Exploration of the Model "1523+N" Application-oriented Cultivation of Talent under the AI and Digital Intelligence Era

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Abstract: With development of the artificial intelligence technology, the higher education model has undergone a systematic change. There are some issues in the traditional education paradigms, such as limitations of physical space, data silos, delayed teaching and learning feedback, and weak industry-education integration, which hinder the support for multi-scenario teaching, precise diagnostics, and the cultivation of innovative talents. A new model named "1523+N" is proposed in this paper to solve the current dilemmas of application-oriented universities. Firstly, a digital teaching platform is set up to break the constraints of traditional teaching spaces and promote the teaching governance and management. With an AI-driven "523" data governance mechanism, it enables continuous collection and real-time analysis of teaching process data, allowing for accurate assessment of teaching and learning performance. Furthermore, it forms *N*-dimensional pathways by a multi-angle graph of "industry-job-ability-knowledge-course-cultivation objectives" to facilitate precise alignment between industry and education and foster innovation through virtual-physical integrated practices. This research provides an actionable reference for higher education teaching systems in the context of digital transformation.

Keywords: Digital Teaching Platform; AI-Driven; Data Governance; Talent Cultivation

1. Introduction

The wave of digital transformation in education is profoundly reshaping the higher education ecosystem and driving a systemic reform [1]. In response to this trend, China's Outline for Building a Strong Education Nation (2024-2035) explicitly proposes to promote AI-enabled educational transformation, aiming to establish strategic technologies i.e., artificial intelligence (AI), as core engines driving innovation in the education system, with the goal of building a globally leading education nation by 2035. The domestic higher education organization has embarked on extensive exploration [2]. Some universities used big data models of learning behaviors to stimulate student potential and constructing smart management systems that cover the entire process of teaching, learning, management, assessment, and research, which focus on achieving a profound shift from "tool assistance" to "ecosystem reconstruction" through data-driven approaches and process re-engineering.

However, the deepening of these practices still faces lots of challenges: First, physical space barriers need to be overcome, i.e., fixed classrooms, static resources, and data silos in the traditional teaching management [3], which is hard to support cross-scenario teaching and the deep integration of AI+ education. Second, teaching data feedback mechanisms are lagging, fragmented collection, delayed analysis, and coarse evaluation of educational data [4] make it difficult to achieve precise diagnosis and dynamic optimization of the teaching process. Third, bottlenecks exist in industry-academia collaboration, disconnects between program development and industry needs, coupled with difficulties in cultivating students' engineering practice quantitatively and innovative literacy [5], result in talent development lagging behind technological evolution. The construction of university teaching governance system based on data middle platform is discussed in [6]. The AI-driven process evaluation model is proposed in [7], and a virtual-physical integrated practical teaching system is constructed by [8]. In [9], an innovative model of engineering education based on digital twin technology is developed. Ref. [10] gave some ideas about the growth path of teachers' intelligent education literacy under the background of digital transformation. The generalization and replicability of the existing model is still challenging.

To solve these problems above, Guang'an Institute of Technology has actively aligned with national strategies, establishing a guiding philosophy of "digital-intelligence leadership, student-centered, integration of teaching and research, and combination of management and evaluation". An integrated digital-intelligence-driven education and teaching system in this paper is raised to explore a digital-intelligence model for cultivating application-oriented talents in higher education. The proposed model establishes a new teaching foundation, breaking spatial constraints and innovating management paradigms. Data governance model is generated with AI for teaching and learning to achieve "embedded collection" and "real-time analysis" of educational data, enabling precise evaluation of teaching and learning performance. A new *N*-dimensional cultivation framework linking "industry-job-ability-knowledge-course-cultiva-tion objectives" is constructed to break down industry-academia barriers and fostering an innovative training ecosystem.

2. Cultivation Model Design

In the aspect of cultivating application-oriented talents, a fully cohesive, digitally intelligent, and ecological model need to be constructed. The new model can reorganize teaching spaces, innovate governance frameworks, and integrate educational paradigms driven by AI and digital-intelligence technologies, and guided by the OBE philosophy. The detailed design will be introduced in the following.

2.1 Build a Digital-Intelligence Foundation to Reconstruct Teaching Spaces and Transform Governance Models

To break through the bottlenecks in traditional educational environments, such as enclosed physical spaces, fragmented teaching resources, and isolated data silos, a digital-intelligence foundation is established, which integrates a tripartite teaching field encompassing physical spaces, e.g., classrooms and laboratories, virtual spaces, e.g., virtual teaching and research offices and simulation labs, and social spaces, e.g., industry-academy collaborative institutes. The physical space enables intelligent inter-connectivity and environmental adaptability through smart classrooms or IoT devices; the virtual space leverages cloud-based resource pools and virtual simulation platforms to deliver infinitely expandable immersive learning resources; while the social space integrates authentic industry environments and projects into the teaching process via industry-academy collaboration networks. The convergence of these three spaces enables a fundamental shift in teaching and learning scenarios from static and fixed to dynamic and seamless. In addition, by implementing a unified data platform and business micro-services, seven key educational processes with teaching, learning, preparation, management, assessment, evaluation, research are integrated to establish a data closed-loop that covers the entire instructional life-cycle. The system could achieve real-time collection, integrated analysis, and intelligent feedback of teaching data, thereby powering a leap in the teaching model from extensive, experience-dependent management to refined governance rooted in digital-intelligence symbiosis and comprehensive data chains. It paves a concrete systematic path for the digital transformation of higher education.

2.2 A New Teaching Governance Model "Five-Domain Data, AI Dual Diagnosis, Three-Stage Evaluation" is Developed for Accurate Measurement

In response to the challenges of fragmented data collection, subjective evaluation methods, and delayed quality feedback in traditional teaching, a paradigm for teaching governance is characterized by holistic perception, precise diagnostics, and scientific assessment. Firstly, a holistic data collection covering stakeholders, resources, processes, management, environment is put up to achieve comprehensive connectivity of all elements with teacher-student behaviors, resource utilization, interactions, decisions and environmental state. Secondly, AI technology is introduced to conduct in-depth analysis of both teaching and learning data in the classroom. This enables deep diagnostics such as micro-expression recognition of teacher and student behaviors, quantification of the emotional atmosphere, and generation of interaction maps, thus achieving a paradigm shift from superficial data collection to the extraction of insights into emotional states and intrinsic value. Thirdly, multi-modal data is integrated to form process-outcome-value-added three tiered quantitative evaluation system. This system not only focuses on final learning outcomes but also emphasizes the effort and progress demonstrated during the learning process. Furthermore, it scientifically measures students' ability improvement from the beginning to the end of the learning journey, thus propelling educational quality assessment from traditional vague experiential judgment to a data-empirical driven stage.

2.3 The Interdisciplinary Education Paradigm of "Industry-Education Intelligence Integration, Ideological-Political Synergy, and Virtual-Physical Symbiosis" to Reshape the Logic of Talent Cultivation

To address the disciplinary barriers, superficial industry-education collaboration, and the disconnect between value cultivation and knowledge, a new interdisciplinary education paradigm of "industry-education intelligence integration, ideological-political synergy, and virtual-physical symbiosis" is constructed. At the level of industry-education intelligence integration, a mapping conversion model of "industry demand → job competencies → course modules" is explored. And industrial technical standards and job competency requirements are captured dynamically through AI and big data, this approach drives the automated iteration and restructuring of course content and teaching programs to ensure talent development plans keep pace with or stay appropriately ahead of industrial evolution. At the level of ideological-political synergy, by embedding value elements such as red culture, craftsmanship spirit, and engineering ethics as a genetic sequence into the professional curriculum framework and project practices, an immersive educational pathway is formed, creating a trinity of value cultivation, knowledge transfer and ability development. At the level of virtual-physical symbiosis, virtual simulation and digital twins are employed to replicate real industrial environments in virtual space. This enables students to safely and efficiently conduct high-cost and high-risk engineering practices in the campus. The interaction between virtual and physical environments breaks the constraints of physical learning spaces, driving a shift in the logic of talent cultivation from a closed discipline-oriented approach to open ecosystem integration model.

3. Research and Implementation

3.1 Construct a Digital-Intelligent Foundation to Reshape the Teaching Environment and Governance Paradigm

3.1.1 Physical-virtual-social integration

The development of physical spaces focuses on building smart classroom clusters with integrated capabilities in intelligent perception, environmental control and IoT connectivity. There are enough teaching infrastructures including smart blackboards and multi-screen interaction systems to support seamless one-click transition between online and offline teaching. The development of virtual space is powered by cloud computing and VR technologies to establish an integrated digital teaching platform featuring virtual teaching-research units, simulation laboratories and cloud resources. With virtual experiments spanning core disciplinary courses, the platform enables spatio-temporal independent inquiry learning. Expanding the social learning space involves creating cross-school alliances and industry-education platforms that connect students with real-world projects, forming open university-enterprise-community ecosystem.

3.1.2 Intelligent teaching governance

The intelligent teaching governance hub is built on a technical architecture with data mid-end plus business microservices. The data mid-end layer consolidates information flows from those key data sources including educational administration data, learning process tracking and quality assurance mechanisms to implement standardized data models and interoperable interfaces. The business microservices layer deploys lightweight modules for classroom monitoring, learning alerting and quality evaluation. Through advanced visualization, it builds relational networks of educational data to deliver actionable insights of teaching decision-makers. For instance, through continuous tracking of classroom interaction dynamics and curriculum coverage, the system autonomously detects teaching process deviations and then produces improvement recommendations, to support the change from experiential reliance to data-centric decision-making.

3.1.3 Teacher empowerment

Construct a trinity development system based on resources-tools-competencies. Using learner profiles, recommend adaptive study resources intelligently, timely establish a teaching case repository. The AI teaching assistant provides a five-step instructional cycle service covering the entire teaching process: before class, it automatically generates differentiated lesson plans according to student learning data; during class, generate real-time classroom interaction maps; after class, grade assignments effectively, produce diagnostic learning reports intelligently; personalized teaching recommendations weekly is delivered comprehensive teaching behavior analysis reports is produced monthly. This framework reduces lesson preparation workload, enhances learning assessment precision, and facilitates the iteration of methodology from traditional experience-driven to digitally-powered pedagogy.

3.2 AI-Powered Data Governance Framework is Established to Integrate Five-Domain Data, Bidirectional Teaching-Learning Diagnostics, and Tri-Level Assessment

A comprehensive data network covering five domain data, for instant, teaching stakeholders, teaching resources, teaching processes, teaching management, and teaching environment, has been established to deal with the challenges of knowledge fragmentation and subjectivity in traditional teaching evaluation. It implements multidimensional data acquisition through: (1) collecting behavioral trajectories of teachers and students, (2) monitoring utilization rates of educational resources, (3) documenting full-cycle instructional activities, (4) integrating cross-departmental management records, and (5) gathering learning environment parameters. The data mid-end enables standardized processing and relational structuring of heterogeneous data sources, an integrated data infrastructure is proposed to support evidence-based governance.

The AI diagnostics layer develops dual-purpose diagnostic engines capable of real-time analysis for both instructional and learning processes. Deep learning and computer vision technologies are employed to perform real-time analysis on classroom teaching video streams, enabling the identification of teaching behaviors and student classroom status. Natural language processing (NLP) algorithms deconstruct lecture content through quantitative metrics including speech velocity, vocal modulation and information concentration to evaluate pedagogical delivery. Knowledge graph technology further enables the system to build structured knowledge frameworks, integrate real-time learning data, and pinpoint specific conceptual deficiencies within student understanding. By automatically generating per-session emotional metrics and periodic teaching performance visualizations, the system empowers educators to transition from post-class corrective actions to real-time instructional modifications, enabling dynamic pedagogical interventions with sub-minute responsiveness.

A tripartite evaluation structure is established to integrate process-oriented, outcome-based and value-added assessment. Process evaluation focuses on the entire teaching and learning process, generating dynamic growth trajectories for both teachers and students by documenting granular indicators of instructional behaviors and key observation of student engagement. Outcome evaluation integrates traditional academic achievement with derived metrics such as innovation capability indices to construct a weighted comprehensive assessment model. By tracking student development from initial proficiency levels longitudinally, value-added assessment utilizes hierarchical linear modeling to quantify pedagogical contributions to learning growth. It transitions educational evaluation from subjective perception to data-informed practice.

3.3 Establish a N-Dimensional Ecosystem for Interdisciplinary Education

In the aspect of industry-education intelligence integration, a big data-based industrial talent demand monitoring system is established. AI automatically collects and analyzes recruitment data, technical reports, and skill requirements from enterprises across multiple industries. It extracts core competency points with NLP, and dynamically generates industrial talent demand profiles. The system interfaces with academic program plans intelligently, and enable the identification of knowledge supply gaps and automatic generation of curriculum adjustment recommendations. By collaborative platforms established with key regional industrial parks, a demand-supply coordination mechanism is formed, and achieves quarterly synchronization between specialized course content and industrial technical standards, ensuring talent development maintains both foresight and adaptability.

Regarding the integration of ideological and political elements, value shaping permeates all aspects of professional education through comprehensive integration. Firstly, red cultural resources are systematically categorized to form a digital repository containing ideological-political elements. Secondly, interdisciplinary teaching teams are organized to systematically embed value elements, including the spirit of craftsmanship, engineering ethics, innovation awareness into the professional curriculum system following the concept of "genetic integration", resulting in the development of a case library for curriculum-based ideological and political education. In engineering courses, the introduction of major project cases subtly cultivates students' sense of responsibility and professional spirit. This integration model organically unifies value cultivation, knowledge impartation, and ability development, thus effectively resolving the disconnection between professional education and ideological-political education.

In dimension of virtual-physical symbiosis, a multi-level and stereoscopic practical teaching system is constructed. Through collaboration with top enterprises, immersive training bases integrating authentic production, practical teaching, and technological innovation are set up on campus. Advanced technologies, virtual simulation and digital twins, are introduced to develop virtual simulation experiment projects, establishing a dual-spiral practical teaching model of "virtual simulation+real projects". Students conduct skill training and solution validation in virtual environments before taking part in real project implementation in physical training bases. This model not only transcends the temporal, spatial, cost and safety constraints of traditional practical teaching but also significantly enhances students' engineering practical abilities and innovation competencies. It achieves a paradigm shift in talent cultivation quality from "vague qualitative assessments" to "precise quantitative evaluations", thereby accelerating synchronous evolution of applied talent development and industrial technological advancement.

4. Conclusions

A systematic digital-intelligent teaching reform is proposed in this paper to promote the overall transformation of education and teaching from traditional paradigms to a new form. Firstly, an intelligent teaching environment covering all teaching scenarios is constructed. An integrated education teaching platform is constructed to break down the boundaries between traditional physical classrooms and digital resources and integrate smart classroom facilities with multi-modal resources, realizing the digitalization of teaching governance and the refinement of management processes, then provides strong support for teachers to explore the innovation of AI+ teaching models and methods. Secondly, a innovative "five-domain driven" mechanism based on bidirectional teacher-student data is introduced. AI technology is used to monitor the entire teaching process and academic performance, interconnecting multidimensional data including teaching stakeholders, resources, teaching management, teaching evaluation, and teaching environment interactions to achieve concurrent collection and immediate analysis of fundamental teaching data, enhancing the accuracy and timeliness of teaching and learning performance assessment. Finally, a *N*-dimensional knowledge graph is formed to map systematically the logical relationships among "industry-job-ability-knowledge-course-cultivation objectives", and dynamically identifies students' knowledge gaps and pushes adaptive resources intelligently. It promotes the precise alignment of industry and education needs, and achieves the deep integration of engineering practice and virtual simulation, constructing an innovate educational ecology characterized by interdisciplinary integration and innovation capability orientation. This system reform path provides a referential practical paradigm for the restructuring of teaching structures in higher education institutions within the context of digital transformation.

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References

[1] Qian, H. H., Wang, M. Y., and Xiong, Y. Research on the Current Situation and Development of Digital Transformation in Higher Education. Big Data Research, 2023(3): 56-70.

[2] Tian, J. L., Duan, L., and Wang, C. Y. Research on the path of digital education support system for cultivating top-notch talents. China Information Technology Education, 2025(2): 104-107.

[3] Zhang, X. Analysis of the Transformation Path of AI-Enabled Teaching Management Model in Higher Vocational Education. Modern Vocational Education, 2025(23).

[4] Xu, H. X. "Intelligent+Education": Application scenarios, risks and challenges, and governance strategies. Fudan Education Forum, 2023, 21(2): 24-30.

[5] Luo, J. J. Research on teaching management in

higher vocational colleges under the background of artificial intelligence. Vocational Education Development, 2025, 14(4): 128-132.
[6] Chen, L. M., Zhang, W., and Liu, X. Y. Research on the Construction of University Teaching Governance System Based on Data Middle Platform. Modern Educational Technology, 2024, 34(1): 45-52.
[7] Wang, Z. Q., Li, J., and Zhou, T. Research on the AI-Driven Process Evaluation Model for Teaching. e-Education Research, 2025, 46(3): 78-85.
[8] Liu, J. P., Zhao, M., and Sun, L. H. Construction of a Virtual-Physical Integrated Practical Teaching System under the Background of Industry-Education Integration. Laboratory Research and Exploration, 2024, 43(5): 112-118.
[9] Huang, M. L., and Wu, J. J. Research on the Innovative Model of Engineering Education Based on Digital Twin Technology. Research in Higher Education of Engineering, 2025, 43(2): 89-95.
[10] Zheng, X. F., Wang, L. N., and Chen, Z. G. Research on the Development Path of Teachers' Intelligent Education Literacy under the Background of Digital Transformation. China Educational Technology, 2024, 42(8): 67-74.