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Theoretical Logic and Practical Pathways for Distance Open Education Empowering the Enhancement of Digital Literacy among Rural Cadres

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Abstract At present, enhancing the digital literacy of village cadres faces practical constraints such as governance capability gaps induced by the second-level digital divide, the absence of a systematic cultivation system, incomplete last-kilometer implementation for translating skills into practice, and inadequate incentive mechanisms. As a novel educational form deeply integrating digital information technology with teaching and learning, distance open education provides multi-directional empowerment for enhancing village cadres' digital literacy. This is achieved through open learning methods, the application of modern digital technologies, tailored learning programs, and the establishment of "overpass bridges" for translating learning outcomes into practice. Based on this, it is essential to further streamline the pathways for educating and cultivating village cadres, vigorously promote the digitalization of teaching, practice, and support services, develop systematic and localized digital education resources, and actively explore and establish a complementary credit bank system for their digital literacy cultivation.

Key words Distance open education, Digital literacy, Village cadres, Rural digital governance

0 Introduction

Vigorously enhancing the digital literacy of rural cadres is an urgent need for deepening digital rural development and the digital transformation of rural governance. It holds significant practical importance for advancing the modernization of the rural governance system and governance capabilities[1]. In November 2021, the Cyberspace Administration of China issued the *Action Outline for Enhancing National Digital Literacy and Skills*. This document proposed empowering rural governance through digitalization, advancing "Internet + Rural Governance", and explicitly stated the need to extend digital services and training to rural areas. In May 2025, multiple departments, including the Cyberspace Administration of China and the Ministry of Agriculture and Rural Affairs, jointly issued the *Key Tasks for Digital Rural Development in 2025*. This document clearly mandated enhancing the effectiveness of rural digital governance and continuously strengthening the digital literacy and skills of rural residents. In recent years, with the deepening implementation of national digital development strategies such as "Digital Countryside" and "Digital Commerce Boosting Rural Economy", the construction of digital infrastructure in vast rural areas has accelerated and improved significantly. Consequently, the "first-level digital divide", characterized by unequal access to digital technology, has been largely bridged. The focus has now shifted to the "second-level digital divide", characterized by disparities in the ability to effectively utilize digital technologies. Village cadres, being the direct implementers of grassroots rural governance, possess a level of digital literacy that directly impacts the effectiveness of rural digital governance. Currently, the digital literacy level of the village cadre cohort still falls short of meeting the practical demands of rural governance's digital transformation. Their digital literacy cultivation process continues to face real-world constraints, including a significant second-level digital divide, the lack of a systematically formed training system, insufficient supply of digital resources, and incomplete resolution of the "last-kilometer" implementation gap.

Distance open education, as a novel educational form underpinned by modern digital information and communication technologies, leverages the application of digital tools like mobile internet, artificial intelligence, big data, and virtual reality, along with flexible and open learning approaches. This further dismantles the entry barriers and spatiotemporal limitations inherent in traditional education models, thereby offering crucial support for overcoming the practical challenges in enhancing village cadres' digital literacy. Building upon an analysis of the connotation of digital literacy and the practical constraints facing its enhancement among village cadres, this paper clarifies the theoretical logic underpinning how distance open education empowers this improvement. It further proposes practical pathways to effectively elevate their digital literacy, thereby providing theoretical support and policy references for the practice of empowering the modernization of rural governance

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through digital means.

1 Connotation of digital literacy

The concept of "digital literacy" originated from a definition proposed by Israeli scholar Alkalai in the early 1990s. He posited that digital literacy constitutes the fundamental skills necessary for citizens to live, work, and learn in the digital age[2]. Subsequently, in his 1997 book *Digital Literacy*, Paul Gilster defined it as the comprehensive ability to effectively access, accurately comprehend, systematically organize, and critically evaluate digital information[3]. Although the concept of digital literacy was introduced to China as early as the 1990s, domestic scholars commenced their research on it relatively late. Currently, academia has not yet reached a unified definition of digital literacy. Some scholars interpret it as the capability to efficiently acquire and critically evaluate various types of digital information, and to integrate and innovatively apply this information using digital tools to solve practical problems and generate new knowledge[4]. Other scholars contend that digital literacy is the ability of individuals in the digital age to utilize digital devices for acquiring, understanding, and using digital information. Its core essence lies in highlighting the pivotal value of digital technology as a fundamental life skill for modern citizens[5]. China is one of the first countries globally to elevate the enhancement of national digital literacy to the level of a national strategy and to establish a systematic educational framework for it[6]. The *Action Outline for Enhancing National Digital Literacy and Skills*, issued by the Cyberspace Administration of China in 2021, provides a definition of digital literacy. It refers to the collection of qualities and abilities that citizens in a digital society should possess for learning, working, and living, encompassing digital acquisition, creation, use, evaluation, interaction, sharing, innovation, security assurance, and ethical considerations. Based on the conceptual definitions above, the digital literacy discussed in this paper primarily refers to the comprehensive qualities and abilities of village cadres concerning the cognition, understanding, application, and normative use of digital technologies in their learning, rural governance work, and social life.

2 Practical constraints facing the enhancement of rural cadres' digital literacy

2.1 The second-level digital divide induces governance capability gaps The digital divide within the village cadre group manifests concretely as disparities in information acquisition and processing capabilities, data-driven thinking and decision-making abilities, digital security awareness, and the capacity to use digital tools for handling village affairs. These disparities further lead to variations in the level and capability of rural digital governance. Regarding its causes, on the one hand, differences in human capital among village cadres contribute to gaps in digital literacy and skills. This is specifically reflected in disparities in their educational attainment, age, and learning abilities. On the other hand, there exists a gap in the level of understanding of digital technology. Some cadres lack sufficient awareness of the profound transformations brought about by digital technology, exhibiting a particularly short-sighted view of its governance and economic value in the era of the digital economy. Furthermore, deeply entrenched traditional mindsets, coupled with long-established work habits and path dependence, make it difficult for some village cadres to accept and adapt to digitalized workflows.

2.2 A systematic digital literacy cultivation system has not yet taken shape In terms of training content, the current cultivation of village cadres' digital literacy suffers from a "one-size-fits-all" approach. Training content predominantly focuses on theoretical knowledge of digital technology, basic computer applications, and the operation of common office software. There is a lack of tiered and categorized precision training tailored to the cadres' age structure, competency gaps, and differentiated job requirements. Regarding training methods, the emphasis remains primarily on theoretical instruction and simple operation of digital devices. There is a notable absence of case-based teaching deeply integrated with practical scenarios such as rural digital governance, digital agricultural development, and agricultural product e-commerce operations. Consequently, this leads to a severe disconnection between the training provided and the actual needs. Simultaneously, due to the lack of hands-on practical guidance and regular follow-up support, the outcomes of cultivation struggle to be effectively translated into tangible improvements in the real-world effectiveness of rural governance.

2.3 The "last-kilometer" implementation gap for translating digital literacy into practice remains unresolved The key to enhancing village cadres' digital literacy lies in sustained practical application. Currently, the digital governance system in rural areas is not yet fully established, and the operational processes for village affairs management and services have not undergone comprehensive digital transformation. Furthermore, the integration of digital technologies with core tasks such as government affairs transparency, public service delivery, and industrial management remains superficial. Consequently, after acquiring basic digital skills, village cadres lack consistent and structured application scenarios to consolidate and deepen their practical capabilities. This directly hinders the effective translation of digital literacy into tangible governance outcomes. Moreover, the absence of local digital skill leaders to provide exemplary guidance in some villages makes it difficult to foster a digital application atmosphere characterized by mutual learning, knowledge sharing, and healthy competition. This further impedes the transformation and upgrading of digital literacy.

2.4 Incentive mechanism for enhancing digital literacy urgently needs improvement Establishing a sound and effective incentive mechanism is a crucial driver for promoting the enhance-

ment of village cadres' digital literacy. However, the current relevant incentive mechanisms still require further refinement. On the one hand, during the recruitment process for village cadres, digital literacy and skills have not been explicitly incorporated as core assessment criteria. On the other hand, within the performance appraisal system for village cadres, indicators related to the improvement of digital skills and the innovative application of digital tools are assigned relatively low weightings. This results in low motivation and a weak sense of achievement among some cadres regarding their investment in digital skill acquisition, thereby failing to generate an effective incentive effect.

3 Theoretical logic of distance open education empowering the enhancement of rural cadres' digital literacy

3.1 Facilitating equity and inclusivity in cadre education through open learning The openness of distance open education provides a learning pathway for enhancing the digital literacy of the village cadre cohort. "Openness" constitutes the most fundamental and defining characteristic of distance open education, distinguishing it essentially from traditional education models. It breaks down the barriers of traditional education, enabling equitable access to continuing education opportunities for all members of society and genuinely realizing the inclusive development of education. This openness is not confined to a single dimension but represents a multi-layered, systematic conceptual framework. First, comprehensive openness in educational access. Distance open education reduces the stringent admission restrictions inherent in traditional education, dismantling enrollment barriers. By employing a registration-based admission system that verifies foundational educational qualifications, it provides village cadres with opportunities for continuing education. Second, flexible openness in the teaching-learning process. Distance open education grants learners significant autonomy and flexibility. Learners can independently schedule their study time and flexibly control their learning pace according to their work and life rhythms, thereby constructing a lifelong learning environment for village cadre learners characterized by "learning anytime, anywhere". Third, open sharing of educational resources. By integrating and sharing high-quality course resources developed by top experts and excellent teachers nationally and even globally, it achieves the openness and sharing of courses, teaching content, and knowledge with the public, enabling village cadre learners to access learning resources suited to their competency needs.

3.2 Bridging the "last-kilometer" gap in cadre digital literacy cultivation through digital empowerment Digital technology is the cornerstone upon which distance open education exists and develops. Constrained by spatiotemporal limitations and high costs, traditional education models struggle to cover all village cadres, particularly those in remote areas. Distance open education leverages digital media such as the internet and mobile terminals to construct an online learning space that transcends spatiotemporal constraints, fundamentally resolving the prominent work-study conflict faced by village cadres. It enables regularized learning characterized by "no need to leave the village or the post", effectively overcoming the "last-kilometer" challenge in sustained learning, thereby ensuring the equity and accessibility of opportunities for enhancing digital literacy. Secondly, distance open education integrates teaching modes such as live interactive sessions, virtual simulations, and community discussions. Through interactive, practice-oriented, and immersive teaching scenarios, it addresses the issue of insufficient practicality. For instance, using virtual simulation technology, it constructs virtual scenarios like smart rural governance, allowing village cadre learners to immerse themselves in rural governance contexts and conduct digital governance process drills. Additionally, through live interactive sessions, it facilitates real-time Q&A and in-depth exchanges and discussions between village cadre learners and experts, simulating the resolution of digital governance challenges encountered in actual work.

3.3 Achieving supply-demand alignment in cadre digital literacy cultivation through precision empowerment Adhering to a learner-need-oriented teaching philosophy, distance open education can provide village cadre learners with customized, modular learning plans and resources. On the one hand, leveraging big data analysis, it creates a "digital profile" for each village cadre learner. Utilizing an online assessment system, it conducts precise diagnostics of their digital literacy and skill levels across multiple dimensions, including information retrieval, office software proficiency, data analysis, and data security. This helps them identify knowledge gaps and skill deficiencies. On the other hand, based on the digital competency assessment, it intelligently generates personalized learning pathways, accurately matches learning resources, and provides a modular curriculum system, including course resources on basic operations, government affairs applications, data analysis, e-commerce operations, *etc.*, thereby achieving precise alignment between learning needs and resource provision. This contributes to stimulating the intrinsic motivation of village cadre learners to enhance their digital literacy.

3.4 Promoting the transformation of digital literacy into digital governance efficacy through outcomes conversion Distance open education establishes an "overpass bridge" for the conversion of learning outcomes (such as the credit bank system), thereby creating a value conversion center for the personal learning and capabilities of village cadres. The credit bank system, by establishing a standardized credit system, converts learners' specific learning or work achievements into standard credits. Learners can then redeem their accumulated credits for other types of learning outcomes as needed, thereby enabling the conversion between different learning outcomes. Specifically, through the outcomes con-

version mechanism of distance open education, the tangible results achieved by village cadre learners in rural digital governance can be converted into standard credits. Learners can accumulate and redeem these credits for corresponding learning outcomes (such as academic diplomas, skill certifications, *etc.*). Furthermore, such learning outcomes can serve as significant bonus items in the performance appraisal of village cadres, effectively stimulating their motivation to continuously enhance their digital literacy, thereby accelerating the translation of digital literacy into tangible rural digital governance efficacy.

4 Practical pathways for distance open education to empower the enhancement of rural cadres' digital literacy

4.1 Further streamlining the pathways for educating and cultivating village cadres

4.1.1 Creating flexible "admission pathways". On the one hand, further dismantle the access barriers of traditional education, appropriately relax academic qualification thresholds, and place greater emphasis on practical experience. Factors such as the years of service, job contributions, and honors received by village cadres should be treated as equally important criteria in the admission review process.

4.1.2 Innovating the "online + offline" blended teaching model. "Online Classroom" primarily delivers core course resources to learners via mobile apps and computer platforms. "Offline Practice" involves establishing learning centers in counties and townships to regularly organize face-to-face tutorials, case study discussions, and practical exercises. "Delivering Education to the Countryside" entails field experts and technical specialists traveling to the rural frontline to provide on-site teaching and guidance to learners.

4.1.3 Broadening diversified certification channels. Learners can obtain nationally recognized academic diplomas by participating in degree upgrading programs and completing the required credits. Through specialized competency certifications, micro-credentials are awarded for specific skills (*e.g.*, Rural Data Analyst, Rural E-commerce Leader), thereby certifying digital competencies. Feeding learners' learning outcomes and competency certifications back to local organizational departments enables their use as important references for performance appraisals, awards, and promotions. Through the above empowerment pathways, a comprehensive, end-to-end education and cultivation channel—from "entry" to "exit"—is further opened for village cadre learners.

4.2 Promoting the digitalization of teaching, practice, and support services

4.2.1 Building a one-stop, intelligent mobile learning platform. By constructing a one-stop, intelligent mobile learning platform, high-quality digital educational resources and online learning services are provided to village cadre learners.

This includes features such as creating digital literacy and skills learning portfolios and offering one-on-one remote assistance from "digital mentors."

4.2.2 Creating an integrated cultivation model of "learning, research, and application". Specifically, by regularly organizing online competitions such as digital governance case contests, rural revitalization short video contests, and specialty product online store design contests, the outcomes of digital skill learning are transformed into practical innovation achievements. Additionally, leveraging smart learning management systems to implement project-based learning, incorporating "digital empowerment micro-projects" into practical learning and assessment components, such as establishing standardized management systems for village WeChat groups or designing online marketing plans for local specialty products, thereby driving the transformation of cultivation outcomes into applied learning.

4.3 Developing systematic and localized digital education resources

4.3.1 Constructing a modular digital literacy cultivation curriculum system. It is necessary to divide the digital literacy required for village cadres into content modules such as Basic Operations, Smart Party Building, Digital Benefits for the People, E-commerce Assisting Agriculture, and Rural Big Data. This supports village cadre learners in pursuing on-demand learning, shifting the paradigm from "learning what is taught" to "addressing what is lacking", thereby fundamentally resolving the supply-demand mismatch issue in their digital literacy cultivation.

4.3.2 Developing and building a localized case repository. Based on the actual conditions of local rural governance, each region should collect typical cases of digital governance practices, comprehensively covering governance scenarios such as online rural government affairs, digitalization of rural industries, intelligent rural management, digitization of rural services, digitalization of rural culture, and digital citizen participation. Fully integrating the learning characteristics and digital competency needs of village cadre learners, and utilizing digital formats such as micro-courses, short videos, and virtual reality, a systematic repository of localized digital education resources can be developed.

4.4 Exploring the construction of a complementary credit bank system for village cadres' digital literacy cultivation It is necessary to actively explore embedding the credit bank system into the village cadre digital literacy cultivation framework to establish a long-term incentive mechanism. First, it is necessary to incorporate digital literacy training into the assessment and promotion system for village cadres. Learners accumulate credits by completing courses, passing assessments, and submitting practical case studies, which serve as the basis for certifying their digital competencies. Second, it is necessary to establish competency certification standards by dividing digital literacy into specific

competency units, and assign corresponding credit values to each unit. Crucially, it is necessary to include outstanding achievements in the application of digital skills by village cadres and the effectiveness of rural digital governance within the scope of credit certification, such as e-commerce entrepreneurship results, award certificates, and exemplary cases of digital village construction, assigning them significant weightings. These can be recognized as credits after expert review and unified verification. Third, it is necessary to establish implementation rules for credit redemption and open up redemption channels, allowing village cadre learners to redeem their digital competency credits for academic course credits, professional qualification certificates, or as key evidence for awards and commendations. This effectively stimulates their endogenous motivation to enhance their own digital literacy.

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clearly discern differences in spatial effect, functional layout, and aesthetic expression across the proposals. For instance, in a waterfront landscape design project, instructors can use AI to generate contrasting images of a modern minimalist style and a naturalistic wildscape style, helping students and evaluators quickly determine which style better aligns with the site's practical requirements and design objectives.

3 Conclusions

Image-generative AI technology offers new opportunities for innovation in undergraduate Landscape Architecture courses. When applied appropriately, this technology can effectively stimulate students' creative potential, broaden their design thinking, and significantly enhance the visual presentation of spatial scenes. Looking ahead, as image-generating AI continues to advance and educational approaches evolve, its application in Landscape Architecture education is expected to become more widespread and deeply integrated. This progression will help lay a solid foundation for cultivating highly skilled professionals in the field.

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