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PRACTICAL PATHS OF DIGITAL TRANSFORMATION OF LIFELONG LEARNING UNDER THE BACKGROUND OF HIGH-QUALITY DEVELOPMENT

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Abstract: At present, China is at a crucial juncture of demographic structural transformation and industrial upgrading. The digital transformation of lifelong learning is an effective means to promote the high-quality development of education, advance the construction of a learning society and enhance China's comprehensive national strength. From the perspective of high-quality development, this transformation must follow the basic principles: taking fairness and inclusiveness as the cornerstone, quality and efficiency as the core, collaborative innovation as the driving force, and sustainable development as the ultimate goal. The five paths of technological empowerment, resource supply, subject collaboration, institutional guarantee and quality improvement can be adopted to tackle the prominent problems in the digitalization of lifelong learning, such as the digital divide, unbalanced resource allocation and unsound governance mechanism, which calls for the joint efforts of all stakeholders. The successful digital transformation of lifelong learning will inject strong impetus into the construction of an educational power, and lay a solid foundation for the all-round development of individuals and the harmonious progress of society.
Keywords: High-quality development; Lifelong learning; Digital transformation; Practical paths

1 INTRODUCTION

The report explicitly proposed to "advance the digitalization of education and build a learning society and a learning power for all through lifelong learning", elevating the digital transformation of lifelong learning to a national strategic level [1]. Currently, digital technologies in China have been applied in all aspects of national economic development, including education, healthcare, and industry. High-quality development has become the main theme of China's economic development and also the core theme in the field of education. The digital transformation of lifelong learning will develop in a deeper and more refined direction, benefiting all citizens, and will undergo systematic changes in terms of concept innovation, model reconstruction, and governance upgrading [2].

Currently, digital technology is undergoing a deep integration with education. A large number of innovations in digital technology such as 5G, artificial intelligence, virtual reality, and blockchain have been widely applied in the field of education, providing convenient, personalized, and intelligent paths for lifelong learning [3]. In the fields of secondary and higher vocational education, an intelligent education cloud platform is being constructed to achieve seamless connection between "work-study alternation"; education for the elderly can break through the "digital divide" by leveraging digital platforms; ordinary higher education can expand the coverage of learning resources by relying on online course resources. These practices all demonstrate the strong momentum of digital transformation [4].

In the Asia and the ASEAN region, digital technology innovation is used to promote the development of lifelong education; in Europe, countries promote the digital transformation of lifelong education from three aspects: optimizing the lifelong education environment system, improving the lifelong education resource system, and strengthening the lifelong education subject system. Both provide regional practical examples for the global digital transformation of lifelong learning [5-6]. However, the digital transformation of lifelong learning still faces many bottlenecks during the promotion process, such as uneven digital infrastructure among regions, insufficient supply of high-quality resources, significant differences in digital literacy among different groups, and incomplete governance mechanisms, which restrict the quality and effectiveness of the transformation [7].

This article is based on high-quality development and aims to achieve the core goals of "fairness and inclusiveness, high quality and efficiency, collaborative innovation, and sustainable development". By integrating existing research results and practical cases from both domestic and international sources [6], it explores the practical path for the digital transformation of lifelong learning. The intention is to promote the transition of lifelong learning from "simple digital coverage" to "true high-quality development", providing strong support for building a learning society where everyone can learn, everywhere can be a place for learning, and learning is possible at all times [8], and providing continuous impetus for the development of the national economy.

2 THE SIGNIFICANCE OF DIGITAL TRANSFORMATION IN LIFELONG LEARNING AND THE CONNOTATION OF HIGH-QUALITY DEVELOPMENT

2.1 The Significance of Lifelong Learning in the Digital Transformation Process

Digital transformation of lifelong learning refers to the comprehensive reconfiguration of the concepts, resources, models, governance, etc. of lifelong learning driven by digital technologies, achieving a transformation of learning services from "standardized supply" to "precision adaptation", from "periodic learning" to "full life-cycle learning", and from "physical space learning" to "ubiquitous learning" [3]. Its core characteristics are manifested in three aspects: First, the convenience of technology empowerment, building a complete and extensive digital infrastructure, allowing learners to obtain necessary learning resources at anytime and anywhere through digital technology; second, personalized service supply, relying on big data and artificial intelligence technologies to provide customized learning paths and resources for learners, striving for precise and efficient services [9]; third, an intelligent governance system, making decisions through data-driven methods, achieving dynamic monitoring and service optimization throughout the entire process of lifelong learning [2].

2.2 The Connotation of Lifelong Learning Digital Transformation

From the perspective of high-quality development, the digital transformation of lifelong learning emphasizes a learner-centered approach, taking into account fairness and quality, efficiency and effectiveness, innovation and norms. Its core connotations include: First, fairness and inclusiveness, through digital means , eliminate educational disparities among regions, urban and rural areas, and different groups, ensuring equal learning rights for all citizens and enabling them to learn whenever they want; Second, building diversified and high-quality digital learning resource libraries to ensure the targeted and effective nature of learning; Third, promoting collaborative innovation involving multiple entities such as the government, schools, enterprises, and communities, forming an open and win-win lifelong learning ecosystem [10]; Fourth, establishing a sound institutional guarantee and ethical norms to ensure the sustainable development of the digital transformation.

3 THE CURRENT REALISTIC FOUNDATION AND KEY ISSUES OF DIGITAL TRANSFORMATION IN LIFELONG LEARNING IN CHINA

3.1 The Actual Foundation for the Digital Transformation of Lifelong Learning in China

3.1.1 The policy support system has been continuously improved

In November 2021, the Central Cyberspace Affairs Commission issued the policy document "Action Outline for Enhancing the Digital Literacy and Skills of the Entire Population". In February 2023, the Central Committee and the State Council issued the policy document "Overall Layout Plan for the Construction of Digital China". These two policy documents provide clear policy guidance and guarantees for the digital transformation of lifelong learning. As of May 2025, the registered users of the national smart education platform in China have exceeded 164 million, and it has gathered over 154,300 high-quality course resources, providing a solid guarantee for the digital transformation of lifelong learning in China [8]. In the field of lifelong learning, the application of digital technologies such as artificial intelligence, virtual reality, and blockchain is becoming increasingly widespread. Virtual simulation training systems for vocational education and online open courses for higher education have diversified the forms of learning, continuously enhancing the learners' experience and learning outcomes [4].

3.1.2 A diversified participation pattern has initially taken shape

Universities, vocational colleges, enterprises, and communities, as the main entities, actively participated in the digital construction of lifelong learning, forming a diversified service supply system [11]. Enterprises and universities, especially higher vocational colleges, carried out industry-education integration projects to develop position-specific skills courses. Communities provided convenient learning services and assistance through smart learning service stations, and social organizations conducted digital literacy training through public welfare projects, initially forming a multi-subject collaborative participation pattern for the digital transformation of lifelong learning [1].

3.2 The Prominent Issues in the Digital Transformation of Lifelong Learning in China

3.2.1 The problems of the digital divide and the structural imbalance in resource supply still persist

The uneven development of regional economies has led to an imbalance in the construction of digital infrastructure. For instance, the network coverage and equipment availability in rural and remote areas are relatively low. Elderly people, rural residents, and disadvantaged groups face difficulties in using digital technologies, such as "not knowing how to use, not daring to use, and not being able to use well". The digital divide and the divide in digital literacy coexist, seriously restricting the promotion of lifelong learning [12].

3.2.2 The governance system is not in sync with technological development, and the mechanism for diversified collaboration is not yet complete.

The development of digital technology has been rapid, but the digital governance of lifelong learning still follows the traditional governance model, which leads to data silos, inconsistent standards and inadequate supervision. Data cannot flow between different platforms and resources are not shared, resulting in the inability to recognize learning achievements. The traditional education governance system is difficult to cope with the new ethical and moral risks brought by digitalization, and the digital management of open education systems also has problems such as inefficient processes and insufficient flexibility. The lack of coordinated collaboration among government, schools, enterprises and communities, where each party acts independently, has led to a significant waste of resources [9].

4 THE PRACTICE PATHWAYS FOR THE DIGITAL TRANSFORMATION OF LIFELONG LEARNING IN CHINA FROM THE PERSPECTIVE OF HIGH-QUALITY DEVELOPMENT

4.1 The Investment in the Digital Infrastructure Support System has Increased, While the learning Costs have Decreased

The digital transformation of the lifelong learning system primarily lies in breaking the time and space limitations of learning scenarios, which depends on highly convenient and inclusive digital infrastructure. Therefore, the construction of basic networks should increase the coverage of 5G networks and gigabit broadband in rural and remote areas to eliminate the digital access gap [8]. However, merely achieving hardware connectivity is not enough. Building a "cloud-edge-end" collaborative digital foundation that can accommodate complex learning needs is the key. This means not only integrating national smart education platforms with local resources, but also breaking the data barriers between platforms to achieve cross-domain circulation and interconnection of resources [9].

4.2 The Digital Learning Ecosystem Achieves Diverse and High-Quality Offerings

4.2.1 Optimization of the overall planning for resource construction

Resource construction is the core content supply for the digital transformation of lifelong learning, and its quality directly affects the sense of gain and participation of learners. At the top-level design level, a planning mechanism of "national coordination and local implementation" needs to be established. The Ministry of Education should take the lead in formulating unified standards and medium- and long-term plans for the construction of digital learning resources, clearly defining the technical specifications, content framework and key directions for resource development, and each provincial education department should promote implementation in line with regional characteristics [9]. This top-down standard guidance aims to solve the current problems of fragmented and repetitive resource construction, and lay the foundation for cross-platform resource sharing and interconnection.

4.2.2 Promote the diversification of resource supply

Learning resources should closely align with the urgent needs of the national economy and social development, focusing on areas such as vocational skills improvement, life health services, cultural literacy cultivation, and elderly education. The diversification of resource supply can meet the diverse needs of learners. Universities, large enterprises, communities, and even other social organizations can all take action to contribute to the construction of learning resources. For instance, universities, especially higher vocational colleges, should actively participate in the construction of digital resources for lifelong learning and open high-quality course resources to the outside world on a planned basis; leading enterprises in the industry, especially large state-owned enterprises, should develop training courses that meet the job requirements based on their own industries and actively promote the integration of industry and education; communities and other social organizations can also join in the development of specialized and localized learning resources.

4.2.3 Strengthening the precise push service of resources

If lifelong learning resources are extremely abundant, then how to help learners efficiently obtain the necessary knowledge from the vast amount of content becomes the key to enhancing the learning experience. To this end, building a personalized resource recommendation engine based on user needs is the core technical support for achieving the transformation of the "learner-centered" service model. This engine conducts in-depth exploration and dynamic modeling of various aspects such as the age, occupation, interests, and learning progress of learners to form precise user learning profiles, thereby achieving intelligent matching and precise push of learning resources [13].

4.3 Establish a Multi-Party Collaborative Governance Management System

The digital transformation of lifelong learning requires going beyond the boundaries of a single entity and must promote governance involving the participation of the government, universities, enterprises, communities and social organizations. Among them, the government assumes the core governance function of overall planning, policy provision and financial guarantee, establishing a system framework for the operation of the system; universities leverage their teaching staff and research advantages, focusing on academic education and non-academic training, and promoting the opening up of academic resources to the society; enterprises, especially large enterprises and state-owned enterprises, should fulfill the main responsibility for employee training, through self-built training centers or school-enterprise cooperation, achieving the connection between talent cultivation and industrial demands; communities integrate venues and local resources to build learning centers or teaching sites, consolidating the grassroots platforms for learning to occur; social organizations play a supplementary role in resource development and service supervision.

The collaborative governance involving multiple entities requires the establishment of a cross-departmental and cross-regional coordination and dialogue mechanism. It is necessary to break down the data barriers among departments such as education, human resources and social security, and industry and information technology, to promote functional coordination through information sharing. The scattered resource supply should be integrated into a service network covering the entire population and spanning the entire life cycle.

4.4 Build a Sound, Standardized and Orderly Support System

4.4.1 Improve the construction of laws and regulations

The sustainable advancement of the digital transformation in lifelong learning relies on a tripartite institutional guarantee of legislation, finance input and security. Firstly, accelerate the formulation and implementation of the "Lifelong Education Law", clearly defining digital transformation from the legal perspective and providing top-level design and behavioral guidelines. Secondly, incorporate lifelong education funds into the fiscal budgets of all levels of government to ensure the funding needs for digital infrastructure, resource development and teacher training, avoiding the impact on long-term construction due to short-term policy fluctuations. Finally, improve digital intellectual property protection and data security regulations to safeguard the legitimate rights and interests of resource creators and protect the privacy of learners [6].

4.4.2 Establishing the credit bank and qualification framework

Establish a unified credit bank system, foster a nationwide "coordinated effort" mindset, establish lifelong learning accounts for learners, and achieve the conversion and accumulation of credits for different types of learning outcomes such as academic education, vocational skills training, and community learning [8]. Clarify the corresponding relationships between different learning outcomes, ensuring mutual recognition and conversion. Promote the connection of learning outcomes with professional qualifications and professional title evaluations, actively enhancing the value recognition and benefits of lifelong learning.

4.4.3 Strengthening the cultivation of digital literacy

The cultivation of digital literacy must start from primary school. Currently, digital literacy has been incorporated into the national higher education system, but it has not yet been included in the basic education stage. Efforts should be made to start training students' digital skills and awareness from the lower age groups [9]. Vigorously carry out digital literacy training for the entire population, especially paying attention to the elderly, rural residents, and disadvantaged groups, and strive to achieve low or no fees. Through a combination of online and offline methods, enhance the the population‘s ability to operate digital devices, obtaining digital resources, and preventing digital security risks.

4.5 Establish and Improve a Scientific and Effective Evaluation and Feedback Mechanism

The high-quality advancement of lifelong learning digital transformation requires the establishment of an evaluation and feedback mechanism. Firstly, a comprehensive scientific evaluation index system covering learning participation, learning outcomes, resource quality and service satisfaction should be established to conduct a comprehensive diagnosis of the transformation results. Secondly, a lifelong learning digital transformation monitoring platform based on big data technology should be built to collect and analyze real-time data on resource supply, learning behavior and service quality, providing precise basis for quality control. Finally, a problem feedback and rectification mechanism should be created. Based on the monitoring results, problems can be quickly identified, causes analyzed and improvements implemented to form a closed-loop process of "monitoring - analysis - feedback - optimization" [9].

5 CONCLUSION

Currently, China is at a crucial juncture of demographic changes and industrial transformation. The digital transformation of lifelong learning can effectively promote high-quality education development, accelerate the establishment of a learning society, and is also an effective means to cope withthe accelerating pace of knowledge renewal and enhance the comprehensive national strength of China. The digital transformation of lifelong learning from the perspective of high-quality development must follow the principles of being based on fairness and inclusiveness, with quality and efficiency as the core, with collaborative innovation as the driving force, and with sustainable development as the goal. Through five paths of technological empowerment, resource supply, entity collaboration, institutional guarantee, and quality improvement, the current problems such as digital divide, resource imbalance, and governance inefficiency in lifelong learning digitalization can be solved. This requires the joint efforts of all parties. The success of the digital transformation of lifelong learning will inject strong impetus into the construction of an education power, lay a solid foundation for achieving comprehensive human development and harmonious social progress, and provide guarantees for the great rejuvenation of the Chinese nation.

COMPETING INTERESTS

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AUTHOR CONTRIBUTIONS

Conceptualization, X.D. and X.L.; methodology, X.D.; software, X.D.; validation, X.D., and X.L.; investigation, X.D.; resources, X.D.; data curation, X.L.; writing—original draft preparation, X.L.; writing—review and editing, X.D.; visualization, X.D.; supervision, X.D.; project administration, X.L.; funding acquisition, X.D. All authors have read and agreed to the published version of the manuscript.

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