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A Study on the Pathways for Artificial Intelligence to Reconstruct the "Health Assessment" Course from the Perspective of Integration of Industry, Education, and Innovation

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Abstract: Driven by the dual imperatives of national vocational education reform and the "Healthy China" strategy, nursing education is undergoing a fundamental transformation from skill transmission to the cultivation of "digital and intelligent literacy" and innovative competence. Focusing on the core module Health Assessment in vocational undergraduate nursing programs, this paper explores innovative pathways for restructuring the curriculum through artificial intelligence (AI) within the theoretical framework of "integration of industry, education, and innovation." The study analyzes traditional teaching challenges—clinical practice barriers, unitary assessment methods, and disconnection from industry frontiers—and demonstrates the necessity of AI empowerment. It constructs a trichain synergy model (education chain, industry chain, innovation chain) to guide curriculum reform. Four core pathways are elaborated: reshaping objectives and content, innovating methods and resources, reforming evaluation through datadriven approaches, and building collaborative platforms with robust mechanisms. Drawing on international trends, the paper also proposes safeguard measures. The research aims to provide a theoretical reference and practical blueprint for the digital transformation of vocational undergraduate nursing education.

Keywords: Integration of industry; Education and innovation; Artificial intelligence (AI); Health assessment

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1. Introduction

Health assessment serves as a bridge course connecting basic medicine and clinical nursing, and its quality is crucial for fostering clinical thinking skills among nursing students. The integration of big data and artificial intelligence technologies into the healthcare sector has transformed nursing practice from experience-driven to data-driven approaches, and from manual operations to human-machine collaboration [1]. The application

of smart hospitals, wearable devices, and AI-assisted decision support systems has imposed new demands for "digital and cognitive literacy" on nursing professionals.

Professional undergraduate education aims to cultivate high-level technical and skilled professionals with "solid foundational knowledge, strong practical skills, and innovative capabilities." However, current health assessment curricula still adhere to the models of specialized or general undergraduate programs, exhibiting significant deficiencies in content, practical training, and evaluation methods, making them inadequate for meeting the demands of the smart healthcare era [2].

"The integration of industry and education, along with school-enterprise collaboration," constitutes the fundamental approach to vocational education. The concept of "industry-education-innovation integration" incorporates industrial demands, educational instruction, and innovation/entrepreneurship practices into a unified framework, while AI technology offers new solutions to teaching challenges. Incorporating AI into health assessment courses represents not merely an upgrade in teaching methods but also a systematic overhaul of curriculum objectives, content, evaluation systems, and the overall educational ecosystem.

Based on these insights, this study examines the practical realities of vocational undergraduate nursing education and explores pathways for reconstructing AI-enhanced health assessment courses from the perspective of industry-education-innovation integration. It addresses key questions: how AI can overcome traditional limitations, how the industry-education-innovation integration concept guides this restructuring, and how implementation plans and supporting mechanisms should be designed, aiming to provide references for curriculum reform in similar institutions.

2. Challenges and AI-enabling opportunities in traditional health assessment course teaching

The current undergraduate nursing health assessment curriculum faces multiple challenges, which serve as both a practical impetus for curriculum reform and a clear direction for leveraging AI technology.

2.1. Core teaching challenges

Significant barriers exist in clinical practice: The skills required for physical examinations—such as visual inspection, palpation, percussion, auscultation, and olfaction—demand repeated practice; however, patient resources are limited, and the assessment of critical illnesses and infectious diseases involves ethical considerations, leaving students with few opportunities to engage hands-on and resulting in slow acquisition of practical experience. Insufficient representation of dynamism and complexity: Traditional teaching relies heavily on static text cases or standardized patients (SPs), making it difficult to demonstrate the continuous changes in vital signs, disease progression, and the complexity of multi-system interactions [3]. Students lack a deep understanding that assessment is a continuous, dynamic, and comprehensive process. Evaluation methods are subjective and one-sided: assessments often depend on instructors' subjective ratings, lack traceability, and employ no advanced evaluation tools. Although smart monitoring devices have become widely adopted in clinical settings, relevant curriculum coverage remains inadequate, forcing graduates to relearn these technologies when entering the field of smart healthcare. Weak support for personalized learning: Under large-class teaching models, instructors have limited capacity to address individual differences.

2.2. Opportunities and value of AI empowerment

Artificial intelligence technology offers new possibilities for addressing the aforementioned challenges: Overcoming temporal, spatial, and ethical constraints: VR/AR/MR (virtual/augmented/hybrid reality) technologies can create virtual simulation training environments [4]. Students practice complex clinical cases and protective procedures in virtual wards, compensating for insufficient practical resources. Simulating dynamic and complex scenarios: AI-driven intelligent dynamic case systems can simulate nonlinear changes in disease progression over time and under various interventions, enabling students to assess continuity and decision-making adjustments, thereby fostering dynamic clinical thinking. Achieving precise and intelligent evaluation: Leveraging computer vision technologies, systems can collect operational data and provide objective assessments and improvement recommendations through machine learning analysis. Integrating with smart clinical practices: Advanced electronic health records, wearable device parameters, and medical imaging data can serve as teaching materials. Combined with data analysis tools (e.g., Python, BI tools), these resources guide students in conducting data-driven health risk assessments and adapting to data-driven nursing practice models. Supporting personalized adaptive learning: AI systems can recommend tailored learning pathways and resources based on individual learning behaviors, enabling customized education.

3. The concept of "integration of industry, education, and innovation" and related educational theories

"The integration of industry, education, and innovation" serves as the core concept guiding this curriculum restructuring, combined with a series of modern educational theories to form the logical foundation for reform.

3.1. The connotation of "industry-education-innovation integration" and the "three-chain synergy" model

"Industry-Education-Innovation Integration" represents an advanced development of industry-education collaboration, with its core objective being to break down barriers between employment, education, and innovation while establishing a closed-loop ecosystem that mutually reinforces each other [5]. In vocational undergraduate nursing education, this is specifically manifested as follows: Employment Chain — Demand-Side Guidance: Starting from the demand for digital literacy and innovation capabilities in fields such as smart healthcare and elderly care, it informs the setting of educational objectives and curriculum content. Education Chain — Supply-Side Reform: Guided by industrial needs, it drives systematic restructuring of curriculum frameworks and assessment standards, integrating cutting-edge technology and innovation cultivation throughout the entire educational process. Innovation Chain-Momentum Transformation and Value Enhancement: It uses technological, practical, and service model innovations as bridges connecting industry and education, facilitates the transformation of new technologies into teaching tools, and encourages both faculty and students to contribute back to industry through technology commercialization.

3.2. Supportive education theory

Outcomes-Based Education (OBE): Emphasizes that teaching should be designed in reverse based on the learning outcomes students are ultimately expected to achieve. In AI-driven curriculum redesign, it is essential to first define the "digital-intelligent" assessment competencies students should possess, thereby

guiding both instruction and evaluation. Situational Learning Theory [6]: Posits that learning is a process of interacting with the environment and others within real or simulated contexts. VR/AR simulations create realistic professional scenarios, enabling students to construct knowledge and develop professional identity through assessment tasks. Constructivism highlights learners' active construction of knowledge; inquiry-based learning and data-driven case studies facilitate students' autonomous development of a robust knowledge framework for health assessment.

4.Insights from the current landscape: Applications and implications of AI in nursing education domestically and internationally

4.1. Trends in foreign applications of AI in nursing education

Foreign countries were among the earliest to integrate AI into nursing education, demonstrating the following trends:

The advancement of virtual simulation and high-fidelity modeling: Virtual patients (VPs) and VR-based training have been widely adopted in fields such as health assessment and emergency care, with research demonstrating their positive impact on students' knowledge retention and clinical reasoning skills. AI-driven adaptive learning and intelligent tutoring systems: Some institutions utilize AI algorithms to analyze learning behaviors and develop personalized learning pathways for students. Many nursing schools abroad have integrated data analysis and health information technology into curricula to cultivate students' ability to apply electronic health records in evidence-based practice. The American Association of Colleges of Nursing (AACN) explicitly emphasizes informatics and medical technology competencies as core elements of nursing education [7]. Emphasis on ethics, privacy, and humanistic considerations: Issues such as nurse-patient relationships in virtual environments, AI decision biases, and data privacy have been incorporated into ethical curriculum discussions to ensure that technological applications remain aligned with the humanistic principles of nursing.

4.2. Domestic progress and unique explorations

China's AI-driven nursing education is still in its early stages, characterized by policy-driven initiatives and close collaboration between industry and academia.

Development of Virtual Simulation "Golden Courses": The Ministry of Education's initiative for virtual simulation "golden courses" has already seen the implementation of national and provincial-level nursing education projects. Development of teaching products through university-industry collaboration: VR devices, intelligent simulators, and other products developed through such partnerships are being progressively integrated into educational settings. Research focus on outcome evaluation: Most current studies remain focused on verifying the short-term effectiveness of AI tools in specific skill-based instruction; how to embed AI into curriculum frameworks, support competency assessment, and achieve deep integration of industry-education-innovation remains under exploration [8].

Insight: When advancing the restructuring of health assessment curricula, it is essential to ground efforts in local realities by transforming industry data into teaching materials and corporate technologies into instructional tools, while simultaneously cultivating students' ability to solve practical clinical problems.

5. Innovative approaches to health assessment courses enhanced by AI

Based on the above analysis, this paper proposes four interconnected core approaches for AI-driven reform of the undergraduate nursing health assessment curriculum, forming a comprehensive systemic reform framework.

5.1. Pathway 1: Goal reengineering and content restructuring — Based on clinical needs and AI capability matrix

The primary task of curriculum restructuring is to define learning outcomes and reorganize instructional content. Goal refinement: Beyond traditional knowledge, skills, and attitude objectives, a new dimension of "Digital Literacy and Innovative Practice" has been introduced [9]. This includes: (1) Utilizing intelligent assessment tools (e.g., electronic stethoscopes, smart ECG machines, remote monitoring devices) for data collection; (2) Identifying abnormal trends using data analysis software; (3) Conducting standardized high-risk scenario assessments in VR simulations; (4) Making preliminary nursing decisions based on clinical data; (5) Understanding the application limitations and ethical risks of AI. Content reorganization: Departing from the conventional chapter structure organized by bodily systems, a modular framework of "Basic Module + Core Module + Advanced Innovation Module" has been adopted. The Basic Module covers an introduction to health assessment, communication skills, and digital literacy. The Core Module integrates history-taking, physical examination, and AI-assisted interpretation, supplemented with exercises on smart device usage and electronic medical records. The Advanced Innovation Module introduces topics such as anonymized data and wearable devices, encouraging students to develop innovative solutions addressing clinical challenges and collaborate across disciplines.

5.2. Pathway 2: Methodological innovation and resource reengineering — Building a new smart teaching ecosystem integrating virtual and physical elements

Innovation in teaching methods and resources serves as the vehicle for achieving the new objectives.

A blended teaching model integrating online and offline approaches: Pre-class (online): Students acquire foundational knowledge through MOOC/SPOC courses, self-assess using AI-based question banks, obtain personalized preview materials, and watch instructional videos on intelligent medical equipment provided by healthcare institutions [10]. In-class (offline + virtual): Problem-Based Learning (PBL)/Project-Based Learning (PjBL) is employed. Following concise instructor guidance, students complete case assessment exercises on smart simulators or VR systems, with real-time recording of procedural steps and duration. Post-class (extension and innovation): Advanced training sessions and extended projects are scheduled. Development of smart teaching resources includes: Intelligent dynamic case libraries developed in collaboration with hospitals and enterprises, where cases can evolve differently based on student interpretation; VR/AR training resources focusing on cardiopulmonary-abdominal examinations, neurological assessments, infectious disease prevention, and emergency response scenarios; Clinical big data case packages constructed from anonymized electronic medical records; and integration of real hospital projects as inquiry-based learning tasks.

5.3. Pathway 3: Evaluation reform and data-driven approaches — Towards process-oriented, personalized developmental assessment

Leverage AI technology to transform evaluation systems from outcome-oriented to process-oriented and

developmental. Multimodal data collection: Data are gathered during practical training using sensors, cameras, and operation logs, covering operational behaviors and learning records. AI-assisted automated skill assessment: Computer vision and machine learning enable the development of standardized models for quantitative scoring and detailed feedback on VR operation videos. Personalized feedback and early warning based on learning analytics: The platform integrates data from various stages to generate "ability profiles" and learning dashboards, visually presenting knowledge mastery levels, strengths/weaknesses, and learning patterns. Teachers can provide targeted guidance accordingly, while the system identifies students facing learning difficulties. Value-added assessment and innovation achievement evaluation: Focus on overall competency enhancement throughout the semester, incorporating innovative achievements into assessments with emphasis on information integration and critical thinking skills.

5.4. Pathway 4: Joint platform development and institutional safeguards — Building a sustainable collaborative education community among universities, research institutes, and enterprises

Curriculum restructuring requires a robust collaborative platform and sustainable mechanisms. A joint "AI + Nursing Education" innovation platform should be established, enabling collaboration among educational institutions, partner hospitals, and enterprises to establish joint laboratories. This platform serves four key functions: (1) Technology development and translation: Jointly developing teaching-oriented AI tools and virtual case scenarios; (2) Resource co-construction and sharing: Hospitals provide anonymized data, enterprises contribute technology, and educational institutions facilitate instructional adaptation, forming a dynamic resource repository; (3) Faculty training and exchange: Corporate engineers and clinical experts provide training for educators, while educators participate in enterprise research, achieving mutual empowerment; (4) Student practice and innovation incubation: Serving as a base for student practical training, competitions, and entrepreneurial incubation. Interdisciplinary dual-qualified teaching teams should be established, comprising nursing faculty, clinical nursing experts, and AI/data science professionals or engineers, who engage in regular joint research to foster mutual enhancement. A learner-centered support system must be developed, including technical assistance and mentoring frameworks to help students adapt to new technological tools.

6. Conclusion

From the perspective of integrating industry, education, and innovation, AI empowers health assessment courses in vocational undergraduate programs to meet the demands of smart healthcare and address challenges in traditional teaching. This transformation is not merely a technical addition but a systemic overhaul guided by industrial needs and innovative capabilities, encompassing curriculum objectives, content, teaching methods, and evaluation systems. Through goal redefinition, methodological innovation, evaluation reform, and collaborative platform development within the tri-chain synergy framework, AI technology can serve as a driving force for enhancing teaching quality and students' core competitiveness. The collaborative efforts among educational institutions, hospitals, and enterprises are poised to open new horizons for vocational nursing education and provide robust talent support for the healthcare sector.

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