

## Article

# Research on the Practical Path of the 1+X Model of Open Education Courses Empowered by Digitalization and Intelligence

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**Abstract:** With the rapid development of information technology and the profound transformation of contemporary educational forms, open education, serving as an increasingly important component of the comprehensive lifelong education system, is currently facing the dual challenges of digital transformation and high-quality development. Based on the strategic background of the "1+X Certificate System," this paper systematically explores how emerging digital and intelligent technologies can effectively empower the construction and optimization of open education courses. The primary objective is to build a highly student-centered and competency-based curriculum alongside an innovative teaching system that meets modern pedagogical demands. By comprehensively analyzing the current status and inherent limitations of traditional open education courses, this study identifies the optimal integration path for digital and intelligent technologies. Furthermore, it investigates the systematic construction of practical teaching frameworks and the necessary reform of talent cultivation mechanisms to align with industry requirements. Consequently, this paper proposes a robust "theory + practice" dual-driven curriculum construction model designed to bridge the gap between academic knowledge and vocational skills. The ultimate goal of this research is to significantly promote the digital, intelligent, and personalized development of open education courses. By doing so, it provides valuable theoretical references and actionable practical paths for the high-quality development of regional education, ensuring that learners are adequately equipped with the versatile competencies required in today's rapidly evolving, technology-driven global workforce.

**Keywords:** digitalization; open education; certificate system; curriculum development; practical teaching

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## 1. Introduction

Open education is widely acknowledged as a pedagogical framework that emphasizes flexibility, inclusiveness, and accessibility, enabling learners from diverse backgrounds to access educational resources and opportunities. This model has seen significant global integration and expansion, driven by the increasing demand for equitable and adaptable learning systems. Concurrently, the emergence of "Digital-Intelligence" technology, which represents the convergence of digitalization and intelligentization, is revolutionizing educational structures. This transformation transcends the mere addition of technological tools, instead fostering a systemic evolution in how education is delivered and experienced [1]. By leveraging comprehensive data collection, robust platform architectures, and advanced algorithmic capabilities, this paradigm integrates cutting-edge technologies such as machine learning, artificial intelligence, natural language processing, and educational big data analytics. The result is an educational empowerment system capable of autonomous perception, in-depth

analysis, strategic decision-making, and real-time feedback, thereby enhancing the overall learning experience and outcomes for students and educators alike.

Traditional educational models, which primarily rely on physical classrooms and instructor-led teaching, are increasingly unable to address the evolving needs of modern learners. These learners often seek personalized, lifelong, and fragmented learning pathways that align with their individual goals and schedules. In response to these challenges, the "1+X Certificate System" introduced by the Chinese government offers a forward-looking approach to curriculum development within the framework of open education. This system, underpinned by digital-intelligence technology, aims to create a learner-centered educational ecosystem that aligns with contemporary demands for flexibility and adaptability. The "1+X" structure integrates foundational knowledge (the "1") with specialized skills and competencies (the "X"), providing a comprehensive framework for skill development and certification. This approach not only addresses the immediate needs of learners but also contributes to the broader goal of modernizing the national human capital development framework [2, 3]. By fostering a more dynamic and responsive educational system, the "1+X Certificate System" holds significant theoretical and practical value in advancing the quality and accessibility of education in the digital age.

## 2. Literature Review

Scholars globally have conducted extensive and rigorous inquiries into the empowerment of education via digital-intelligence and the implementation of the "1+X" certificate system [2]. Current research primarily converges on three critical dimensions, reflecting the multifaceted nature of these advancements and their implications for educational reform. These dimensions encompass macro-strategic considerations, curriculum and pedagogy innovations, and mechanisms for nurturing talent and ensuring quality. By examining these areas, researchers aim to uncover the transformative potential of digital-intelligence technologies and their integration with national educational frameworks, thereby contributing to the broader discourse on systemic educational evolution.

At the macro-strategic level, academic discourse has deeply analyzed the pivotal role of digital-intelligence in promoting high-quality development within Chinese higher education in the new era. These studies highlight how such technology serves as a critical driver for systemic educational reform, enabling institutions to adapt to the demands of a rapidly evolving digital landscape [4]. Simultaneously, the "1+X" system has been explored as a national initiative designed to deepen the integration of industry and education. This system aims to reconstruct talent cultivation frameworks by aligning educational objectives with industry needs, thereby fostering a more dynamic and responsive educational ecosystem. Theoretical interpretations and strategic mappings have provided valuable insights into the implementation of this system, offering a foundation for its broader application across diverse educational contexts.

In the realm of curriculum design, pedagogy, and learning experience, research has become increasingly refined, reflecting the nuanced challenges and opportunities presented by digital transformation. On one hand, the development of construction models, technical applications, and optimization strategies for micro-courses in open education has emerged as a focal point. These efforts aim to enhance the accessibility and effectiveness of educational content, ensuring that learners can engage with materials in a meaningful and impactful manner [5]. On the other hand, the creation of "1+X" online open courses within a digital context has been a significant area of exploration. These courses are designed to reconstruct the design logic and learning experience from a "student-centered" perspective, prioritizing learner engagement and knowledge retention. By leveraging digital tools and methodologies, educators are better equipped to meet the diverse needs of students, fostering a more inclusive and adaptive learning environment.

Regarding the nurturing mechanism and quality assurance, research has emphasized the integration of moral education, often referred to as Curriculum Ideology and Politics,

within open education. This approach ensures that talent development aligns with broader societal and ethical objectives, providing students with a well-rounded educational foundation. Additionally, studies have focused on the development of robust pedagogical operation mechanisms to support the implementation of digital-intelligence teaching. These mechanisms are designed to ensure stability and efficiency, enabling educators to deliver high-quality instruction while adapting to the dynamic demands of digital transformation [6, 7]. By addressing these critical aspects, researchers aim to create a sustainable and effective framework for digital-intelligence education, ensuring its long-term success and impact.

Despite these achievements, current research possesses inherent limitations that must be addressed to fully realize the potential of digital-intelligence technologies. Most existing studies adopt a generalized national perspective or focus on the experiences of developed eastern regions, often proposing universal frameworks that fail to account for the unique strategic positioning and developmental requirements of Western China [8, 9]. This oversight has significant implications, as it restricts the ability to synthesize advanced global experiences with the specific industrial characteristics, regional cultural backgrounds, and existing digital ecologies of the Western region. Consequently, this research gap hinders the precise implementation of national designs and limits the regional benefits of digital-intelligence advancements. To address this issue, this paper explores a localized practical path with Chengdu-specific characteristics. By providing a regional case study, it contributes to the "Digital-Intelligence + 1+X" theoretical map and offers a replicable model for similar regions, thereby advancing the discourse on localized educational innovation.

### **3. Curriculum Setting of Digital-Intelligence Empowered Open Education under the 1+X Model**

To establish a robust theoretical foundation for the "1+X" model in digital-intelligence-empowered open education, this paper introduces a pyramid-style curriculum framework that emphasizes "Student Competency Output" as its central focus [10]. This framework is designed to systematically guide the development of students' abilities, ensuring that their academic and vocational skills are seamlessly integrated. By prioritizing competency output, the curriculum aims to align educational objectives with the practical demands of the digital economy, fostering a holistic approach to learning that bridges theoretical knowledge and applied skills.

The structure of the curriculum framework is meticulously defined to ensure comprehensive learning outcomes. At its base are the Professional Foundation Courses, which aim to solidify students' general theoretical knowledge and essential disciplinary literacy. These foundational courses provide the groundwork for understanding core concepts and principles across various fields. Building upon this base, the Professional Core Courses form the central body of the framework, focusing on critical knowledge and skills that are directly aligned with the vocational requirements of "X" certificates. These core courses are designed to equip students with the expertise needed to meet industry standards and excel in their chosen professions. At the apex of the framework are the Professional Expansion Courses, which are oriented toward cutting-edge industrial developments and interdisciplinary integration. This tier allows students to exercise autonomy in selecting and combining modules that align with their personalized career trajectories, enabling them to acquire advanced knowledge and transfer competencies across domains. The "Foundation-Core-Expansion" hierarchy serves as the theoretical cornerstone for the integration and progressive development of academic education ("1") and vocational skills ("X"), ensuring a balanced and dynamic approach to learning.

Building upon this theoretical foundation, the paper proposes a comprehensive practical teaching system known as the "4343 system," which translates abstract concepts into actionable teaching strategies. This system is designed to cultivate four core competencies: professional proficiency, comprehensive analysis, practical application, and innovative thinking. By focusing on these competencies, the system ensures that

students are equipped with the skills necessary to navigate the complexities of the digital economy and contribute meaningfully to their fields [11]. The "4343 system" represents a structured approach to competency development, bridging the gap between theoretical knowledge and practical application.

Competency cultivation within the "4343 system" is embedded into a "Three-Stage" process that encompasses pre-class preparation, in-class interaction, and post-class reinforcement. This staged approach ensures that learning is continuous and adaptive, allowing students to build upon their knowledge and skills incrementally. The system further dismantles traditional boundaries of time and resources through "Four Combinations": teaching and learning, learning and practicing, online and offline, and on-campus and off-campus. These combinations create a flexible and integrated learning environment that accommodates diverse educational needs and maximizes resource utilization. By leveraging these combinations, the system fosters a dynamic and inclusive approach to education that transcends conventional limitations.

1. Course Teaching Platforms, such as Smart Learning Systems, play a pivotal role in facilitating knowledge interaction within the "4343 system." These platforms provide students with access to interactive learning tools and resources, enabling them to engage with course materials in a meaningful and efficient manner. By integrating advanced technologies, these platforms enhance the learning experience and support the development of critical thinking and analytical skills.
2. Practical Training Platforms, including Virtual Simulation Labs, are integral to skill validation within the "4343 system." These platforms offer students the opportunity to apply theoretical knowledge in simulated environments, allowing them to develop and refine their practical skills. By providing a safe and controlled setting for experimentation and practice, these platforms ensure that students are well-prepared to meet the demands of real-world scenarios.
3. School-Enterprise Cooperation Platforms, such as Industry Academies, facilitate authentic project experiences that bridge the gap between academic learning and professional practice. These platforms enable students to collaborate with industry experts on real-world projects, providing them with valuable insights into workplace dynamics and expectations. By fostering partnerships between schools and enterprises, these platforms enhance the relevance and applicability of education, ensuring that students are equipped to succeed in their careers.

This "4343" innovation system establishes a closed-loop process that seamlessly integrates theory and practice, ensuring the unification of standardized and personalized talent cultivation through digital empowerment. By aligning educational strategies with the evolving demands of the digital economy, the system provides a comprehensive framework for developing well-rounded and adaptable professionals [12]. The closed-loop approach ensures that students receive a balanced education that prepares them for both academic and vocational challenges.

To further encapsulate the "student-centered" philosophy of high-quality education, this paper constructs a stepped and progressive practical curriculum system. This system is designed to address the diverse growth needs of students across different academic years, ensuring that their educational journey is both structured and adaptable. By emphasizing student-centered learning, the curriculum system fosters an environment that prioritizes individual development and achievement [2].

- Practical sessions within the curriculum system are staged to align with the developmental needs of students across various academic years. Competitions are utilized as a dynamic tool to drive both learning and teaching, encouraging students to engage actively with course materials and apply their knowledge in competitive settings. This approach not only enhances learning outcomes but also fosters a spirit of innovation and collaboration among students.
- The teaching cohort is expanded to include school faculty, industry experts, and administrative staff, fully implementing a "Total-Staff Nurturing" mechanism. This inclusive approach ensures that students benefit from diverse perspectives and

- expertise, enriching their educational experience and preparing them for the multifaceted challenges of the digital economy. By involving a wide range of stakeholders, the system promotes a collaborative and holistic approach to education.
- Using the curriculum as a lever, the system integrates "One Center" (the student), "Four Competencies," "Three Levels" (Basic, Professional, and Comprehensive practice), "Four Modules" (Disciplinary, Skill-based, Interdisciplinary, and Innovative), and the "Three Platforms" mentioned above. This multi-dimensional approach ensures that the practical teaching system is both rigorous and adaptable to the evolving demands of the digital economy. By aligning educational strategies with industry requirements, the system fosters a dynamic and responsive learning environment that prepares students for success in their academic and professional pursuits.

#### **4. Practical Paths for Digital-Intelligence Empowering Open Education under the 1+X Model**

##### *4.1. Constructing a Three-Level Integrated Framework of "Foundation-Core-Expansion"*

The primary task in constructing the "Foundation-Core-Expansion" three-level integrated framework is the systemic restructuring of the traditional curriculum architecture to establish a modular system compatible with the vocational skill level certificate system [13]. Traditional open education has long faced challenges such as the separation of academic education from vocational training and the misalignment between course content and the demands of industry. To address these issues, it is essential to harness the potential of digital-intelligence technologies. This framework is designed to achieve a seamless integration and progressive development of academic qualifications alongside skill acquisition, ensuring that learners are better equipped to meet the evolving needs of the workforce. By restructuring the curriculum, this approach aims to create a more cohesive and adaptable educational system that bridges the gap between theoretical knowledge and practical application.

At the Foundational Level, it is necessary to break down disciplinary barriers to integrate general education, professional basics, and vocational literacy. By employing AI-driven algorithms to construct interdisciplinary knowledge graphs, learners can access a consolidated intellectual foundation that supports lifelong development. This foundational integration ensures that students acquire a broad base of knowledge and skills that are essential for adapting to diverse career paths. The Core Level emphasizes aligning educational content with the technical requirements of vocational certificates. This involves embedding professional industry standards directly into the curriculum, enabling learners to engage in "Integration of Learning and Doing" through advanced tools such as high-fidelity virtual simulations and project-based learning. These methods provide practical, hands-on experiences that mirror real-world scenarios, enhancing the relevance and applicability of the education provided. The Expansion Level focuses on leveraging intelligent technologies to create a dynamic and open-ended repository of curriculum resources. This repository allows learners to autonomously select modules that align with their unique career goals, fostering personalized competency development. Additionally, the application of blockchain technology ensures the credible recording and seamless circulation of learning outcomes. This innovation bridges the gap between formal and non-formal education, creating a flexible and transparent lifelong learning ecosystem. By integrating these levels, the framework supports a holistic approach to education that not only meets current industrial demands but also anticipates future trends, ensuring that learners remain competitive in an ever-changing global landscape.

##### *4.2. Developing a "Theory-Practice" Dual-Drive Smart Teaching Ecology*

A core practical path for digital-intelligence-empowered open education involves constructing a learner-centered, competency-based smart teaching ecology. This approach addresses prevalent challenges such as the disconnect between theoretical teaching and practical application, as well as the inadequacies in hands-on training. By

leveraging digital intelligence technology, it becomes possible to achieve a seamless integration of theoretical instruction with practical exercises, fostering a pedagogical model that combines online and offline learning, merges virtual and real-world experiences, and promotes collaboration between educational institutions and enterprises. This innovative framework ensures that learners are equipped with both theoretical knowledge and practical skills, enabling them to adapt effectively to dynamic professional environments. Furthermore, the integration of digital tools facilitates the creation of a more interactive and engaging learning experience, enhancing the overall effectiveness of the educational process.

In the realm of theoretical instruction, intelligent tutoring systems based on knowledge graphs can be implemented to provide personalized learning pathways tailored to individual needs. These systems offer continuous support through virtual teaching assistants and automated question-and-answer bots, ensuring learners receive guidance at every stage of their educational journey. For practical instruction, a tiered and progressive system should be established, beginning with virtual simulations that allow learners to practice in controlled environments. This is followed by remote real-world operations, which provide exposure to authentic scenarios, and culminates in participation in corporate projects that mirror actual industry practices. Such a progression enhances operational proficiency and professional adaptability, preparing learners for real-world challenges. The cornerstone of this pedagogical innovation lies in the establishment of an integrated "Teaching-Training-Evaluation" mechanism. By embedding competency assessments, such as "X" certificate evaluations, directly into the instructional process and utilizing big data analytics to monitor skill development in real-time, a closed-loop system of "Learning-Practicing-Evaluating-Improving" is created. This iterative process not only elevates the quality of talent cultivation but also ensures that graduates possess a competitive edge in the labor market. Additionally, the use of advanced analytics enables educators to identify areas for improvement and refine instructional strategies, thereby fostering continuous enhancement of educational outcomes.

#### *4.3. Constructing a Data-Driven Full-Chain Governance System*

The deeper significance of digital intelligence in open education lies in its potential to modernize educational governance. This transformation involves the development of a comprehensive, data-driven quality assurance system that spans the entire educational process, including curriculum design, instructional implementation, learning evaluation, and ongoing improvement. Traditional quality monitoring methods, which depend heavily on manual intervention and summative evaluation, often face challenges such as delays in feedback and a lack of precision. In contrast, digital intelligence introduces the capability for real-time monitoring, precise diagnostics, and intelligent early warning systems, enabling a more responsive and effective governance framework. By leveraging these advanced technologies, educational institutions can address inefficiencies and enhance the overall quality of education delivery.

In the area of curriculum construction, a dynamic optimization mechanism should be established, driven by the analysis of learning behavior data [9]. Key metrics such as dropout points, resource utilization rates, and question discrimination indices can be analyzed to enable the continuous and iterative refinement of course content. This ensures that the curriculum remains relevant and effective in meeting learners' needs. During the instructional process, data from various platforms should be integrated to create a robust teaching quality monitoring system. By defining key performance indicators (KPIs) and implementing automated warning mechanisms, management can achieve a higher level of precision and refinement in instructional oversight. For learning evaluation, the system should promote a shift toward diversified, process-oriented, and competency-based assessments. This approach includes the involvement of multiple evaluative participants, such as industry experts and peers, to provide a more comprehensive assessment of learners' abilities. Additionally, the use of blockchain technology can ensure the

immutability and credibility of evaluation results, enhancing trust in the assessment process. Simultaneously, a "Credit Bank" system should be developed and integrated with "X" certificates to facilitate the accumulation, transfer, and certification of learning outcomes. This system supports the transition of open education from experience-based management to data-driven governance, providing a strong institutional foundation for the sustainable development of the 1+X model. By adopting these measures, the educational system can achieve greater efficiency, transparency, and adaptability, ensuring that it meets the evolving demands of learners and society.

## 5. Conclusion

The empowerment of the 1+X model in open education through digital-intelligence technology signifies a transformative leap in the educational landscape, transcending the mere integration of technical tools to redefine the foundational structure of the ecosystem itself. This paradigm shift marks a departure from traditional educational philosophies centered on "Knowledge Transmission" and ushers in a new era focused on "Competency Empowerment." By fostering dynamic and modular curriculum structures, this approach enables a more adaptive and responsive educational framework that aligns with the evolving needs of learners and industries. Furthermore, the integration of data-driven decision-making and human-machine synergy revolutionizes pedagogical practices, allowing for more precise interventions and personalized learning experiences. The implications of this shift extend beyond the classroom, influencing institutional strategies and policy-making to create a more cohesive and forward-thinking educational system.

Such a systemic transformation holds the potential to propel open education toward unprecedented levels of personalization, intelligence, and cross-domain integration. As digital-intelligence technologies continue to advance, their application in curriculum design, pedagogical evaluation, and resource management must be further refined to address the diverse needs of learners, particularly working adults seeking flexible and accessible educational opportunities. This evolution is critical for establishing a robust foundation for lifelong learning, ensuring that education becomes universally accessible regardless of time or location. By prioritizing adaptability and inclusivity, this transformation supports the development of a resilient and technologically advanced learning society capable of addressing global challenges and fostering innovation. Future research should explore the optimization of human-machine collaboration in educational settings, the ethical implications of data-driven methodologies, and the scalability of modular curriculum designs to ensure equitable access and sustainable growth. Additionally, the role of emerging technologies such as artificial intelligence and machine learning in enhancing pedagogical practices warrants deeper investigation to unlock their full potential in shaping the future of education.

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