

The Digital and Intelligent Transformation of China's Higher Education in the Context of New Quality Productive Forces: Significance, Shifts, and Pathways

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Abstract: Against the backdrop of the rapid development of New Quality Productive Forces, the digital and intelligent transformation of higher education has become a critical strategic pivot for China to seize the high ground in educational development and cultivate new competitive drivers in the education sector. This transformation not only opens up new pathways for educational modernization but also provides a key breakthrough for building a high-quality education system. As the main force in scientific and technological innovation and the primary front for talent cultivation, the digital and intelligent transformation of higher education is an inevitable requirement for continuously advancing profound changes in educational philosophy, a vital support for deepening the reform and innovation of educational teaching models, and a core need for accelerating the optimization of the higher education governance system. Facing the contemporary demands of developing New Quality Productive Forces, the strategic orientation of higher education's digital and intelligent transformation should shift from standardization to personalization, from rote instruction to intelligent teaching, and from equalization to refined precision. In view of this, this paper proposes practical pathways such as reshaping an inclusive and open teaching model, optimizing scientific and reasonable teaching content, and establishing a refined and intelligent education system, thereby providing important support for accelerating the digital and intelligent transformation of China's higher education.

Keywords: New Quality Productive Forces; Higher Education; Digital and Intelligent Transformation; Personalized Education;

Intelligent Teaching

1. Introduction

At present, China is actively advancing the digitalization of education and building a learning society and a learning powerhouse that supports lifelong learning for all [1]. From the perspective of driving innovation in higher education, the development of intelligent technologies has injected new vitality into the sector [2]. The cutting-edge technologies and innovative concepts embedded in New Quality Productive Forces prompt higher education institutions to optimize their curriculum systems, achieve intelligent management of teaching processes, provide personalized learning support, and enable precise assessment of teaching quality, thereby improving educational efficiency and quality, and facilitating the digital and intelligent transformation of higher education [3]. From the perspective of driving change in higher education [4], the development of New Quality Productive Forces encourages higher education to break away from traditional closed-door schooling models, actively engage and integrate with various sectors of society, and form an open and shared educational ecosystem. In light of this, in the process of developing New Quality Productive Forces, it is urgent to transform the traditional teaching models, content, and methods of higher education, further improve the integration mechanism between higher education and intelligent technology development, and explore effective pathways, thereby providing strong support for cultivating high-quality talents capable of adapting to future social development.

2. The Contemporary Significance of the Digital and Intelligent Transformation of Higher Education for the Development of New Quality Productive Forces

2.1 An Inevitable Requirement for Continuously Advancing Profound Changes in Educational Philosophy

As the crystallization of thought within specific historical contexts, educational philosophy not only deeply reflects the core characteristics of the era but also contains rich practical value. Against the backdrop of developing New Quality Productive Forces, the digital and intelligent transformation of higher education can facilitate a technological shift in the educational ecosystem, a systemic reconstruction of knowledge production, and a rational reshaping of educational subjects, thereby continuously advancing profound changes in educational philosophy.

First, the technological shift in the educational ecosystem. Based on the cluster of intelligent technologies spawned by New Quality Productive Forces, higher education breaks through the physical boundaries of traditional education [5], compelling educational philosophy to shift from a purely physical space to a fusion of virtual and real spaces. This fundamentally transforms the educational ecosystem, ensuring that the educational environment is no longer confined to material carriers. By constructing an immersive intelligent educational ecosystem, the education system promotes the diversification of knowledge dissemination pathways, aligning educational processes with the era of the Internet of Things and further advancing the transformation of educational philosophy.

Second, the systemic reconstruction of knowledge production. At present, traditional higher education teaching philosophies are undergoing a fundamental shift, steering higher education toward intelligent development. Relying on artificial intelligence technologies, higher education builds networked curriculum structures, cultivates learners' internet-based cognitive abilities, and transitions knowledge production from manual construction to a human-machine collaborative symbiotic model [6], continuously driving the transformation of educational philosophy.

Third, the rational reshaping of educational subjects. The digital and intelligent transformation of higher education helps break down the traditional binary opposition between educational subjects and objects, shifting the teacher-student relationship from authoritative

transmission to equal dialogue [7]. This satisfies the two-way interaction between educators and learners and plays a catalytic role in transforming educational philosophy.

2.2 A Key Support for Deepening the Reform and Innovation of Educational Teaching Models

The development of New Quality Productive Forces places higher demands on talent cultivation, making it difficult for traditional educational models to meet society's need for versatile and innovative talents. The reform of educational teaching models centered on facilitating the digital and intelligent transformation of higher education has become a key support for higher education to respond to the imperatives of the era.

First, the holistic development of individuals facilitates the construction of a precision education mechanism. In the context of New Quality Productive Forces, the rapid pace of knowledge renewal forces educational supply to advance from scale-driven to quality-driven approaches. The transformation helps educators comprehensively understand learners' cognitive development trajectories and ability growth curves, formulate dynamically evolving personalized cultivation plans, and thereby allocate resources rationally to precisely meet the holistic development needs of individual learners [8]. This ensures that educational model reforms always align with the frontiers of social development, thus providing key support for deepening the reform and innovation of educational teaching models.

Second, the digital and intelligent transformation is catalyzing a profound evolution of educational forms. The educational application of intelligent technologies extends the teaching field from physical spaces to virtual-physical integrated spaces, reconstructing the spatiotemporal dimensions of knowledge transmission. The creation of a four-element integrated environment composed of humans, the physical world, intelligent machines, and the virtual information world breaks through the planar limitations of traditional teaching [9], transforming abstract theories into perceptible cognitive patterns and providing key support for deepening the reform and innovation of educational teaching models.

Finally, a deeper transformation lies in the structural reconstruction of the educational

ecosystem. The digital and intelligent transformation of higher education helps break down organizational boundaries of educational institutions, promotes the construction of a collaborative education community involving government, industry, academia, research, and application, and continuously innovates organizational forms such as cross-border virtual teaching and industry colleges [10]. This satisfies the need to align talent cultivation with social demands, thereby providing key support for deepening the reform and innovation of educational teaching models. It enables a seamless connection between knowledge production and practical application, endowing the education system with continuously iterative knowledge renewal capabilities, ensuring that the quality of talents remains dynamically adaptable to the evolutionary direction of New Quality Productive Forces, and prompting the deepening of reform and innovation in educational teaching models.

2.3 A Core Need for Accelerating the Optimization of the Higher Education Governance System

Against the backdrop of New Quality Productive Forces, higher education governance urgently needs to build a new education system that aligns with the developmental laws of the intelligent era. The transformation integrates intelligent technologies into the educational governance framework, satisfying the needs of the higher education governance system for human-centered value guidance, innovative talent drivers, and data element empowerment, thereby optimizing the governance system.

First, the construction of an educational governance framework helps realize human-centered values. By reshaping subject relationships and institutional designs, the governance framework provides systematic guarantees for the realization of human-centered values. Through the “triple” innovations of a multi-stakeholder governance structure, a human-centered institutional system, and digitally empowered pathways, it transforms the value declaration of “people-oriented” into an actionable operational paradigm, ultimately bringing education back to its essence of “awakening life’s self-awareness and realizing individual value.”

Second, the improvement of the educational ecosystem facilitates the driver of innovative

talents. The transformation deeply integrates intelligent technologies with educational governance, continuously breaking down traditional disciplinary barriers and meeting the need to construct a composite talent cultivation system that synergizes education, science and technology, and industry, thereby optimizing the higher education governance system. The deep integration of the educational governance system with intelligent technologies enables educators to break free from traditional training models, forming cross-disciplinary talent echelons with capabilities in both educational principles and technological research and development. This keeps the education system at the forefront of technological innovation, reconstructs multi-dimensional evaluation systems, establishes long-term assessment frameworks for knowledge production in basic research, and creates dynamic incentive mechanisms for achievement transformation in applied innovation. This forms a talent support system that drives the transformation of the educational governance system and realizes the optimization of the higher education governance system.

Third, the improvement of the educational data governance system benefits the empowerment of data elements. Data resources have become the core production factor in educational governance, necessitating the construction of an all-factor data governance system for education. The digital and intelligent transformation of higher education helps build intelligent decision-making systems covering teaching, research, and management, forming a dynamic governance loop of data collection, analysis and early warning, and strategy optimization. On the dimension of data security, it establishes a composite guarantee system incorporating both technical safeguards and institutional constraints, ensuring the value flow of educational data elements within controllable boundaries. This ultimately creates a new data-driven pattern of educational governance, thereby achieving the optimization of the higher education governance system.

3. Strategic Shifts of the Digital and Intelligent Transformation of Higher Education for the Development of New Quality Productive Forces

3.1 From Standardization to Personalization: Building an Intelligent Education System

through Scale Education and Characteristic Cultivation

As core technologies of New Quality Productive Forces, emerging technologies such as artificial intelligence, big data, and cloud computing have been widely applied in higher education, driving transformations in the economic and social development landscape. These technological upheavals, transmitted through the labor market, significantly influence the talent cultivation concepts of higher education. Traditional higher education systems exhibit pronounced standardization characteristics, with their functional positioning highly aligned with industrial demands. This functional positioning effectively supported rapid economic and social development in specific historical stages. However, the emergence of artificial intelligence has altered the productive forces and relations of production, pushing industrial systems toward digital and intelligent upgrading. The transformation of social production methods requires higher education to reshape its standardized talent cultivation philosophy and shift toward a new model that places greater emphasis on personalized cultivation [11].

First, regarding the environment for personalized cultivation, universities can use VR/AR and holographic projection technologies to break through the mind-body dualism cognitive model, achieving virtual-real integration and interaction, enhancing learners' embodied perception. Second, in terms of personalized cultivation resources, universities can use knowledge graphs and adaptive learning systems to form dynamic knowledge networks, mining and analyzing data generated by learners during the learning process, and precisely matching learning resources based on learners' mastery levels, needs, and goals. Third, concerning personalized cultivation pathways, universities can use intelligent terminals and learning analytics technologies to build full-cycle data tracking systems, enabling data-driven representation of the learner cultivation process. Based on dynamic data such as learners' emotional changes during the learning process, they can form dynamic adjustment mechanisms for personalized learning models, continuously optimize personalized learning recommendation pathways. In view of this, as New Quality Productive Forces become deeply embedded, the education system gives rise to a new type of educational ecosystem. The knowledge dissemination

mechanism is undergoing a paradigm shift from one-way transmission to two-way interaction, teaching spaces expand from physical entities to virtual-real integrated environments, and evaluation systems shift from outcome-oriented to process-oriented, continuously driving the education system to evolve toward greater inclusiveness, adaptability, and sustainability.

3.2 From Rote Instruction to Intelligent Teaching: Forming a Scientific Knowledge Model through Curriculum Content Compilation and Design

At present, the curriculum content design model in higher education is undergoing a profound transformation from traditional mass production paradigms to personalized customization paradigms. However, traditional curriculum systems mainly transmit knowledge to learners through "rote instruction," and curriculum content tends to be "canned," thereby limiting learners' personalized development. Therefore, curriculum content design should leverage intelligent technologies to conduct precise analysis of learners and customize curriculum content structures that align with individual learning characteristics, bringing revolutionary changes to the talent cultivation model of higher education. There are three main methods:

First, customized curriculum content. Curriculum content shifts from mass production-oriented to personalized development. Relying on the deep integration of artificial intelligence and big data technologies, multi-dimensional analysis of learners' cognitive characteristics, behavioral patterns, and learning trajectories is conducted through intelligent algorithms, achieving precise matching between curriculum content structure and learners' thinking habits. This stimulates learners' personalized learning needs, realizes the educational philosophy of teaching according to aptitude.

Second, diversified curriculum content. In the digital and intelligent era, curriculum design should break through traditional disciplinary barriers and build interdisciplinary knowledge networks. Through the deep integration of artificial intelligence and knowledge graph technologies, multi-dimensional associations among massive amounts of knowledge can be systematically established, presenting learners with clear interdisciplinary knowledge threads. This diversified curriculum content system not only expands learners' knowledge horizons but

also cultivates their interdisciplinary thinking abilities, thereby effectively meeting the demand for innovative talents and promoting the intelligent and digital transformation of higher education.

Third, intelligent curriculum content. Curriculum compilation can rely on artificial intelligence to assist higher education curriculum developers in further optimizing the knowledge structure and content configuration of courses. By establishing professional courses such as artificial intelligence and integrating digital literacy content into regular curriculum content, the digital and intelligent transformation of higher education can be realized. Future curriculum content design should align with the concept of personalized customized knowledge models. With the help of intelligent recommendation engine technologies and based on learners' individual differences, curriculum content will gradually move toward personalized customization and recommendation, which is of great significance for promoting the digital and intelligent transformation of higher education.

3.3 From Equalization to Refined Precision: Realizing Intelligent Learning Processes through Teaching and Tutoring Models

With the development of New Quality Productive Forces, the education sector is undergoing fundamental changes. Constrained by industrial production thinking and the level of technological development, the traditional education system has led higher education to adopt a knowledge transmission model dominated by collective teaching. This model presumes that learning subjects are a group with similar cognitive levels, relying on standardized curriculum content, uniform teaching strategies, and standardized evaluation systems to implement batch talent cultivation. With the in-depth development of artificial intelligence technologies, teaching and tutoring models are continuously restructuring the underlying architecture of the education system, changing traditional teaching methods, and driving education and teaching toward more personalized, intelligent, and efficient direction. First, intelligent teaching research and lesson preparation. Educators can use technologies such as artificial intelligence to achieve networked collaboration in teaching research within regions, deeply mining and processing large amounts of unstructured data generated in teaching. Based

on learners' needs and actual conditions, they can optimize teaching designs, reasonably organize teaching resources, select teaching methods, and use technologies such as intelligent recommendations to obtain and recommend relevant teaching resources for different course content, meeting learners' personalized needs.

Second, intelligent instruction and precision teaching. Educators can rely on artificial intelligence to change the classroom teaching ecology and innovate teaching models. Using technologies such as 5G and video technology, they can enable remote instruction by renowned teachers or virtual AI teaching. The development of the Internet of Things enables real-time monitoring and analysis of learners' learning behaviors during the teaching process, which can be used to guide, evaluate, and optimize teaching methods.

Third, intelligent question answering and tutoring. Educators can rely on intelligent technologies to resolve learners' doubts regarding key and difficult issues, achieve one-to-one targeted tutoring, improve teaching outcomes, and thus promote the digital and intelligent transformation of higher education. In the context of New Quality Productive Forces, the transformation of teaching by artificial intelligence is reflected throughout the entire teaching process, from the analysis of teaching materials and learning conditions during teaching research and lesson preparation, to classroom teaching monitoring and precision instruction, and then to after-class tutoring and question answering. Artificial intelligence integrates into and reshapes traditional teaching methods at every stage, thereby improving teaching efficiency, teaching quality, and learning outcomes, driving teaching methods from equalization to refined precision.

4. Practical Pathways for the Digital and Intelligent Transformation of Higher Education for the Development of New Quality Productive Forces

4.1 Reshaping an Inclusive and Open Teaching Model

Against the backdrop of New Quality Productive Forces, traditional educational models can no longer meet the needs of the new era. There is an urgent need to innovate educational models, strengthen big data awareness, and skillfully integrate intelligent technologies to precisely

optimize teaching methods, thereby fully releasing the potential for precision education.

First, the transformation of teaching models driven by information technology. Higher education should abandon the traditional model dominated by teacher-centered instruction, break the monotony of educational forms, integrate curriculum resources, and carry out customized integration based on the individual differences, characteristics, and needs of college students. By leveraging digital and intelligent technologies, higher education can achieve an organic combination of online and offline education, promote the deep integration of teaching methods and digital intelligent technologies, explore the correct implementation pathways for university curriculum education, enhance the effectiveness of precision education.

Second, the transformation of teaching models enabled by data processing technologies. Higher education can rely on educational big data analytics technologies to accurately grasp the learning characteristics and needs of each student through multi-dimensional data collection, deep integration, and intelligent analysis. Based on this, educators can implement personalized teaching strategies, carry out precise theoretical instruction, and achieve teaching according to aptitude. This data-driven teaching model not only significantly improves teaching efficiency but also effectively stimulates students' autonomous learning motivation, cultivates their lifelong learning abilities, strongly promotes the precise implementation of higher education work, enhances educational outcomes, and drives the digital.

Third, the transformation of teaching models guided by artificial intelligence technologies. Higher education should increase the flexibility of teaching methods, precisely provide course teaching content based on students' individual differences and cognitive acceptance abilities, and make dynamic adjustments according to changes in students' characteristics and needs to select the most appropriate and effective teaching methods. Educators need to enhance the intuitiveness and empirical nature of teaching methods, using VR, AR and other technologies to construct virtual environments for situational simulation teaching, stimulating students' perceptual and cognitive experiences, improving learners' sense of reality and immersion, enhancing the effectiveness of education,

achieving more precise teaching decisions, and advancing the digital and intelligent transformation of higher education.

4.2 Promoting a Precise Educational Content Supply Strategy

The precision of educational content supply is built upon the scientific identification and systematic control of educational goals. It requires taking target demands as the core orientation and implementing personalized content design based on differences in target attributes. In the context of New Quality Productive Forces, the comprehensive optimization of educational content is key to achieving a precise match between the supply and demand of educational resources and improving the accuracy of educational content supply, playing a crucial role in promoting the digital and intelligent transformation of higher education.

First, the immersive application of virtual reality technology. Higher education can use virtual reality technology for spatial reconstruction and situational simulation, breaking through the spatiotemporal limitations of traditional education. Universities can construct three-dimensional virtual teaching fields, enhance the vividness of teaching supply content, increase the perceptual dimension and cognitive depth of teaching content, and stimulate students' learning enthusiasm and initiative.

Second, the construction of intelligent education platforms. Universities should build intelligent data platforms integrating teaching management and student services, break down data barriers between departments, achieve multi-dimensional integration of academic data, behavioral data, and network trajectory data, enhance the interconnection of educational information.

Third, the dynamic construction of a collaborative education coupling mechanism. Universities should establish a deep coupling mechanism between theoretical instruction and practical education, track and analyze formative evaluation data such as learners' classroom participation and practical performance in real time, and establish dynamic feedback mechanisms to achieve precise alignment and deep matching of educational content.

4.3 Establishing a Refined and Intelligent Education System

Facing the demands of educational

transformation in the intelligent era, building a systematic artificial intelligence education system has become a key proposition for the transformation of higher education. In the process of developing New Quality Productive Forces, the refinement and intelligence of the education system can drive the transformation of artificial intelligence education, thereby laying a theoretical foundation for the digital and intelligent transformation of higher education.

First, constructing an interdisciplinary disciplinary system. Universities should plan the disciplinary layout of artificial intelligence education, taking computer science, cognitive neuroscience, and pedagogy as theoretical foundations to promote the progress of AI education from weak to strong and even beyond the current stage. Higher education can establish a new research paradigm for digital and intelligent humanities, focus on solving new types of issues such as ethical norms and social relationship reconstruction caused by intelligent technologies, break through traditional disciplinary barriers, build knowledge graphs in core areas of intelligent technology.

Second, innovating an academic system that equally emphasizes theory and practice. Higher education should construct a theoretical framework for intelligent education, improve basic theories such as the theory of higher education intelligent transformation and the ethical norm system for artificial intelligence, and form a dynamically iterative theoretical knowledge system. At the same time, it should integrate educational empirical research paradigms with artificial intelligence technical methods, develop research tools such as educational situation modeling and learning behavior analysis, build collaborative innovation platforms involving government, industry, academia, and research, form an influential academic organization network.

Third, constructing a discourse system guided by values. Higher education should explore the contemporary value of traditional educational thought, realize the modern transformation of the educational wisdom of teaching according to aptitude and personalized learning technologies, establish a sound ethical framework for artificial intelligence, and build a human-centered intelligent education concept with learners' holistic development as the core, thereby facilitating the digital and intelligent transformation of higher education.

5. Conclusion

Against the backdrop of New Quality Productive Forces, the digital and intelligent transformation of higher education is an inevitable trend and an urgent requirement of the information age. Higher education should rely on cutting-edge information technologies such as big data and artificial intelligence to deeply explore innovative integration pathways between educational models and technologies, proactively innovate educational concepts and methods to precisely meet the actual needs of learners, and thus achieve the goals of digital and intelligent transformation more efficiently. Under the wave of digitalization and intelligence, multi-dimensional information such as students' learning behaviors and living conditions can be captured in real time using multi-data collection devices and monitoring systems. Through advanced data analysis methods, massive amounts of data can be deeply mined and processed to accurately profile learners' personality traits, interests and preferences, and learning progress. Based on this, educational resources can be customized, personalized guidance services can be provided, and precise support plans can be offered. It is worth noting that the construction of an intelligent teaching system is not achieved overnight. It requires a gradual research process from theoretical exploration to practical deepening, from local pilot projects to full-scale promotion, achieving a deep breakthrough in educational digital transformation through continuous iteration. Therefore, higher education should reshape an inclusive and open educational model, optimize scientific and reasonable teaching content, and establish a refined and intelligent education system, effectively promoting the deep integration of higher education and intelligent technologies, and truly realizing a new teaching form featuring virtual-real coexistence, precise interaction, and composite engagement, thereby successfully achieving the goals of digital and intelligent transformation.

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