng, 2015). For people’s production and life, the epidemic was a menace to society, but for the development of online teaching, the epidemic can be deemed as the catalyst. Under the impact of the epidemic, the immediate transition from offline to online teaching has accelerated the process of educational digitization. During this period, a new form of online teaching has taken root, including MOOCs teaching, recorded lecturing, live-streaming teaching, and remote guidance. Based on the survey of tens of thousands of teachers and students, the Steering Committee for the Innovation of Teaching Informatization and Teaching Methods in Colleges and Universities of the Ministry of Education found that the proportion of MOOCs teaching and live-streaming teaching reached 37%, and the proportion of recorded lecturing accounted for about 20% during the epidemic. In addition, new teaching and learning modes and approaches, such as intelligent guidance, online flipped classroom, SPOC, and human-computer integration, have continuously advanced promoting further development of university teaching towards differentiated teaching and precise learning.

In terms of evaluation methods, data-driven evaluation innovation is carried out to realize a more diversified process evaluation

of teaching. With the support of big data, teaching evaluation methods have been innovated, with machine learning algorithms to assess students' online behaviors and predict their learning performance (Luo, Han, & Zhang, 2022). Through the detection and collection of students' data, learning process, interactive data, achievement data, students' learning habits, and other data in the teaching and learning process, a process-based, instant, and accurate learning evaluation is developed to reflect students' overall performance. It also forms a comprehensive student portrait and learning analysis, and provides support for learning outcome diagnosis, comprehensive evaluation, and academic planning.

In the aspect of quality control, the quality of online curriculum education resources is improved by controlling and managing curriculum resources through technology intelligence (Yang, 2020). From the perspective of the quality of various course resources such as course videos and course documents, the evaluation objectives and standards are clarified. Through the mining and analysis of video image, audio, and text data, the quality of online courses is analyzed using an automatic analysis system. Finally, the analysis results are presented visually, providing a basis for improving the effectiveness of online courses.

In terms of teacher development, training programs on the application of new technologies such as artificial intelligence are launched to help build an intelligent teaching force. To promote the deep integration of new technologies with the construction of the teaching team, and implement the construction of a high-quality education system, China has intensified efforts in the pilot work of artificial intelligence to boost the teaching team development during the "Fourteenth Five Year Plan" period. At present, two groups of universities have been selected, and

positive results have been achieved. With the continuous improvements in the application of artificial intelligence, education gradually turns from "learning from AI" to "learning by AI" to "learning together with AI." AI empowers teaching and puts forward higher requirements for teachers' abilities. Knowing how to make use of AI to improve teaching quality is an important development direction.

In terms of scientific research, the new teaching laws under the circumstances of human-computer cooperation have gradually become the focus of research in the field of education. The reform of digital transformation of higher education is not just about pedagogical changes, but educational scientific research is also transformed by the infiltration of digitalization (Rampelt, Orr, & Knoth, 2021). Knowing how to analyze the teaching scenes, adapt the educational resources, optimize the teaching process, and analyze the learning cognitive mechanism under the human-computer collaborative environment, so that the teaching scenes can be understood, the resources can be adapted, and the process can be regulated. In this process, the promotion and influence mechanism of technology on learning is clarified as well as revealing the laws of learning in the new teaching environment.

In terms of the management mechanism, it has gradually diverted to a flat data-centered paradigm. Data connectivity makes the organizational management structure more flexible, and the management information of the university can be quickly and directly transmitted to every faculty and student. The empowerment of intelligent technology has changed the organizational structure of the management mechanism, reduced the organizational levels, expanded the management scope, and improved the

efficiency, effect, and benefits.

Exploration and Practice of Three Typical Universities

Universities are the strategic highland of talent cultivation, profoundly implementing the policies and measures of higher education digital transformation and accelerating the development of higher education digital transformation. The author has served as the president of three respective universities in China and has actively explored and practiced promoting digital development at the university level. Among them, Central China Normal University has been a pioneer in recognizing the changes, Xidian University has been actively responding to the changes, and Wuhan University of Technology has been actively seeking the changes. The three universities actively explore the digital transformation of higher education, helping to achieve high-quality development of higher education.

Central China Normal University has mainly made an active exploration in the aspects of the talent training system, digital teaching environment, and integrated research and development for education digitalization. First, it has changed the talent training system through the deep integration of information technology. It has built a new talent training system that is student-centered, connected, shared, independent, open, and appropriate in the information era, mainly through the integration and innovation of the eight dimensions of revising the educating programs. The system helps to foster teaching culture, optimize management services, reform evaluation methods, innovate teaching approaches, enrich teaching resources, improve teachers' abilities, and restructure the teaching environment. Second, it has made great efforts to build a large-scale

and accurate teaching environment. It has developed its own teaching platform Xiaoya, and has built the South Lake Comprehensive Building with a coverage of 95,000 square meters, which integrates teaching and research functions and is equipped with more than 100 smart classrooms of seven types. Third, with strategic goals on demand-based service, top-level orientation, innovation integration, and development collaboration, it has built an integrated platform of "artificial intelligence + education" to tackle key problems and strengthens the research on the laws of education, with fruitful results. Since 2018, the direction of F0701 set up by the National Natural Science Foundation of China has continuously supported a series of explorations on the integration of educational technology and teaching. In recent years, the number of projects obtained by this university in this direction ranks first in the country, especially in cultivating a high-quality scientific research platform for young people. In 2022, "Research on theory and key technology of AI-empowered teaching and learning" led by the university was approved as a major program of the National Natural Science Foundation of China.

Xidian University has pioneered innovations in talent cultivation mode, AI-empowered EMOOC course resource construction, teaching organization method, teaching process re-engineering, remote online experiments, evaluation system, and big data-driven targeted management and decision making. First, it actively explores personalized cultivation mode and initiates a cultivation method represented by dual teachers, dual spaces, dual colleges, dual integration, and dual certificates. Lecturers and instructors are arranged for students and teaching activities can be carried out both online and offline, forming a "dual institution" cultivation scenario with the integration of two units, the

school/study, and the college, which greatly improves the level of personalized teaching and management. Second, it has developed the Smart Course Platform that uses artificial intelligence to empower EMOOC construction and realize automatic bilingual translation of course resources. Third, the teaching and learning process has been reconstructed. Taking the C language process as an example, the teaching process has been redesigned to realize the combination of offline teacher classes and online AI assistant classes, which is called a dual-teacher model. Fourth, it has created a remote experimental environment where students can control the experimental platform remotely from home and the whole lab can be unattended. Fifth, it has built a “process evaluation” system (Yang, Ji, & Tian, 2021). Starting in 2021, graduate students will not only be awarded academic qualifications and degree certificates, but also a competency certificate. Sixth, it is committed to realizing big data-driven targeted management and decision-making support through big data collection, analysis of student characteristics, and evaluation of students’ comprehensive abilities, which also provides a reference for employers. The university has built an operation center and an AI + education center to connect business data involved in academic affairs, student affairs, staff management, and assets management to the central platform, realizing the standardized nano-management and interconnection of the whole cycle of data from accessing to sharing. The average daily data exchange volume of the data center is 800 million, and the call interface is nearly 2,000 times.

Wuhan University of Technology has formulated “530” action plans with new standards, new dynamics, new models, new systems, and new cultures as the core. Among these new standards, 5 items are included, which are reconstructing education quality

standards, student ability standards, specialty discipline setting standards, specialty quality standards, and curriculum quality standards. New dynamics refer to three items, namely changing students’ learning, changing teachers’ teaching and changing the school’s management. The new model refers to eight items such as emphasizing education in five domains, breaking four boundaries, promoting three synergies, boosting two integrations, and insisting on one orientation. The new system includes 11 items such as a new system of talent training, a new system of enrollment work, and a new system of employment promotion. The new culture includes three items such as the culture of cultivation, the culture of service, and the culture of quality. These 30 articles fall into three categories: (1) digital empowerment, (2) guiding measures, and (3) management guarantee. For the traditional advantageous disciplines, Wuhan University of Technology explores the new direction of interdisciplinary integration with the empowerment of technology. In the future, the technology represented by the metaverse will provide a richer and more diverse learning experience. By realizing the seamless connection and organic integration between the virtual world and the real world, it will effectively promote the comprehensive digital transformation of education. Teaching scenarios such as 5G IOT, three-dimensional teaching field, and intelligent platform will become possible in the future with the support of the metaverse.

Conclusion

Digital transformation is an inevitable trend for the development of higher education in the future. Major countries in the world have placed the realization of digital transformation high on the development strategy and prioritized the high-quality development of higher education. China has already been

at the forefront of the digital development of higher education by introducing policies related to digital transformation to lead the overall development, building a national public service platform for intelligent education to optimize the digital resource system, launching digital technology training programs to promote the construction of an intelligent teaching force, and pursuing innovative changes in educational evaluation based on big data to achieve diversified development of process evaluation. Digitalization will bring unlimited potential and a new vision for higher education. Based on technologies such as big data, artificial intelligence, and metaverse, digitalization will change the organizational structure, elemental relationship, functional utility of the education system, and even its cultural form and value proposition. Thus, we will create a new higher education ecological system that is more learner-centered, inclusive, integrated, and resilient in the digital era. In the future, we should optimize between human and artificial cognition, and integrate these two for optimal output (Siemens et al., 2022) to promote a comprehensive and thorough digital transformation of education.

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