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Research on Dynamic Adjustment and Curriculum Reconstruction of Nursing Programs in Private Universities Empowered by Artificial Intelligence

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Abstract: *Objective:* Against the backdrop of the "Healthy China" initiative and the digital transformation of higher education, this study addresses the critical disconnect between nursing talent cultivation in private universities and clinical practice demands. It aims to provide theoretical underpinnings and practical pathways for optimizing nursing curriculum systems in this context. *Methods:* A systematic literature review was conducted, utilizing 87 valid articles selected from Chinese and English databases spanning 2019 to 2025. The review synthesized the current state of artificial intelligence (AI)-empowered nursing education, refined the theoretical construction of a core conceptual framework, and performed a multi-perspective comparative analysis from three dimensions: traditional educational models, AI application strategies, and controlled experimental results. *Results:* AI technology significantly enhances the alignment between nursing curricula and job requirements, improves students' clinical practical competencies, and boosts teaching efficiency. Private universities can achieve dynamic curriculum reconstruction by establishing diversified resource support systems, implementing modular curriculum design, and developing intelligent evaluation mechanisms. *Conclusion:* AI serves as a pivotal enabler for nursing education reform in private universities. Future efforts should focus on standardizing AI nursing education resources and integrating humanistic literacy into technological applications, thereby fostering interdisciplinary nursing professionals competent for the era of smart healthcare.

Keywords: Artificial intelligence; Private universities; Nursing science; Professional dynamic adjustment; Curriculum reconstruction; Smart nursing education

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1. Introduction

With the advancing implementation of the "Healthy China" strategy, societal demands for both the quality and quantity of nursing professionals have witnessed a dual surge. As key institutions for nursing talent development, private universities rely heavily on the adaptability and foresight of their curriculum systems to ensure graduates meet market needs. The breakthrough advancements in artificial intelligence (AI) technology have furnished critical technical support for nursing education reform, driving the transformation of traditional curriculum models

toward dynamism and intelligence.

Nevertheless, the current AI-empowered reform of nursing programs in private universities faces multiple challenges, including insufficient data support, the absence of standardized comparison frameworks, and underdeveloped theoretical foundations. This study employs a systematic literature review to synthesize existing research on AI-empowered nursing education, with a specific focus on the unique characteristics of private universities. By constructing a scientific curriculum reconstruction framework, this paper aims to provide actionable theoretical guidance for practical educational reforms.

2. Research methods

This study adopted a systematic literature review approach, adhering to the research process of "theme definition–literature retrieval–screening and evaluation–analysis and synthesis" to ensure methodological rigor and result reliability.

2.1. Literature retrieval strategy

Core keywords, including "Artificial Intelligence," "Nursing Education," "Private Universities," "Curriculum System," and "Dynamic Adjustment," were used to conduct cross-database searches. Retrievals covered both Chinese databases (China National Knowledge Infrastructure [CNKI], Wanfang Data, VIP Chinese Science and Technology Journals) and English databases (Web of Science, PubMed). The time frame was set from January 2019 to October 2025 to incorporate the latest research findings and emerging trends.

2.2. Literature screening criteria

Included literatures comprised empirical studies on AI applications in nursing education, curriculum reform proposals, theoretical framework constructions; research related to nursing program reforms in private universities; and academic papers, dissertations, and policy documents supported by specific data or comparative analyses. Exclusion criteria included: pure technological R&D studies, research without clear educational application scenarios, and duplicate publications. Ultimately, 87 valid articles were selected, consisting of 62 Chinese and 25 English articles.

2.3. Analysis methods

Content analysis was applied to code and analyze the included literature, extracting core mechanisms, application models, and effectiveness indicators of AI-empowered nursing education. Comparative research methods were used to evaluate the efficacy of different AI application strategies and develop a multi-dimensional evaluation system. Theoretical tracing was employed to consolidate academic support for core concepts and refine the theoretical framework.

3. Current status of AI-empowered nursing education

3.1. Industry demand and technical support

Population aging and the rising prevalence of chronic diseases have fueled sustained growth in nursing service demands. According to 2024 data from the Ministry of Civil Affairs, the annual growth rate of nursing service needs for disabled elderly in China reaches 18%, while the shortage of professionals with intelligent nursing skills

exceeds 50,000 [1]. AI applications in nursing have evolved from auxiliary tools to core supportive technologies, with mature solutions including intelligent nursing robots, virtual simulation systems, and big data assessment platforms, laying the groundwork for curriculum reconstruction [2]. For instance, intelligent nursing robots can replace 2–3 human caregivers in routine tasks, making operational proficiency with such technologies a prerequisite for nursing graduates [3].

3.2. Reform practices in private universities

Several private universities have pioneered AI-empowered nursing education initiatives. The Nursing Department of Southwest Jiaotong University Hope College has established a digital-intelligent training system, equipped with intelligent health assessment simulators and 3D anatomical virtual simulation systems, achieving digital transformation of core courses [4]. Yongzhou Vocational and Technical College launched a pilot project in the Nasal Feeding Nursing course, integrating AI simulator technology with tools such as ChatGPT and Doubao to create a "teacher-machine-student" tripartite teaching model. Through pre-class AI simulator assessments, in-class paired interactive training, and post-class multi-dimensional evaluations, student interest in the course increased from 75.8% to 95.6%, demonstrating remarkable teaching effectiveness [5]. While these practices have accumulated valuable experience, they remain fragmented and lack systematic design.

4. Theoretical construction of the core conceptual framework

Based on literature synthesis and theoretical integration, this study refines the "Demand Perception–Intelligent Decision–Dynamic Optimization" three-stage model and the "Three-Stage & Three-Dimension Curriculum Model," forming a comprehensive conceptual framework.

4.1. The "demand perception–intelligent decision–dynamic optimization" three-stage model

Rooted in closed-loop management theory [6], this model integrates the A10 methodology's "Strategy-Execution-Feedback" architecture—a digital management tool focusing on "Aim-Action-Amend" dynamic governance. It achieves precise adaptation and continuous improvement of complex systems through a three-stage logic: "strategic orientation, operational implementation, and feedback-driven optimization" [7].

This study leverages this framework to establish a dynamic response mechanism:

(1) Demand perception: Utilizes big data technology to integrate industry employment requirements (e.g., intelligent equipment operation in medical institutions), student learning data (e.g., skill deficiencies), and policy guidelines (e.g., National Nursing Career Development Plan) [8], constructing a multi-source demand database to address the lag of traditional curriculum design.

(2) Intelligent decision-making: Employs an intelligent decision engine to conduct quantitative analysis of demand data via algorithmic models, generating curriculum adjustment recommendations (e.g., module optimization for Nursing Informatics, training equipment configuration) to enhance decision-making scientificity and precision [2].

(3) Dynamic optimization: Iterates the curriculum system based on continuous feedback data (e.g., student assessment results, enterprise evaluations), forming a virtuous cycle of "perception-decision-optimization"—consistent with dynamic resource adaptation principles in enterprise digital transformation [6].

4.2. The "three-stage & three-dimension curriculum model"

Centered on Outcome-Based Education (OBE) theory and aligned with the "practice-oriented, employment-focused" orientation of private universities, this integrated model combines three dimensions ("Technology Application–Competency Development–Literacy Cultivation") and three stages ("Foundation Building–Competency Enhancement–Comprehensive Improvement").

The three dimensions include:

(1) Technology application: Focuses on skill development in AI nursing equipment operation (e.g., intelligent simulators, nursing robots) and nursing information system utilization.

(2) Competency development: Emphasizes clinical reasoning and problem-solving abilities supported by intelligent decision tools.

(3) Literacy cultivation: Prioritizes humanistic care and technical ethics education to prevent humanistic alienation in technological applications.

The three-stage implementation pathway is

(1) Foundation building (freshman year): Offers courses such as Basic Nursing Informatics and Introduction to AI Technology to establish technical fundamentals.

(2) Competency enhancement (sophomore year): Improves comprehensive application abilities through virtual simulation training and case-based learning.

(3) Comprehensive improvement (junior year): Conducts on-the-job internships via school-enterprise cooperation platforms to realize school-clinical integration.

This model achieves synergistic development of knowledge, abilities, and literacy through cross-integration of dimensions and stages.

5. Multi-dimensional comparative analysis of AI-empowered curriculum reform

To clarify the causal relationship between AI applications and curriculum reform effectiveness, this study conducts a systematic analysis from three dimensions: comparison with traditional models, differences among AI strategies, and controlled experimental results, verifying reform value through empirical data.

5.1. Comparison with traditional non-AI curriculum models

Traditional curriculum models, dominated by theoretical lectures and simple model demonstrations, suffer from insufficient practical scenarios and simplistic evaluation methods [5]. Post-AI intervention, teaching effectiveness has improved significantly: Yongzhou Vocational and Technical College's pilot showed student interest in Nasal Feeding Nursing rose from 75.8% to 95.6%, classroom satisfaction increased from 76.1% to 88.9%, and average practical assessment scores improved by 14.6 points [5]. A comparative study by Kaifeng University revealed that the experimental group (AI-integrated immersive teaching) achieved significantly higher theoretical and practical scores than the traditional teaching group ($P < 0.05$), with 92.2% satisfaction in clinical thinking ability—far exceeding the control group's 72.0% [9]. In terms of training costs, intelligent nursing robots reduced elderly care institution operating costs by 22% [3], a logic applicable to university training through virtual simulation, reducing consumable waste and lowering training expenses [2].

5.2. Effectiveness differences among AI application strategies

Literature analysis categorizes current AI empowerment strategies into three types with distinct effectiveness:

(1) Equipment empowerment (e.g., intelligent simulators): Primarily enhances practical skills. Southwest Jiaotong University Hope College's practice increased first-aid skill assessment pass rates from 72% to 94%—a 30.6% improvement over traditional training [4].

(2) Tool empowerment (e.g., ChatGPT, AI case generators): Focuses on supporting theoretical learning and clinical reasoning, increasing case teaching efficiency by 45% and independent study time by 28% [2].

(3) System empowerment (e.g., OBE teaching support platforms): Enables precision teaching through big data analysis, improving curriculum-job requirement alignment from 58% to 95% [4]—significantly outperforming single-equipment or single-tool applications. This indicates system-based empowerment best suits private universities' overall reform needs and should be prioritized [5].

5.3. Controlled experiment analysis: Reform vs. non-reform groups

Controlled experiments serve as the core method for verifying causal relationships [6]. Kaifeng University's comparative study of two nursing classes showed:

(1) Experimental group (traditional + AI immersive teaching): Average theoretical score 89.2, practical score 91.3.

(2) Control group (pure traditional teaching): Average theoretical score 76.5, practical score 78.8.

Differences were statistically significant ($P < 0.05$) [9]. Southwest Jiaotong University Hope College's comparison between 2022 and 2023 nursing cohorts found the 2023 reform group (intelligent training system-supported) achieved a 92% nursing qualification exam pass rate—17 percentage points higher than the 2022 non-reform group's 75%—further validating AI empowerment effects [4]. These experiments confirm the causal link between AI applications and curriculum reform effectiveness, providing empirical support for reform promotion [6].

6. Implementation pathways for curriculum reconstruction in private universities

Integrating the conceptual framework and comparative analysis results, specific pathways for nursing curriculum reconstruction in private universities are proposed from three aspects: resource allocation, curriculum design, and evaluation systems.

6.1. Establishing a diversified resource support system

(1) Funding: Adopt a "school-enterprise co-construction" model to address private universities' funding constraints—e.g., joint development of digital-intelligent training centers with medical equipment enterprises to reduce equipment procurement costs [4].

(2) Talent support: Develop a "dual-qualification" faculty training mechanism, enhancing teachers' AI application capabilities through enterprise internships and specialized training, while inviting medical institution technical experts to participate in curriculum design [5].

(3) Technology platforms: Integrate existing resources (e.g., Chaoxing Learning Tong, National Virtual Simulation Platform) to build a unified digital-intelligent teaching platform enabling resource sharing and data interoperability [2].

6.2. Implementing modular curriculum design

Based on the "Three-Stage & Three-Dimension Curriculum Model," the curriculum module system is reconstructed as follows:

(1) Basic modules: Core courses including Nursing Informatics and Fundamentals of AI Nursing Technology.

(2) Professional modules: Specialized sub-modules such as intelligent emergency nursing and geriatric intelligent care.

(3) Expansion modules: Content covering technical ethics and data security.

A "flexible credit system" allows students to select modules based on career plans. A dynamic curriculum update mechanism adjusts module content annually in response to industry needs—e.g., incorporating emerging content like intelligent nursing robot operation.

6.3. Developing an intelligent evaluation system

A three-dimensional evaluation model of "Process + Outcome + Feedback" is constructed [9]:

(1) Process evaluation: Utilizes digital-intelligent platforms to collect student learning data (e.g., virtual training records, online test scores) for dynamic monitoring.

(2) Outcome evaluation: Combines theoretical examinations and skill assessments to comprehensively measure training quality [5].

(3) Feedback evaluation: Applies AI algorithms to analyze evaluation data, generating curriculum optimization recommendations to support the "Demand Perception–Intelligent Decision–Dynamic Optimization" mechanism [6].

Drawing on Yongzhou Vocational and Technical College's experience, multi-source evaluation (student self-assessment, peer assessment, machine assessment, teacher assessment) is integrated to enhance comprehensiveness and objectivity [5].

7. Conclusion and prospects

AI technology presents a revolutionary opportunity for nursing curriculum reconstruction in private universities . The " Demand Perception–Intelligent Decision–Dynamic Optimization" three-stage model and "Three-Stage & Three-Dimension Curriculum Model" effectively address the lag and rigidity of traditional curriculum systems [6]. Multi-dimensional comparative analysis confirms AI-empowered curricula demonstrate significant advantages in improving teaching effectiveness, cultivating practical competencies, and aligning with market demands [4, 9]. Private universities should seize the digital education transformation opportunity to achieve leapfrog improvements in nursing talent quality through resource integration, curriculum reconstruction, and evaluation reform [5].

Practically, models such as Yongzhou Vocational and Technical College's "teacher-machine-student" tripartite teaching and Southwest Jiaotong University Hope College's digital-intelligent training system provide replicable and scalable reform paradigms for private universities [4,5]. Future initiatives could promote large-scale application of these experiences through inter-university alliances.

Future research can be deepened in three dimensions:

(1) Theoretical research: Integrate Johnson and Smith's AI nursing education framework to develop a standardized AI nursing education evaluation index system tailored to private universities' characteristics, addressing fragmented effectiveness assessment and inconsistent indicators. Educational neuroscience theories could also explore AI's impact on nursing students' cognitive development [2].

(2) Practical exploration: Leverage private universities' flexible governance to develop "AI + Nursing" micro-majors, collaborate with medical technology enterprises on customized virtual simulation training (e.g.,

intensive care scenario simulation using digital twin technology) to enhance clinical emergency response capabilities [3], and expand controlled experiment sample sizes and timeframes to verify long-term AI empowerment effects [9].

(3) Ethical research: Address privacy protection and algorithmic bias in AI nursing applications, integrate medical AI ethical norms into the curriculum's literacy dimension [8], and explore "technology + humanism" integrated teaching—e.g., incorporating humanistic nursing scenarios (hospice care, patient communication) into AI simulator training to prevent humanistic deficiency [3]. Ultimately, this will cultivate interdisciplinary nursing professionals equipped with both intelligent nursing skills and a humanistic care spirit, meeting the core demands of the smart healthcare era.

Disclosure statement

The author declares no conflict of interest.

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