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A Study on Implementation Pathways for AI-Powered Full-Process Intelligent Courses to Enhance Precision in Medical Education

Xiaozhong Chen [1], Jianing Liang[2], Yueyang Jiang [3], Xiaofeng Jin [4,*]

[1] School of Graduate, Wenzhou Medical University, Wenzhou 325000, China

[2] School of Traditional Chinese Medicine, Wenzhou Medical University, Wenzhou 325000, China

[3] School of medical humanities and hospital management, Wenzhou Medical University, Wenzhou 325000, China

[4] Teade Union, Wenzhou Medical University, Wenzhou 325000, China

*** Correspondence:**

Xiaofeng Jin

wmcjxf@163.com

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Abstract

This study focuses on innovative pathways for leveraging artificial intelligence (AI) technology to enhance higher education course development, with the core objective of establishing a smart course system that encompasses the entire process from course design, teaching implementation, learning support, to evaluation and feedback. Leveraging AI technologies such as knowledge graphs and large language models, a systematic smart course platform has been developed, featuring core modules including AI-assisted lesson plan design, intelligent student performance analysis, digital virtual teachers, adaptive learning pathways, and intelligent assessment feedback. Practical applications have demonstrated that the platform addresses key challenges through four pillars: 'AI-empowered course design and planning,' 'innovative "teacher/student/machine" deep interaction teaching models,' 'adaptive learning paradigms enabling "active learning,"' and 'enhancing assessment methods through diversified evaluation.' This has effectively addressed key issues such as inaccurate learning situation analysis, monotonous teaching models, insufficient teacher AI skills, and the lack of dynamic quantification in evaluations. It has significantly improved course teaching quality and student learning efficiency, providing a scalable smart course model for the digital transformation of higher education.

Keywords: Artificial Intelligence; Smart Courses; Full-Process Construction; Knowledge Graphs; Adaptive Learning; Medical Education

1. Introduction

In the era of artificial intelligence driving the digital innovation and development of education, higher education is undergoing profound transformation. In 2024, the Higher Education Division of the Ministry of Education issued a document titled *Artificial Intelligence Driving the Digital Innovation and Development of Higher Education*, clearly stating the need to promote the deep integration of artificial intelligence and other information technologies with education and teaching, and to implement an artificial intelligence empowerment initiative (Wang et al., 2024). For medical schools facing the challenge of balancing the expansion of graduate education scale with the enhancement of educational quality, leveraging AI technology to strengthen the construction of online medical and pharmaceutical courses and promote educational reform has become an urgent need to improve educational quality. Current course development faces systemic challenges that hinder improvements in teaching quality, primarily manifested in four key issues: inaccurate analysis of student learning situations, insufficient student initiative, monotonous teaching models, and outdated evaluation systems (Thurzo, 2025). This paper will address these issues by adopting a problem-oriented approach to establish an effective, multi-dimensional AI-based course quality improvement system and explore a comprehensive smart course development implementation pathway tailored to medical education. This holds significant implications for improving the teaching quality of medical courses at medical institutions. However, the model and implementation path require a larger dataset and broader application scope during the initial phase to assess their rationality and effectiveness. This will also provide the most direct information and data sources for subsequent model optimisation and path refinement, thereby enhancing the efficacy of the model and path. This holds significant implications for improving teaching quality, ensuring students' comprehension of course content, and fostering their innovative thinking.

2. Current Status and Challenges of AI Integration in Medical Education

The AI revolution is sweeping the globe, and medical education—a field characterised by its knowledge-intensive nature and stringent skill requirements—is on the brink of a silent transformation. AI-enabled medical education is hailed as the ‘golden key’ to breaking free from traditional constraints and reshaping the future model of physician training. Currently, the integration of AI and medical education exhibits a pattern of ‘localised application enthusiasm but systemic integration lag.’ According to data from Grand View Research, AI-driven virtual anatomy platforms, intelligent diagnostic simulation systems, and medical imaging assistance tools have already been implemented in some top medical schools. The global medical education AI market is projected to reach 6.18 billion US dollars by 2027. However, its technological applications remain fragmented, such as surgical simulation training and knowledge graph-assisted learning, and have not yet formed an ecosystem-level integration covering the entire chain of ‘teaching, learning, assessment, and management.’ Meanwhile, educational administrators are beginning to recognise the value of learning behaviour data, but data silos remain widespread, and utilisation efficiency remains low. A 2023 survey by China Medical Education Technology covering 50 medical schools showed that only about 15% of institutions have established preliminary unified learning data analysis platforms (Huang et al., 2023). This indicates that the current integration process is still in its exploratory phase, facing numerous challenges, yet also holding significant untapped potential.

Through daily teaching experiences and surveys of key groups within campuses, combined with existing data and literature, the team identified four major issues in the current integration of AI technology with medical education: First, there is the issue of inaccurate learning situation analysis. AI could integrate multi-dimensional data such as online learning duration, resource click streams, forum interactions, simulation operation paths, and even eye movements and physiological signals (in the experimental stage). However, in reality, data sources are fragmented, and algorithm models are simple, making it impossible to construct accurate personalised learning profiles, resulting in teaching interventions that are 'aimless.' Currently, medical schools that have introduced AI learning platforms primarily use them for automatically tracking video viewing duration, failing to delve into the correlation between behavioural patterns and knowledge mastery. The second challenge is insufficient learning initiative, with existing issues such as passive information dissemination and lack of personalisation remaining severe (Zhou et al., 2025). Current AI tools often feature rigid designs, awkward interactions, and a lack of deep appeal and emotional connection, resulting in a poor user experience for students and an inability to effectively ignite learning enthusiasm. The third challenge is the extreme lack of diversity in current teaching models. Innovative teaching models, whether due to technical costs, insufficient digital literacy among teachers, or outdated teaching designs, have failed to effectively integrate into mainstream classrooms, leaving the traditional 'lecture + memorisation' model largely intact (Fu, 2025). Finally, the lagging evaluation system continues to have a significant impact, with evaluation reforms facing multiple challenges such as technical reliability verification, ethical and privacy concerns, and difficulties in integrating with traditional scoring systems, resulting in slow progress in implementation. The severe lag in evaluation feedback makes it difficult for students to receive timely and effective guidance for improvement. This issue has seriously impacted the integration of AI technology and medical education (Lang et al., 2025).

To ensure that the aforementioned AI-enabled smart course platform (covering its technical architecture based on knowledge graphs and four core functional systems) can be effectively implemented and truly solve the deep-seated issues in course development, this study has constructed a clear and collaborative implementation model and working mechanism. This model focuses on addressing the key bottlenecks in current teaching practices, driving systematic improvements in course quality through the deep application of the platform's core capabilities and multi-stakeholder collaboration.

3. Establishing a closed-loop quality improvement mechanism for AI-enabled medical and pharmaceutical courses

To ensure that the aforementioned AI-enabled smart course platform (covering its technical architecture based on knowledge graphs and four core functional systems) can be effectively implemented and truly solve the deep-rooted problems in medical course development, this study has constructed a clear and coordinated implementation model and working mechanism. This model focuses on breaking through the key bottlenecks in current medical teaching practices, driving systematic improvements in medical course quality through the in-depth application of the platform's core capabilities and multi-party collaboration.

3.1. Construction of the Smart Course Platform Implementation Model and Analysis of Its Mediating Role

3.1.1. Establishing New Pathways for Medical Education Logic and Competency Development with a Multidimensional Dynamic Knowledge Graph as the Core Foundation

Current medical education practices commonly face two critical challenges: firstly, insufficient precision in learner profiling hinders systematic understanding of individual and group cognitive characteristics and competency disparities among medical students, thereby undermining evidence-based differentiated instruction (Jin, 2025); Secondly, course resource development often lacks systematic planning, resulting in fragmented resource types that poorly align with teaching objectives, thereby failing to effectively support the cultivation of advanced medical competencies (Fu et al., 2025). To address these challenges, this platform utilises a proprietary multi-dimensional dynamic knowledge graph as its core foundation. By deeply integrating the unique educational logic and competency development pathways of medical disciplines, it constructs a comprehensive precision teaching support system.

This knowledge map is not a static structure in the traditional sense, but rather integrates three core dimensions: firstly, the advanced problem-solving framework unique to medical disciplines, encompassing complex pathways from fundamental mechanisms to clinical applications; secondly, a competency-based dual-track map of clinical and research capabilities, clarifying the operational skills, cognitive approaches, and research literacy required at different learning stages; Thirdly, a continuous thread of medical humanities and professional ethics course-based ideological and political education, embedding elements such as ethical decision-making, doctor-patient communication, and professional ethics within the knowledge structure. This dynamically updated, multi-dimensional knowledge graph system provides a theoretical model and data annotation framework for conducting in-depth learning analytics.

This platform's multidimensional dynamic Knowledge Graph is constructed based on the unique logic of Medical education: it first integrates multi-source data including the Chinese Undergraduate Medical Education Standards, authoritative textbooks, clinical cases, and teaching processes. In its construction methodology, it first distils the discipline-specific problem frameworks, competency objectives, and core medical humanities themes. Subsequently, machine extraction forms a structured Knowledge Graph with precise associations between ‘knowledge nodes – competency tiers – ideological and political elements’. Leveraging data feedback and periodic revisions for dynamic iteration, it both responds to updates in medical knowledge and adapts to the competency development needs of medical students at different stages, providing a dynamically evolving knowledge foundation for precision teaching.

To address the significant challenge posed by insufficient precision in learning analytics, which hinders systematic understanding of individual and group cognitive characteristics and ability disparities among medical students, the task of constructing a multidimensional dynamic Knowledge Graph is now imperative.Leveraging this knowledge map, the platform has developed an intelligent learning diagnostics tool for educators. This tool integrates behavioural data from multiple learning contexts—theoretical study, simulation training, and clinical placements—to generate individual and cohort-level learning reports through node-based mapping and competency alignment. Educators can not only pinpoint students' weaknesses at specific knowledge nodes—such as insufficient spatial comprehension of anatomical structures or delayed reasoning abilities regarding certain pathological mechanisms—but also identify collective biases in clinical reasoning, research literacy, or doctor-patient communication. This enables truly precise identification, providing clear direction for subsequent instructional design.

In addressing the challenges of course resource development—which often lacks systematic planning, features fragmented resource types, and exhibits poor alignment with teaching objectives，the technical team collaborates with medical educators to comprehensively review and optimise existing teaching resources under the systematic guidance of the knowledge graph. This effort also involves planning and constructing a new generation of multimodal medical teaching resource repositories. Resource development strictly adheres to an integrated ‘objective-resource-assessment’ principle, striving for high alignment with medical education goals and student cognitive characteristics. Specifically, the platform prioritises developing high-quality, diverse teaching resources such as: - Interactive 3D models precisely matching complex anatomical structures, enabling multi-angle observation and virtual dissection; - Virtual simulation experiments illustrating dynamic pathological mechanisms, aiding comprehension of disease onset and progression; - Case libraries integrating authentic clinical scenarios, covering end-to-end training from diagnostic reasoning to treatment planning. Additionally, it incorporates evidence-based research training modules and standardised patient simulation resources.

Each resource category is precisely linked to corresponding knowledge nodes, competency objectives, and ideological elements within the knowledge graph. For instance, a 3D model of a cardiac valve lesion connects not only to anatomical knowledge nodes but also aligns with clinical differential diagnosis competency training objectives, while integrating the ideological discussion point of ‘patient informed consent’ from medical ethics. This structured, tag-based resource management enables the platform to automatically recommend personalised resource combinations tailored to students' varying competency levels and learning styles based on learning analytics. This supports tiered teaching and individualised guidance by educators.

Ultimately, through a knowledge graph-driven closed-loop system of learning analytics and resource development, the platform significantly enhances the targeted nature of medical education resource construction and the precision of instructional design. Educators can formulate tailored teaching strategies based on objective data, while students gain learning experiences better aligned with their individual cognitive development pathways. This fundamentally propels medical education from a ‘one-size-fits-all’ approach towards ‘personalised cultivation,’ thereby supporting the systematic development of high-calibre medical professionals.

3.1.2. Establish an intelligent platform to serve as an intermediary in addressing the teaching and learning needs of both staff and students.

To overcome challenges such as the limited diversity of teaching methods in medical curricula (particularly in foundational and bridging disciplines like anatomy, pharmacology, and pathology), restricted depth and breadth of interaction between medical students and faculty, and difficulties in sharing high-quality pedagogical experiences (Yang et al., 2025), the intelligent teaching tools provided by the platform serve as a critical support. Medical educators can flexibly utilise features such as AI lesson plan design, automated courseware generation and enhancement, and AI content creation (e.g., generating teaching scenario descriptions based on real cases, expanding clinical decision analysis) to efficiently construct high-quality, highly interactive teaching materials. Concurrently, digital virtual tutors (AI teaching assistants) provide round-the-clock intelligent medical knowledge Q&A and guidance. AI-accelerated video production (such as rapid creation of surgical procedure breakdown videos and disease progression animations) significantly lowers the threshold for high-quality video resources. Combined with intelligent interactive classrooms (incorporating technologies like universal whiteboards), this creates a new ecosystem for medical digital-intelligent classrooms featuring seamless online-offline integration and deep ‘teacher-student-machine’ collaboration. This process is complemented by the establishment of virtual teaching and research rooms, effectively facilitating the consolidation and sharing of high-quality teaching experiences, resources, and strategies among medical educators through intelligent tools. This includes effective methods for teaching complex diseases and clinical reasoning training, greatly enriching teaching formats, enhancing classroom engagement and efficiency, and effectively addressing the challenges of teaching abstract medical concepts while overcoming limitations in class hours and student comprehension capacity.

However, as the core implementers, medical educators' proficiency in intelligent teaching skills and application levels directly impacts the platform's effectiveness. To address this, the platform itself incorporates low-threshold AI-assisted tools (such as intelligent generation of medical examination questions, automated analysis of clinical skills simulation operation data, and automatic generation of learning progress reports), providing an intuitive ‘scaffolding’ for teachers to develop their digital literacy. Concurrently, the institution provides systematic training and technical support at the organisational level. This focuses on empowering educators to efficiently evaluate AI-recommended medical resources, interpret learning data and assessment profiles to inform teaching decisions, and master AI-integrated instructional design principles and methodologies. This significantly lowers the threshold for AI adoption, enabling educators to concentrate on core medical teaching design and student guidance, thereby facilitating a seamless transition from traditional to intelligent teaching.

3.2. Data-Driven Dynamic Evaluation and Faculty Collaborative Development Mechanism

Traditional medical education evaluation systems have long faced multiple challenges, including lagging assessment timelines, limited assessment modalities, and subjective evaluation practices (Lillehaug & Lajoie, 1998). Conventional methods such as written examinations and practical assessments often lack real-time feedback and multidimensional quantitative support. Consequently, they struggle to comprehensively reflect students' knowledge acquisition, clinical reasoning abilities, and professional competence levels (Li et al., 2024). Moreover, they fail to provide sustained, reliable data support for the dynamic optimisation of teaching processes (Chen et al., 2024). To fundamentally transform this situation, this platform has established a data-centric, intelligence-driven dynamic evaluation and collaborative development mechanism, achieving a systemic shift in medical education assessment from ‘experience-led’ to ‘data-driven’.

The core of this mechanism lies in establishing a closed-loop system covering the entire ‘teaching, learning, assessment, and optimisation’ process. Through embedded data collection modules, the platform comprehensively tracks and records medical students' behavioural data across multiple learning scenarios. This encompasses operational steps in virtual simulation experiments, clinical decision pathways in case simulations, the quality of contributions in online interactive discussions, and performance in various theoretical and practical assessments. These high-frequency, multi-modal, continuous data points form the digital footprint of student learning, providing a robust foundation for in-depth analysis.

At the intelligent assessment level, the platform integrates multiple cutting-edge artificial intelligence technologies to construct a robust medical education-specific evaluation system. For instance, the medical English oral assessment module not only evaluates pronunciation accuracy but also analyses the appropriateness of terminology usage and communication fluency. The automated marking of case analysis reports and clinical decision-making essays is achieved through an intelligent assessment system customised for Medical education scenarios. The system constructs its assessment logic by learning from two core corpora: firstly, representative error samples from students' routine assignments (e.g., common issues such as knowledge gaps); secondly, the latest clinical practice guidelines and textbooks (including standardised textbooks like Internal Medicine and Diagnostics, alongside industry standards such as the Chinese Medical Association's Guidelines for the Diagnosis and Treatment of Acute Myocardial Infarction and the Chinese Clinical Practice Guidelines for Community-Acquired Pneumonia in Emergency Settings), which define the boundaries of evidence-based medical knowledge and the basis for clinical decision-making. Furthermore, the platform's plagiarism detection and originality assessment capabilities for medical literature reviews significantly enhance the practicality of academic integrity education. Collectively, these capabilities expand the depth and efficiency of assessment, enabling comprehensive evaluation of ‘knowledge-skills-competencies’.

Leveraging multi-source data and intelligent assessment results, the platform's advanced learning analytics engine generates highly interpretable quantitative evaluation profiles and dynamic learning progress reports. These evaluation profiles encompass not only the internalisation of medical knowledge but also comprehensive competencies such as clinical reasoning ability, practical operational skills, doctor-patient communication performance, and medical ethical judgement. Each report visually presents individual and group learning progress, capability gaps, and developmental trends, enabling educators to move beyond reliance on subjective teaching judgements. Instead, they can make precise instructional decisions grounded in objective, comprehensive, and timely data insights.

Building upon this foundation, the platform effectively fosters teachers' professional development and optimises instructional practices. Educators can dynamically adjust teaching strategies based on real-time feedback from the system. For instance, they may provide focused explanations on common knowledge gaps within a cohort or design differentiated training content and resource delivery strategies tailored to students' varying ability levels. Concurrently, the platform supports data-driven teaching reflection and peer collaboration among educators, facilitating a continuous cycle of improvement: assessment → diagnosis → intervention → re-evaluation.

Concurrently, this mechanism enables the platform's self-iteration. Drawing upon continuously accumulated assessment feedback and learning efficacy data, the platform continually refines its internal recommendation logic and resource matching mechanisms. This includes adjusting learning pathway difficulty gradients, increasing the proportion of exercises targeting weaker areas, and introducing case studies and simulation training better aligned with students' current proficiency levels. Consequently, teaching resources are more precisely matched to individual needs.

Ultimately, this data-driven dynamic assessment mechanism, coupled with the collaborative development model for teaching staff, forms a virtuous ‘assessment-feedback-optimisation’ closed loop. This not only significantly enhances the timeliness and accuracy of medical education evaluation but also greatly strengthens the responsiveness and adaptability of the teaching system. It signifies our progression towards a new paradigm of medical education that is more inclusive, scientific, and growth-oriented, providing robust support for cultivating comprehensively skilled medical professionals.

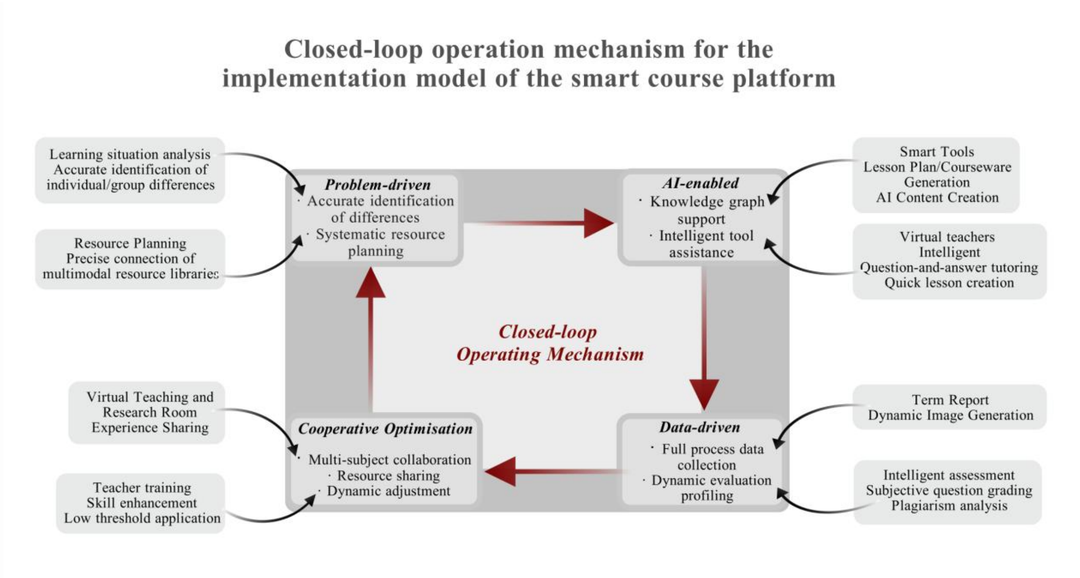

Figure 1. Diagram illustrating the closed-loop operation mechanism of the smart course platform implementation model

4. Research and Validation Methodology

To ensure the scientific rigour, efficacy, and educational applicability of the intelligent models within the constructed Smart Courses platform, this study employs a four-stage closed-loop research methodology: 'Model Construction – Data Collection – Effectiveness Validation – Iterative Optimisation'. This approach systematically advances the development of intelligent models and their educational validation.

4.1. Model Construction and Data Foundations

Centred upon a Medical education Knowledge Graph, the platform integrates natural language processing, machine learning, and adaptive learning algorithms to construct four core intelligent modules: learning diagnostics, resource recommendation, virtual tutoring, and intelligent assessment. The Knowledge Graph is built from multi-source data including the Chinese Undergraduate Medical Education Standards, authoritative medical textbooks, authentic clinical cases, and teaching logs. Through entity extraction, relationship mapping, and semantic fusion, it forms a three-dimensional dynamic structure encompassing 'knowledge-competency-proficiency'. Model training utilises corpus and behavioural data specific to medical education scenarios, including student simulation pathways, case analysis texts, interactive discussions, and assessment records, ensuring the model's adaptability within the medical education domain. During the refinement phase, the platform underwent preliminary trials across medical colleges and medical schools within comprehensive universities within the province, yielding foundational data for subsequent model enhancement and iteration.

4.2. Design of Intelligent Model Validation Methods

To validate the model's efficacy, a combined internal and educational empirical verification mechanism was devised:

(1) Internal technical validation: Employing cross-validation and A/B testing to assess the model's performance in recognition accuracy, recommendation relevance, and feedback timeliness. For instance, the rationality of adaptive recommendation algorithms was tested by comparing the consistency between AI-generated learning pathways and expert-designed pathways in achieving teaching objectives.

(2) Educational Empirical Validation: Pilot classes were selected within partner medical colleges to conduct a semester-long comparative teaching experiment. The experimental group employed the Smart Courses platform for full-process teaching, while the control group adhered to traditional teaching methods. Comprehensive evaluation of the platform's practical effects—including enhancing student learning outcomes, strengthening teaching interaction, and optimising instructional decision-making—was achieved through multidimensional data analysis. This encompassed pre- and post-test score comparisons, learning behaviour analysis, teacher-student interviews, and satisfaction questionnaires.

4.3. Data Collection and Analysis

The platform incorporates an integrated data collection module that records real-time behavioural data throughout the entire learning process, encompassing resource clickstreams, task completion durations, interaction frequencies, assessment outcomes, and teaching adjustment records. Primary data sources are the participating teaching institutions and medical education offices, ensuring authenticity. Following data collection, the model classifies and analyses the information using descriptive statistics, cluster analysis, and association rule mining to identify learner group characteristics, teaching bottlenecks, and optimisation directions. Concurrently, qualitative analysis methods are applied to code and analyse teacher interview content, extracting application patterns and barriers for intelligent tools in actual teaching practice to support system development.

Regarding data sources, foundational data primarily comprises 3,500 records from Wenzhou Medical University's relevant disciplines—including basic medicine, clinical medicine, nursing, pharmacy, and biomedical engineering—serving as the model's core dataset. This data predominantly originates from undergraduate medical and pharmaceutical students. The team employed stratified sampling based on year-level proportions to ascertain each discipline's willingness to utilise the online intelligent platform and identify fundamental requirements. Concurrently, feedback was gathered from subject lecturers across university departments and affiliated hospitals, yielding 580 additional data points. This combined input enabled the development of an intelligent course platform better aligned with both teaching requirements and student needs.

4.4. Model Optimisation and Scalability Assessment

Building upon issues and feedback identified during validation, the research team undertook iterative refinements to the model. Key enhancements focused on updating the Knowledge Graph mechanism, refining the granularity of learner profiling, and improving the resource tagging system. Concurrently, multiple pilot trials across diverse medical institutions tested the model's adaptability and scalability, evaluating its potential for deployment across varied teaching environments, student cohorts, and course types.

5. Conclusion and Outlook

The team identified four major issues encountered in daily teaching and dedicated itself to exploring and implementing AI-enabled solutions for the entire course development process. The core of this effort was the construction of an intelligent course platform based on a knowledge graph and integrating multiple AI technologies. Through the synergistic effects of four mechanisms—precision planning and resource development, intelligent teaching implementation and interaction, support for enhancing teachers' AI literacy, and data-driven dynamic evaluation and optimisation—the team effectively addressed the key bottlenecks in medical course development. The implementation framework has been largely established, but the model remains in a trial and refinement phase.The replicability of the system requires urgent enhancement. Different institutions exhibit varying degrees of granularity in their teaching platforms, with somewhat ambiguous functional positioning requirements. Consequently, a single system cannot adequately meet the needs of all medical schools. Even with the replication of basic procedures and algorithms, modifications remain necessary to accommodate the specific demands of different institutions. The precision of individual student coverage requires improvement. This stems from undergraduate education's holistic approach to student development, where platforms primarily target entire cohorts rather than individuals. While personalised sections exist, they often function more as self-exploration tools, diminishing the effectiveness and utility of personalised modules. The evaluation metrics within the overall assessment framework remain insufficiently comprehensive and specific. Differences in assessment criteria across regions, identified during the pilot phase, necessitate ongoing refinement of the evaluation indicators. These should be categorised to complete the construction of the assessment system. Future research will address these existing issues by deepening efforts in the following directions: first, further expanding the application of AI in precise assessment of English proficiency (especially speaking and writing) and intelligent cultivation of cross-cultural communication skills; second, deepening algorithm optimisation for personalised learning paths to enhance the precision and adaptability of recommendations; third, expanding the research sample size and extending the research period to track the long-term impact of smart courses on students' learning outcomes and skill development; Fourth, explore pathways for integrating AI ethics education into smart courses. The team hopes that the smart course paradigm established in this study will not only provide a practical model for medical education but also serve as a reference for the digital transformation of higher education more broadly, contributing to the high-quality development of medical higher education. Additionally, by pioneering research in the current untapped area of constructing a fully smart course development platform using AI technology, the team aims to lay the groundwork and accumulate experience to provide more samples and insights for future studies.

Author Contributions:

Conceptualization, Xiaozhong Chen; methodology, Yueyang Jiang; software, Xiaozhong Chen; validation, Jianing Liang; formal analysis, Jianing Liang; investigation, Xiaozhong Chen; resources, Xiaozhong Chen; data curation, Yangyang Zhang.; writing—original draft preparation, Jianing Liang; writing—review and editing, Xiaozhong Chen; visualization, Xiaozhong Chen; supervision, Xiaofeng Jin; project administration,Xiaofeng Jin; funding acquisition, Xiaozhong Chen. All authors have read and agreed to the published version of the manuscript.

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Conflict of Interest:

The authors declare no conflict of interest.

References

Chen, B. W., Wu, K. H., Wei, J., Wang, Y. Q., Li, Z. S. N., Yang, S., & Meng, X. Y. (2024). Practice and Thinking of the Supervisor Responsibility System in the Connected Training Mode of Undergraduates and Postgraduates of Medical Students. International Journal of Geriatrics, 45(01), 121-125.

Fu, H. R., Liu, W. J., Zhu, L. Y., Long, Y., Xiang, B., & Yang, H. J. (2025). Exploration of AI-Assisted Diagnosis Teaching Pathways Based on Huazhi Yihui Platform. Continuing Medical Education, (06), 112-115.

Fu, M. (2025). Exploration of a Knowledge Graph-based Smart Teaching Model for Transportation Management Courses. Auto Time, (17), 90-92.

Huang, Y. P., Wu, H. D., Liu, H., Dai, H. L., Jin, L., Wang, L. J., & Sun, J. (2023). Construction and practice of formative evaluation system from the perspective of educational informationization 2.0. China Medical Education Technology, (04), 458-462+467.

Jin, G. P. (2025). Exploratory practice of integrating medical humanities education into clinical teaching of specialised traditional Chinese medicine disciplines. Journal of Chinese Medicine Management, (14), 255–257.

Lang, L. L., Su, J. T., Ren, W. N., Meng, J. J., Lu, Z. Z., Shen, T., & He, H. M. (2025). Generative

AI Empowering Higher Medical Education: The Path of Transformation from Curriculum to Assessment. Chinese Journal of Medical Education Technology, 1-6.

Li, J., Li, Y. K., Wang, Q. B., Liang, Y. B., Luo, W. L., Chen, X. M., & Ke, Y. (2024). Preliminary Exploration of Education Effect of Innovation and Entrepreneurship Competition for Medical Students with the Theme of Medical-Engineering Integration. Medical Education Research and Practice, (04), 404-408.

Lillehaug, S. I., & Lajoie, S. P. (1998). Ai in medical education—another grand challenge for medical informatics. Artificial Intelligence in Medicine, (3), 197.

Thurzo, A. (2025). How is AI Transforming Medical Research, Education and Practice?. Bratislava Medical Journal, 126, 243–248.

Wang, F., Liu, Y. Q., & Zhou, T. H. (2024). Artificial Intelligence Driving Digital Innovation in Higher Education. Chinese Higher Education, (Z1), 9-12.

Yang, X. M., Shen, Z. F., Xiong, Y. B., Chen, W. D., Chen, H., Chen, Y. X., & Shao, Y. J. (2025). Research on artificial intelligence enabling medical students to be creative. Journal of Bengbu Medical University, (01), 46-51.

Zhou, Z., Cao, J., Zhou, B. B., Din, L., Zhu, H. Y., Guo, H. J., & Yang, B. (2025). Exploration and Practice of AI-empowered Pharmaceutical Education Reform. Pharmaceutical Education, (04), 1-6.