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Research on the Spatial Logic of Governance Reform in Higher Education under the Background of Digital Transformation

Zhilei Zhao*

Public Security Administration Department, Jiangsu Police Institute, Nanjing 211800, Jiangsu, China

**Author to whom correspondence should be addressed.*

Abstract: Digital transformation has become a key driving force in the development of higher education. It presents significant theoretical value and practical significance in reconstructing educational spaces and transforming governance models. By taking spatial theory as the entry point for analysis, this paper elaborates on the multi-dimensional transformation logic of higher education governance in the digital age and explains the deep integration mechanism of physical space, virtual space, and social space. It aims to explore innovative paradigms for higher education governance in the digital era and provide new theoretical perspectives and practical ideas for promoting the modernization of higher education governance systems.

Keywords: Digital transformation; Higher education; Governance transformation

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1. Introduction

The extensive and in-depth application of digital technology is reshaping the development pattern of higher education, driving the transformation of educational governance models from traditional management to digital governance. As a systemic change, it has also triggered profound changes in higher education in many aspects such as teaching models, management methods, and organizational forms. Higher education governance is a key link connecting macro educational policies with micro teaching practices. Its digital transformation is of great significance for improving educational quality, promoting educational equity, and driving educational innovation. It has crucial theoretical value and practical guidance for constructing a new paradigm of educational governance in the digital age.

2. The significance of the spatial logic of higher education governance transformation in the context of digital transformation

2.1. Improving the theory of educational space

Improving the theory of educational space can deepen the understanding of the development laws of higher education

in the digital age. Analyzing the interaction mechanism among physical space, virtual space, and social space can reveal the reconstructive effects brought by digital transformation to the educational field, expanding the research dimensions of the theory of educational space. This theoretical innovation can help understand the deep integration relationship between digital technology and educational governance and provide a new perspective for grasping the interaction laws of educational governance subjects and the evolution path of governance mechanisms [1]. The improvement of the theory of educational space lays the foundation for constructing a theoretical framework for higher education governance in the digital age and promotes the innovative development of the educational theory system.

2.2. Optimizing governance model innovation

Optimizing governance model innovation is highly beneficial for enhancing the scientificity and efficiency of higher education governance. By leveraging digital transformation to reconstruct governance space, it breaks the limitations of traditional governance models in terms of time and space, achieving precise allocation of educational resources and personalized supply of educational services. This innovation transforms governance methods from experience-driven to data-driven and promotes the development of governance structures towards flattening and networking [2]. The optimized governance model can better adapt to the new situation of educational development, effectively handle difficult issues in educational governance, improve the response speed and service quality of educational governance, and ultimately achieve the modernization of the educational governance system and governance capacity [3].

2.3. Accelerating education modernization

Accelerating the modernization of education is of positive significance for improving the overall development level and international competitiveness of higher education. In the context of digital transformation, education modernization is manifested in the application of technology, which has a more profound impact on the renewal of educational concepts, innovation of systems, and transformation of models. Promoting the modernization of educational governance through spatial reconstruction can enhance the adaptability and resilience of the education system in the face of complex changes, optimize the allocation of educational resources, make educational service supply more precise, and make educational quality evaluation more scientific. Such a systemic change can build a high-quality education system, cultivate innovative talents, and enhance the ability of education to serve economic and social development, ultimately achieving the strategic goal of high-quality development of education.

2.4. Leading future transformations

Digital transformation is not only a transformation of technology but also a transformation of governance. It is necessary to lead future transformations by focusing on the governance transformation of higher education. This requires not only the application of digital technology but also the transformation of governance concepts, governance structures, and governance mechanisms. It is necessary to promote the transformation of governance models from centralized to decentralized, from hierarchical to flat, and from closed to open. It is also necessary to promote the transformation of governance subjects from single to multiple, from passive to active, and from fragmented to integrated. Only in this way can we lead future transformations and achieve the modernization of higher education governance. Leading the future transformation is highly beneficial for seizing the strategic initiative in the development of higher education. By conducting forward-looking research on the educational transformation trends brought about by digitalization, we can predict the key issues and breakthrough directions in education development, and proactively adapt to and lead educational innovation. Spatial reconstruction provides new ideas for educational transformation,

promoting the shift of educational concepts from knowledge transmission to ability cultivation, the development of educational models from standardization to personalization, and the upgrading of governance methods from administrative management to smart governance. Such leading transformation can create a high ground for educational innovation, cultivate new driving forces for educational development, shape new competitive advantages in the digital era, and promote high-quality and sustainable development of education [4].

3. Problems in the spatial logic of higher education governance transformation under the background of digitalization

3.1. Fragmentation

The spatial planning of higher education shows a fragmented development trend, which restricts the improvement of governance efficiency. On the one hand, the planning of physical and virtual spaces lacks overall coordination, and elements such as teaching venues, experimental platforms, and digital resources are scattered, resulting in insufficient optimization of the spatial structure and low space utilization efficiency. This poses obstacles to resource sharing and limits the efficiency of educational service supply. On the other hand, the spatial planning of education lacks an overall perspective, failing to achieve the organic integration of physical, virtual, and social spaces. Various spaces operate independently, with limited synergy, affecting the optimal allocation of educational resources and the balanced development of educational services, and constraining the modernization process of higher education governance.

3.2. Insufficient synergy

The lack of synergy in higher education governance mechanisms hinders the comprehensive improvement of governance efficiency. Firstly, the traditional hierarchical governance structure is incompatible with the demands of digitalization, with obstacles to information sharing among governance subjects and a relatively closed decision-making process. This makes it difficult to achieve efficient cross-departmental and cross-level collaboration, affecting governance efficiency and service quality. Secondly, the cross-space governance mechanism has not been fully established, with inconsistent governance rules and standards between physical and virtual spaces, an unclear definition of the rights and responsibilities of governance subjects, and a lagging construction of collaborative governance platforms. This makes it difficult to effectively integrate governance resources and fully demonstrate governance efficiency, constraining the in-depth development of educational governance innovation.

3.3. Low integration

The low integration of digital technology and education governance restricts the process of governance modernization. On the one hand, the application of digital technology in education governance is still at the primary stage of informatization, with insufficient data collection and analysis capabilities and limited application of intelligent governance tools, making it difficult to achieve data-driven precise governance and affecting the scientificity and foresight of governance decisions. On the other hand, the digital literacy of education governance personnel needs to be improved [5]. They lack the application ability and innovation awareness of digital technology, and traditional management thinking and working methods are very stubborn, resulting in limited empowerment effects of digital technology and difficulty in fully leveraging the supporting role of technological innovation in governance transformation.

3.4. Lack of precision

The lack of precision in higher education governance services affects the improvement of service quality. Firstly, the current supply model of educational services is mainly standardized and unified, which is difficult to meet the diverse and personalized needs of educational subjects, resulting in low service precision and unsatisfactory user experience, and constraining the improvement of educational service efficiency. Secondly, the governance response mechanism is not flexible enough, with slow perception and response to changes in educational needs, and a lack of proactive and predictive service capabilities, making it difficult to achieve precise and dynamic adjustment of educational services. This affects the service effect and satisfaction of educational governance.

4. Strategies for the spatial logic of higher education governance reform in the context of digital transformation

4.1. Optimize spatial layout and promote spatial integration

Under the background of digital transformation, the integration and optimization of educational space need to break through the limitations of traditional physical boundaries and construct a multi-dimensional integrated educational field. By reconfiguring the relationships among physical space, virtual space, and social space, an open and interconnected educational ecosystem can be created to achieve the goal of fully sharing and efficiently allocating educational resources. Such spatial reconstruction changes the traditional organizational mode of education and promotes the development of educational governance models towards innovation, providing new ideas for enhancing the effectiveness of educational governance.

For instance, in actual teaching practice, teachers can adopt the innovative teaching model of “hybrid immersive classroom.” Before the course begins, teachers use virtual teaching spaces to assign pre-study tasks. Students watch micro-lectures and complete online tests through digital learning platforms. Classroom teaching breaks through the limitations of a single physical space and adopts a form of synchronous interaction between physical classrooms and virtual classrooms. Teachers use intelligent teaching systems to integrate virtual reality technology into classroom teaching, allowing remote students to participate in classroom discussions through holographic projection technology. Teaching content is restructured digitally to form visual knowledge maps, helping students establish connections between knowledge. The interactive part of the class integrates various forms of online and offline activities. Students can conduct group discussions in virtual collaboration spaces, and remote students can perform experiments through intelligent robots. After the course, teachers use learning analysis platforms to track students’ learning trajectories and provide personalized tutoring plans for each student. Social learning spaces are expanded through social media platforms, encouraging students to have in-depth exchanges with external experts and business professionals, closely integrating classroom knowledge with social practice. This innovative model reconfigures the teaching scene through spatial integration, breaks through the limitations of traditional classrooms, and achieves the optimization of educational resource allocation and the improvement of teaching effectiveness. The in-depth application of digital technology makes teaching activities more interactive and open, creating an immersive learning experience for students.

4.2. Improve collaborative mechanisms and enhance governance efficiency

In the context of digital transformation, to improve the collaborative mechanism of educational governance, it is necessary to break through the traditional hierarchical barriers and build a governance network that spans space and

levels. By reconstructing the interaction relationships among governance subjects, a data-driven collaborative decision-making mechanism can be established to promote the efficient flow and integrated utilization of governance resources. This innovation in the collaborative mechanism optimizes the governance structure and accelerates the improvement of governance efficiency, providing new impetus for the modernization of educational governance.

For example, in teaching practice, teachers can use "smart collaborative classrooms" to innovate teaching models. Teachers utilize intelligent teaching collaboration platforms to form cross-border teaching teams with experts and enterprise mentors from both inside and outside the school to jointly develop course content. The platform intelligently matches expert resources from different fields to form a multi-dimensional collaborative lesson preparation mechanism. During the classroom teaching process, the main teacher uses remote collaboration systems to connect various teaching resources in real time. Enterprise mentors can join the class at any time to share practical cases, and subject experts can participate in teaching interactions through intelligent terminals. Based on their learning needs, students can precisely connect with various teaching resources through the intelligent recommendation system, customizing their personalized learning paths. The classroom management adopts a distributed collaborative model. The teaching assistant team uses the intelligent analysis system to monitor students' learning status in real time and provide support for teachers' teaching decisions. The introduction of artificial intelligence teaching assistants helps teachers manage classroom order and answer students' questions.

In the post-class evaluation stage, the system automatically integrates evaluation data from all parties and generates multi-dimensional teaching analysis reports to support continuous improvement of teaching. Teachers can also share teaching experiences and discuss teaching innovations with other teachers through the collaborative community platform. This collaborative teaching model breaks through the traditional single-teacher teaching mode and builds a teaching ecosystem with the collaborative participation of multiple subjects. With the empowerment of digital technology, it achieves precise allocation of teaching resources and overall improvement of teaching effectiveness, creating a richer learning experience for students.

4.3. Deepen technology empowerment and enhance intelligent governance level

When digital technology supports educational governance, it is necessary to expand the scope of technology application and explore its depth, promoting educational governance from the informationization stage to the intelligent stage. By integrating new technologies such as artificial intelligence, big data, and the Internet of Things, a smart governance system can be constructed to achieve scientific decision-making and precise policy implementation in educational governance. This technology empowerment can enhance the intelligence level of governance and also promote fundamental changes in governance methods, adding new impetus to the modernization of educational governance.

For example, in teaching practice, teachers can use the "intelligent perception classroom" to innovate teaching models. The classroom is equipped with intelligent camera systems and biosensors that can capture students' expressions, postures, and physiological data in real time, analyzing their attention and emotional states. Teachers can obtain real-time classroom analysis reports through intelligent teaching assistants and dynamically adjust teaching strategies based on students' conditions. The intelligent system uses voice recognition technology to automatically record classroom conversations and generate teaching interaction heat maps to assist teachers in grasping classroom participation. The presentation of course content uses adaptive technology to automatically adjust the difficulty and form of teaching materials based on students' cognitive levels and learning styles. Teachers can use augmented reality technology to visualize abstract concepts and improve students' understanding.

The artificial intelligence teaching assistant system can automatically identify students' difficulties and push personalized learning resources, and provide intelligent Q&A services for students after class. In the teaching evaluation stage, learning analysis technology is introduced, and the system automatically collects students' learning behavior data to build personalized learning profiles and provide precise teaching feedback for teachers. By using deep learning algorithms, it can predict students' learning trajectories and identify learning risks early to achieve pre-emptive teaching intervention. Teachers can use intelligent lesson preparation systems to optimize teaching design based on big data analysis and improve teaching effectiveness. This technology empowerment model reshapes the teaching scene through intelligent means, achieving precise control of the teaching process and continuous optimization of teaching effectiveness, creating a smart teaching and learning experience for teachers and students.

4.4. Optimize service supply and improve precise efficiency

To optimize the supply of educational services, it is necessary to break the limitations of the traditional standardized model and build a demand-oriented, precise service system. By using data-driven methods for demand analysis and relying on intelligent means for supply matching, the response speed and accuracy of educational services can be improved, transforming service supply from passive response to proactive prediction. This service model innovation enhances the efficiency of educational resource allocation and the adaptability and effectiveness of educational services, opening up new paths for improving the efficiency of educational governance. For instance, in teaching practice, teachers can leverage the "Personalized Learning Service System" to innovate teaching models. This system tracks students' learning behaviors and conducts cognitive diagnosis, building dynamic learning profiles for each student to accurately identify their learning needs. Based on the results of intelligent analysis, teachers can customize personalized teaching plans for students with different learning styles. Before the course begins, the system will push differentiated preview materials based on students' knowledge foundations to help them prepare. In the classroom, an adaptive learning model is adopted, and teachers adjust the teaching pace and difficulty based on real-time learning situation analysis. The system automatically generates multi-level learning tasks, allowing students to choose suitable learning paths based on their levels. For students encountering learning obstacles, the system promptly pushes supplementary materials and exercises and provides advanced learning content for those with more learning capacity. Teachers use intelligent tutoring tools to provide students with immediate feedback and personalized guidance. In the after-class service stage, the system generates personalized homework and review suggestions based on learning data analysis. Teachers rely on the intelligent Q&A platform to offer precise after-class tutoring. The system also predicts potential learning obstacles for students and proactively pushes preventive learning resources. By establishing learning growth profiles, the system continuously tracks students' progress and provides teachers with suggestions for teaching improvement. This precise service model breaks through the traditional uniform teaching approach, achieving personalized supply and dynamic optimization of educational services, creating a more suitable learning environment and a more effective learning experience for students.

5. Conclusion

Digital transformation is profoundly reshaping the governance space of higher education, driving systematic changes in the education governance model. The deep integration of physical space, virtual space, and social space brings new ideas for the modernization of education governance. This spatial reconstruction optimizes the efficiency of educational

resource allocation and promotes the innovative development of governance methods. Higher education governance should seize the opportunities of digital transformation, drive governance innovation through spatial reconstruction, and build a new model of intelligent, collaborative, and precise education governance. This can effectively enhance the scientificity and efficiency of education governance, promote high-quality development of education, and provide strong support for achieving educational modernization.

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