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RESEARCH ARTICLE

Leading the Digital Transformation of Higher Education Through the Reform of Digital Intelligence Education: Exploration and Practice at Wuhan University

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Abstract The Ministry of Education of the People's Republic of China has proposed the deep integration of digital intelligence (DI) technologies into the higher education system to achieve a fundamental transformation. In response to the global imperative for digital transformation in higher education, the research investigates how Wuhan University systematically implements DI technologies across teaching, management, and service to cultivate innovative talents. With a focus on talent development, Wuhan University has built an integrated teaching platform and developed a DI education evaluation system. The research offers practical insights for higher education institutions navigating digital transitions and advancing global DI education practices. By fully integrating DI technologies and concepts into all aspects of teaching, management, and service, the reform aims to create a new synergy between DI technologies and the higher education system. This integration enhances the university's abilities to seize opportunities and meet challenges in the DI era, thereby providing comprehensive support for cultivating top innovative talents.

Keywords digital intelligence education, digital transformation, artificial intelligence, higher education, Wuhan University

1 Introduction

As digital transformation accelerates worldwide, developed countries and international organizations have introduced a series of policies for the digital development of education, recognizing it as a key component of national digital strategies (Wu et al., 2022). Educational digitalization is viewed as a significant breakthrough for China and creates new advantages in the educational areas (Zhu & Hu, 2022). China's digital technologies have entered the digital intelligence (DI) stage, and have influenced social life.

Despite global progress in DI education, two critical gaps remain. First, existing studies focus on isolated technological applications rather than systemic integration across teaching, management, and ecosystem development. Second, few institutions have empirically tested comprehensive frameworks for DI transformation, resulting in a lack of actionable models. In this context, it has become essential to advance the digital transformation of traditional higher education and its evolution toward DI education.

This research aims to address the gaps in systemic DI integration and the shortcomings in related research by analyzing Wuhan University's holistic approach, which uniquely combines platform construction, tiered talent training, and ethical governance. By proposing a replicable framework for higher education transformation, this research contributes a blueprint for institutions to balance innovation with operational feasibility, thereby facilitating the digital transformation of traditional higher education and its evolution toward DI education.

2 Importance of Digital Transformation in Higher Education

Since the advent of the information age, digital transformation has been a key focus for universities worldwide. However, using digital technologies merely as auxiliary tools is no longer sufficient to meet the essential and contemporary requirements for talent development in higher education institutions (Li et al.,

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2022). It is essential to fully integrate digital technologies with higher education to facilitate its transformation toward DI education while elevating talent development to a new dimension. DI transformation can facilitate the cultivation of innovative DI talents, achieve multilevel DI talent training, integrate DI technologies across disciplines and industries, and accelerate the advancement of future DI technologies.

2.1 | Intrinsic Logic of Talent Cultivation in Universities

Promoting the personalized and diversified development of students is the core logic of higher education development. To cultivate high-quality talents, institutions need to utilize DI technologies to optimize resource allocation and collect systematically and manage educational data scientifically. This necessitates the adoption of DI technologies as a technical foundation for building integrated, scientific, and intelligent teaching management platforms, thereby facilitating the modernization of the higher education system. The emergence and rapid development of AI and other DI technologies transcend the boundaries of time and space, overcome resource constraints, and provide essential technical support for personalized education. Furthermore, diversified education relies on DI technologies to create a well-rounded growth environment heavily (Cai et al., 2024). In this environment, Big Data analysis helps align students' interests with employment needs. Meanwhile, educational institutions can leverage the insights from Big Data analysis to offer interdisciplinary courses, catering to students' diverse learning needs. Virtual reality (VR) and augmented reality (AR) technologies create immersive teaching scenarios, and online practice platforms transcend spatial and temporal boundaries to provide students with abundant practical opportunities.

2.2 | Contemporary Requirements for Talent Cultivation in Universities

Since the dawn of the DI era, DI technologies have been integrated into all fields and processes of economic and social development deeply. Core technologies, such as AI, pose challenges for systematic application and standardized management in higher education. The quality of DI talent training determines the pace and extent of future advances in DI technologies directly. Therefore, to enhance the effectiveness of higher education with DI technologies, universities are expected to integrate these technologies into all aspects of education effectively (Wu, 2024a). They need to explore feasible strategies to meet the demand for personalized education, transform talent training objectives, and overhaul evaluation systems to train a larger number of DI professionals to meet the demands of a rapidly developing society. In this regard, universities have abundant technological resources and inherent talent advantages. They should adopt a more open and inclusive approach to understanding and harnessing the challenges and opportunities that DI technologies bring to human society, particularly higher education. Universities should fulfil the mission of cultivating DI talents by advancing multilevel training coverage and promoting the interdisciplinary integration of DI elements, thereby providing a diverse and robust talent pool to support the future development of the DI society (Cheng et al., 2022). Moreover, to continuously advance the innovation-driven development of DI technologies, the DI era requires universities to explore future development directions and models for different disciplines. Therefore, universities should adjust their talent training objectives and evaluation systems shifting their focus from knowledge acquisition to competency development to meet the core demands of digital transformation.

3 Exploring Digital Transformation at Wuhan University

The concept of digital transformation in higher education remains undefined, necessitating collaborative exploration by the global higher education community. Drawing on its previous experience in instruction and management, Wuhan University has pioneered a comprehensive framework for digital transformation in higher education, which takes the cultivation of digital thinking as its foundation, the development of digital literacy as an extension, the refinement of DI courses as a key component, the classification of DI talents for support in different disciplinary and practical aspects, and the establishment of a DI platform as a guarantee of the successful operation. Moreover, Wuhan University proposes four core initiatives: first, adopting a stratified approach to cultivating DI talents to ensure comprehensive coverage of digital transformation across the entire campus; second, creating an integrated teaching platform supported by four real computing elements, including real data, real models, real computing power, and real scenarios, to provide essential technical and platform support for digital transformation; third, overhauling the educational evaluation system to enable more precise assessments of all aspects of education using DI technologies; fourth, building a new DI campus ecosystem to achieve the integration of higher education with DI technologies and philosophies. These initiatives complement each other and promote the

smooth implementation of Wuhan University's digital transformation by providing talent guarantee, technical support, and an accurate assessment system.

3.1 | Comprehensive and Tiered Training for Digital Intelligence Talent

In digital transformation, talent is essential to drive technological innovation and ensure successful transformation. However, universities face challenges currently. The talent cultivation systems are imperfect, with flaws in curriculum arrangement and evaluation mechanisms. There are significant disparities in specialized training, and industry–university–research collaborations in talent cultivation are integrated insufficiently (Zhang, 2024). Universities need to address the higher requirements of digital transformation for DI talent cultivation urgently. These higher requirements refer to the more stringent standards set by digital transformation, which call for DI talents to possess advanced digital skills, innovative thinking, and interdisciplinary knowledge. The goal of DI talent training is to ensure comprehensive coverage and category-based training driven by the inherent need for society-wide engagement and specialized professional education. Universities should develop an integrated and campus-wide DI talent training system based on thorough research and differences among disciplines. By leveraging campus-wide resources, institutions can create DI talent training platforms that serve both faculty and students, ensuring full coverage of data science knowledge acquisition and skills training while strengthening the tiered training of specialized DI talent.

Wuhan University has developed and issued several key documents(Meng, 2024; Wang, 2024; Wu, 2024a, 2024b, & 2024c; Zhang, 2024), which form a systematic framework for cultivating DI talent and developing DI education, as shown in Figure 1.

First, the university offers DI programs aimed at developing general knowledge-equipped, application-oriented, and professional talents, ensuring a seamless transition from high school to bachelor's, master's, and doctoral degrees. The programs are expected to cover eight major fields, including natural science, geospatial science, health and medical care, industrial production, finance and business, urban–rural government service, law and public opinion, and culture and society. A systematic path for the training of DI talent has been established (Zhang, 2024).

Second, the university has deeply integrated the core elements of DI education, such as AI and Big Data into the development of disciplines, programs, and curriculum systems, laying a solid foundation for DI

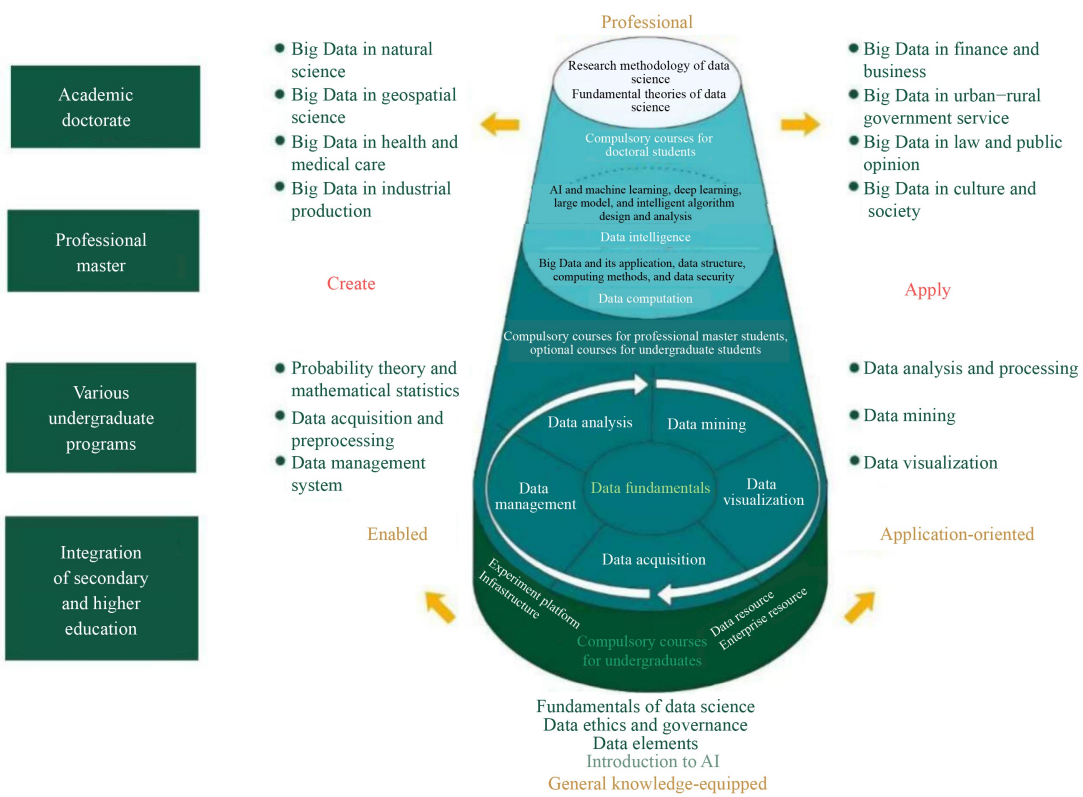

Figure 1 Schematic representation of the integrated curriculum system for training top innovation talent in DI. DI: digital intelligence.

education reform. Moreover, the university applies innovative and effective strategies, such as "classified + gradient" modular course selection, "integration + innovation" course arrangement, and "basis + scenario." The "classified + gradient" modular course selection categorizes courses by different attributes to set courses in progressive difficulty levels and presents contents in independent modules for students to choose from. The "integration + innovation" course arrangement combines interdisciplinary knowledge and teaching methods by innovating learning contents and forms. The "basis + scenario" differentiated teaching focuses on imparting fundamental knowledge, links it with practical application scenarios, and tailors teaching methods to students' differences. These strategies combine general and specialized educational approaches to define the contents, methods, and pathways for DI talent training.

Third, the university has moved beyond the traditional model of pure education by utilizing projects from its innovation and entrepreneurship center. These projects integrate the practical needs of DI talents both within and outside the campus, fostering high-quality collaborations with industry partners. These projects include the development of a robust system of university–enterprise cooperation courses, internships, and practices, creating a diverse and collaborative model, involving academia, industry, and research institutes (Wu, 2024b).

3.2 | DI Teaching Platform Supported by Four Real Computing Elements

Talent cultivation should be carried out based on high-quality teaching platforms. Based on the establishment of a DI talent cultivation system, the digital transformation of teaching platforms has become an important part of promoting the digital development of higher education. DI technologies promote open and shared access to DI educational resources. Educational models based on open and sharing platforms cater to diverse needs, promote fairness in education, and contribute to the development of DI education through feedback. Moreover, the contents and methods of teaching should ensure the integration of digital thinking, digital literacy, and intelligent computing skills with learners' academic disciplines and develop students' competencies in using real data, applying real models, experiencing real processing, and solving real problems.

First, Wuhan University has established the six-in-one platform as shown in Figure 2, which integrates a dataset, a toolkit, a computing pool, a standard set, a one-stop portal, and a DI community. The platform is equipped with experimental and innovative teaching tools for cultivating DI talents, covering all aspects of sharing, openness, interdisciplinarity, innovation, and entrepreneurship. This six-in-one platform embraces the integration of science and education, the integration of industry and education, and the mutual advancement between teaching and research (Meng, 2024). It focuses on four key elements, namely real data derived from genuine scientific requirements, real models based on computational science principles, real computing power with low-threshold and rapidly deployable computational capabilities, and real scenarios towards solving realistic scientific problems. Wuhan University's six-in-one platform, dedicated to building a comprehensive and practical solution, aims to support the digital transformation of teaching platforms and promote the digital development of higher education.

Second, Wuhan University has established a DI education practice and innovation platform that adopts advanced architectural designs, such as modular, distributed, and cloud-based dynamic frameworks, as shown in Figure 3. This is a pioneering exploration

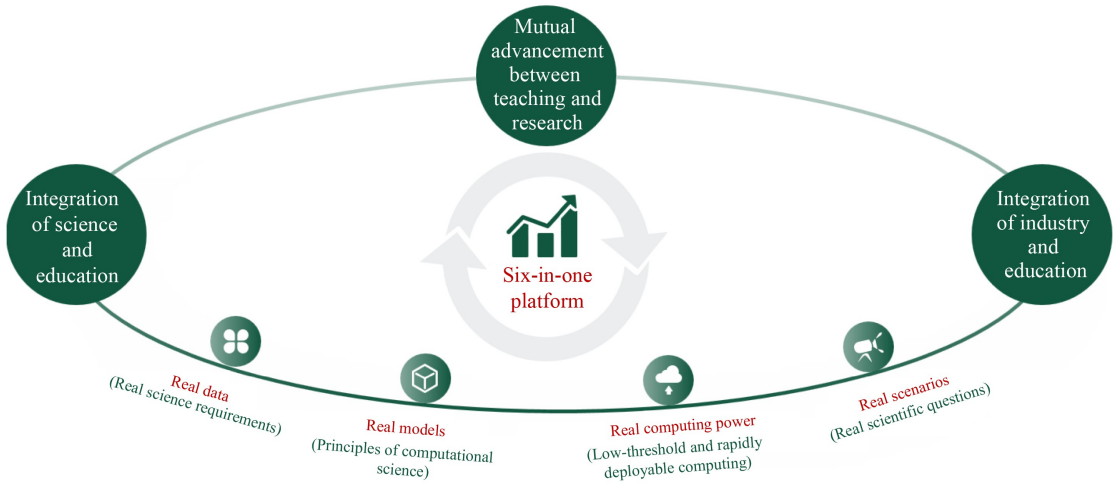

Figure 2 Six-in-one platform.

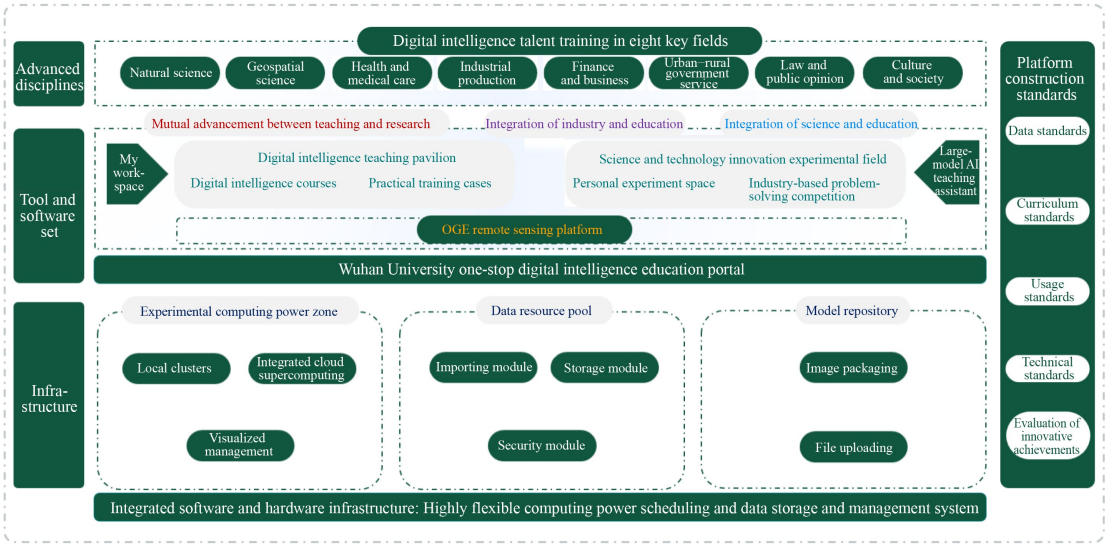

Figure 3 Overall framework of the digital intelligence education practice and innovation platform. OGE: open geospatial engine.

utilizing independent innovation technologies, such as AI Note, teaching and research mirrors, and container nodes, to create a professional, personalized, intelligent, open, and efficient teaching environment (Meng, 2024).

Third, Wuhan University has developed and upgraded the Luojia Online AI Teaching Center continuously, as shown in Figure 4. The center leverages the powerful engines of AI, Big Data, and cloud computing. It integrates knowledge resources, practical training cases, computing environments, AI teaching assistants, and other intelligent elements while pooling teaching, industry, and research resources to build a foundation for the DI education ecosystem.

3.3 | Digital Transformation of the Evaluation System

The upgrade of the teaching platform has facilitated teaching activities. However, to measure teaching effectiveness comprehensively, a scientific evaluation system is essential. Educational evaluation serves as a real-time measure of the outcomes of teaching management and services (Wang, 2024). Traditional educational evaluation, presented in textual formats, tends to be excessively abstract and rigid and fails to fully capture the results of teaching management and services. DI education inherently possesses robust capabilities in data collection, organization, analysis, and prediction. Moreover, DI technologies, with their timeliness and intelligence, provide powerful computational decision-making tools for building evaluation indicator systems. DI education evaluation mechanism enables quantitative and visualized assessments and accurately identifies decision-making and talent training gaps, thus providing more scientific and objective support for educational reform (Wang, 2024).

First, to address these challenges, Wuhan University has strived to create a DI education ecosystem characterized by comprehensive empowerment, efficient application, and scientific decision-making, focusing on enhancing these areas through the application of intelligent technology. First, the university has innovatively developed the "AI +" professional knowledge graph system. The system integrates knowledge systems, problem-based learning methods, and outcome-based education concepts. Utilizing a Big Data platform for teaching, it forms a system of three graphs, including a knowledge graph, competence graph, and quality graph. These graphs generate a matrix of various intelligence portraits, enabling fine and precise teaching management, and accurately reflecting the entire talent cultivation process.

Second, Wuhan University has created an AI teaching system that spans three major levels, including campus-wide, discipline-specific, to course-specific level. The AI teaching system integrates computational, perceptual, and cognitive intelligence and provides intelligent services to faculties and students in various scenarios and modules, including teaching, research, and practice.

Third, Wuhan University has established a DI education and teaching research center, which draws on the expertise of interdisciplinary specialists to advance research on the evaluation of DI education (Wu, 2024c).

3.4 | New Digital Intelligence Campus Ecosystem for Digital Transformation

Improving the evaluation system enhances teaching

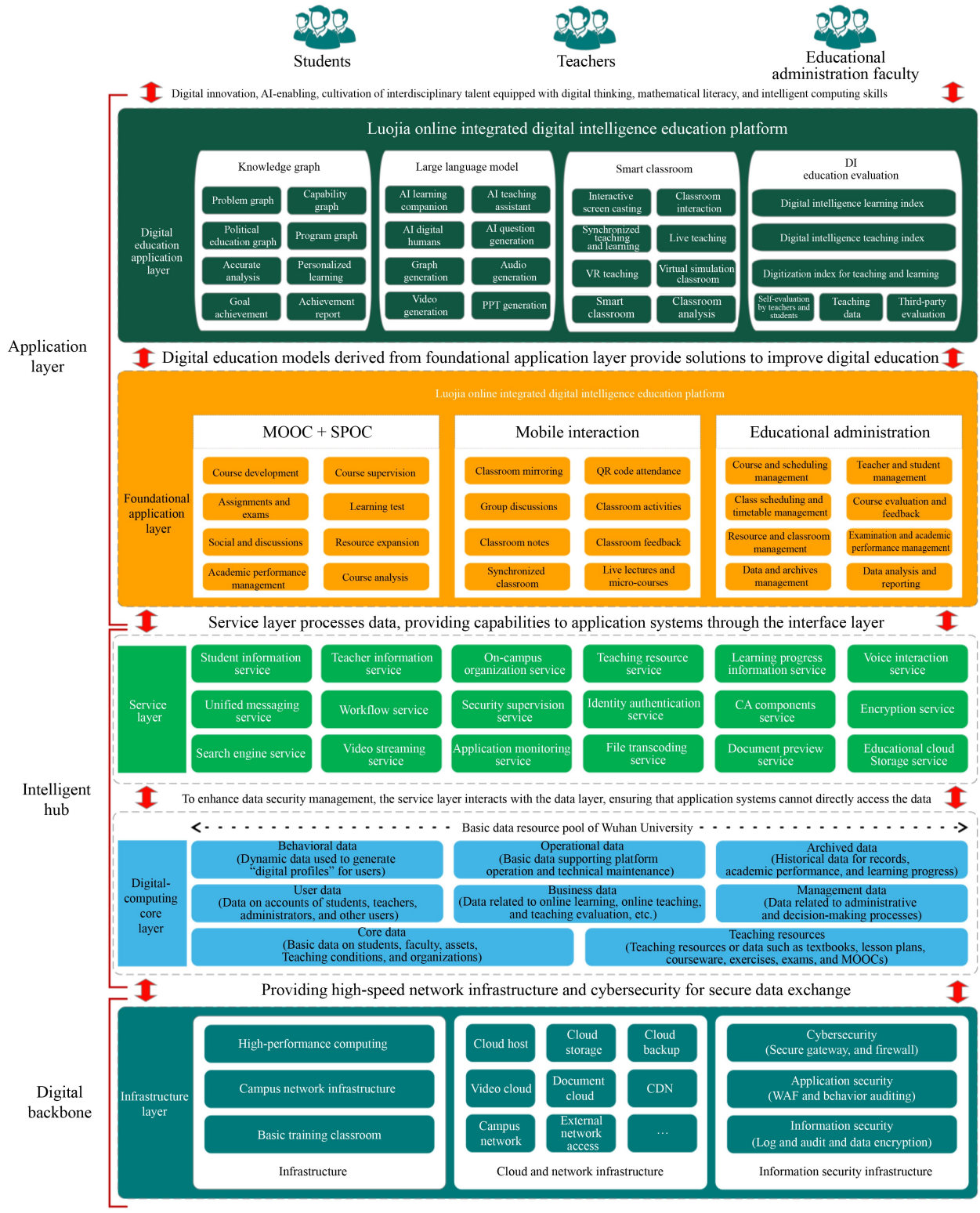

Figure 4 Framework of the Luojia Online AI Teaching Center. VR: virtual reality, QR: quick response, MOOCs: massive open online courses, SPOC: small private online course, CA: certificate authority, CDN: content delivery network, WAF: web application firewall.

quality, while the long-term goal of digital transformation in higher education is to create a favorable campus ecosystem. After completing the digital transformation of talent cultivation, teaching platforms, and evaluation systems, the digital construction of the campus ecosystem has become an

important step toward achieving full-scale digitalization in higher education. The transformation is a process of mutual evolution between DI elements and various aspects, processes, and mechanisms of higher education. The outcome is not just a singular DI training program but a more integrated campus model, and a smart campus that links DI technologies and resources with the physical campus (Hu et al., 2014). The new campus ecosystem has three characteristics. The first characteristic of the new campus ecosystem is educational focus. At its core, the smart campus prioritizes DI education, which encompasses DI-related courses, AI-enabled teaching, digital teaching resources, smart teaching spaces, digital literacy for teachers, and multiple application scenarios, such as research, management, and services. The second characteristic is aggregation. The smart campus integrates physical infrastructure with DI technologies to bridge online and offline environments. It creates a highly efficient, unified virtual environment that supports education, management, research, and services, maximizing convenience for faculty and students while improving the efficiency of resource allocation and utilization. The third characteristic is self-evolution. The smart campus can update itself. By utilizing DI evaluation tools, the ecosystem can collect and analyze real-time data from DI education, management, research, and service applications. It enables the continuous refinement of relevant technologies, rules, and concepts, significantly improving the quality and efficiency of university teaching and management.

3.5 | Implementation Challenges and Mitigation Strategies

Despite the promising prospects of Wuhan University's digital innovation program, several key challenges are emerging during its implementation phase, and it is essential to develop appropriate mitigation strategies to address them. Currently, a considerable number of senior professors are skeptical about AI-driven assessment methods, raising concerns about their accuracy, fairness, and the potential dehumanization of education. Many faculty members are still adjusting to the concept of DI education (Zhang et al., 2022). To address such concerns, Wuhan University has considered organizing mandatory workshops and peer mentoring programs to illustrate the benefits and reliability of AI tools.

Moreover, Wuhan University faces significant obstacles to growth due to existing legacy systems that prevent the sharing of data across departments, resulting in inefficiencies and limiting the potential for data-driven insights. To overcome these challenges, Wuhan University has deployed unified application program interface gateways that consolidate databases, streamline data access, and improve interoperability to enable more comprehensive analysis and decision-making.

There have also been ethical challenges, with students voicing legitimate concerns about privacy in the context of learning analytics, particularly regarding the collection, storage, and use of data (Zhang et al., 2022). In response, Wuhan University has established a dedicated office to review all DI projects to ensure compliance with privacy regulations and to promote ethical scrutiny in the collection, storage, and use of data.

4 Future Prospects for the Digital Transformation of Higher Education

The digital transformation of higher education is still in its infancy and faces many challenges, such as insufficient digital literacy, fragmented development of DI resources, and a lack of standardization and security of DI technologies. Overcoming these obstacles will require proactive research and a multipronged approach to strengthen the foundation of DI education. It includes improving the AI literacy of teachers and students, promoting the joint development and sharing of DI education and teaching resources, and actively addressing challenges in standardization, security, and ethics, ultimately leading to improved talent training models and teaching quality and guiding the global digital transformation in higher education.

4.1 | Improving AI Literacy Among Faculty and Students

DI technologies are complex and updated rapidly, making it challenging to adapt them to educational scenarios. Faculties and students currently have insufficient technical knowledge and application skills, so it is hard for them to take full advantage of these technologies in teaching and learning. Therefore, there is an urgent need to improve the AI literacy of teachers and students (Zhu et al., 2024). Compared to other universities, Wuhan University emphasizes mandatory introductory courses with a focus on discipline-specific adaptations. For instance, law students learn AI ethics through case studies of algorithmic bias, while engineering students tackle AI-optimized design simulations. The transformative development of higher education driven by AI is an inevitable trend in the DI era. The acquisition of AI literacy requires faculties and students to possess not only basic technical knowledge and application skills but also the ability to foresee and assess the potential impacts of AI technologies on the

future of higher education and the socioeconomic landscape. First, universities can develop students' AI literacy by optimizing curriculum design, strengthening practical skills training, deepening interdisciplinary collaboration, and advancing ethics education. These measures will help students develop the critical thinking and coping skills needed to navigate the evolving DI technology environment. Second, improving the AI literacy of teachers is equally important. Ongoing professional training programs can help teachers use various smart tools effectively while fostering their autonomy in teaching practices (Han et al., 2022), thereby avoiding the risks of technological alienation. Third, while proactively adopting advanced technologies, universities must carefully assess the real-world implications of their use. It is important to carefully align the use of technology with real educational needs. It will ensure that the application of AI and other core technologies effectively enhances teaching outcomes and avoids superficial, fragmented, and formalistic technology applications. Moreover, the ability to predict and evaluate can enable teachers and students to keep pace with the DI era, ensuring the right direction of higher education. The right direction involves aligning educational goals with societal needs, fostering innovation and critical thinking, preparing students to meet future challenges, and cultivating suitable talents for society.

4.2 | Deepening the Joint Development and Sharing of DI Education and Teaching Resources

The development of digital teaching platforms in higher education still faces several difficulties, including data silos, information bottlenecks, and decentralized management. Although most universities have established network platforms and centers, the lack of unified planning and top-level design has led to systemic incompatibilities across departments, inadequate information exchange, underutilized data, and a surplus of redundant or low-quality information. Consequently, teaching platforms have become functionally constrained, with limited engagement in academic discipline development, teaching models and talent training reform, and course resource sharing (Zhang et al., 2022). The situation has resulted in issues, such as superficial data analysis and rigid information management approaches, which have hindered the advancement of digital education to some extent. To tackle these challenges, digital transformation requires the further refinement of mechanisms. First, system planning must be strengthened by establishing dedicated educational network information management mechanisms to promote the co-constructing and sharing of educational data. The mechanism includes scientifically designing educational information management platforms, defining platform management responsibilities, breaking down data barriers, eliminating information silos, and ensuring data interoperability and information resource sharing. Second, educational resources should be consolidated. By developing online course systems, such as MOOCs and high-quality microlessons, universities can strengthen collaboration with domestic and international institutions to build robust DI course platforms rich in premium resources collectively, thereby facilitating integrated online and offline teaching and accelerating the digital transformation of education.

4.3 | Proactively Addressing Challenges in Standardization, Security, and Ethics

The digital transformation of higher education presents multiple challenges in standardization, security, and ethics that can undermine the quality of DI education and the overall effectiveness of teaching if left unaddressed (Liu & Cen, 2022). Three research and response strategies can tackle these challenges and ensure a smooth digital transition, including technology standardization, security improvement, and ethical considerations. First, technology standardization optimizes the construction of integrated teaching platforms and established paradigms. Universities should prioritize the application and standardization of technology in DI education and talent development. It can be achieved through specialized courses, regular training, and simulated practical exercises to improve faculty and student skills in areas, such as data protection, information screening, and system maintenance. Second, security improvement facilitates data platforms to handle massive amounts of data and operational loads, making them vulnerable to systemic and security risks caused by incomplete programs and incompatible algorithms. Therefore, establishing appropriate regulatory systems and standards, along with maintenance programs and contingency plans, is critical to regulating the operation of DI technologies and ensuring the stability of the DI ecosystem. Third, ethical considerations help computational systems generate and process massive amounts of real-world data, including, but not limited to student learning progress, skill development, employment information, and teacher evaluation. Universities must carefully balance data transparency and confidentiality to navigate the ethical challenges posed by the digital transformation of higher education.

Wuhan University has developed an effective digital transformation strategy that encompasses reforms in DI talent training, the construction of an integrated DI teaching platform, the establishment of a

DI teaching evaluation system, and the creation of a new DI campus ecosystem. It has gained valuable experience in the digital transformation of universities, providing a practical framework and development strategy for other universities to emulate. Moving forward, Wuhan University should remain focused on both the challenges and opportunities presented by digital transformation, adopt a forward-looking approach to developing the DI education system, and continuously optimize strategies for the digital transformation of higher education through practice.

5 Conclusions

Wuhan University has made outstanding contributions to the digital transformation of higher education. In terms of strategic planning, it has comprehensively laid out the reform of DI talent cultivation, the construction of an integrated DI teaching platform, the establishment of a DI teaching evaluation system, and the creation of a DI smart campus ecosystem. It has constructed a complete digital education framework, providing a transformation model for other universities. At the same time, it has identified the challenges in the transformation process accurately, such as the difficulties in adapting technologies, the shortcomings in the skills of teachers and students, and the issues of standardization, security, and ethics, and laid the foundation for overcoming these challenges.

In the future, at the research level, efforts should focus on the integration of DI technologies and subject teaching, exploring the application paths of technologies that are compatible with the characteristics of various disciplines. Moreover, continuous in-depth research should be conducted to improve the AI literacy of teachers and students to establish a long-term improvement mechanism. In the practical field, universities should strengthen cooperation, integrate DI education resources, and optimize shared platforms. Furthermore, all parties should come together to formulate unified standards and specifications, improve data security management mechanisms, and establish ethical guidelines for DI education, thereby promoting the steady progress of the digital transformation of higher education.

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Ethics Statement The author confirms that his Institutional Ethics Committee determined that no ethical review was required for this study. Written informed consent for participation was not required because all participant data were anonymized prior to statistical analysis.

Data Availability Statements The author confirms that all data generated or analyzed during this study are included in this published article.

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