

Exploratory Research on Knowledge Graph Combined with Artificial Intelligence Teaching Assistant in the Fundamentals of Nursing Course

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Abstract: Higher education is undergoing digital construction, and traditional education can no longer meet the training needs of nursing talents in the new era. The teaching of Fundamentals of Nursing faces several dilemmas, including cumbersome course content and scattered knowledge points. With the iterative update of modern digital technologies, the knowledge graph—structured, semantic, scalable, and multi-source integrated—provides a technical path to solve these problems. This study proposes a planned teaching application scheme based on the Xuexitong platform, which integrates the knowledge graph, artificial intelligence teaching assistant, and task engine. This scheme not only provides practical reference for the teaching innovation of Fundamentals of Nursing but also offers new ideas for the in-depth integration of educational technology and nursing teaching.

Keywords: Knowledge graph; Artificial intelligence; Teaching assistant; Fundamentals of Nursing; Undergraduate nursing education

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1. Introduction

Intelligence is an important engine for educational reform, and digitalization is the core driving force for in-depth changes in education^[1,2]. Fundamentals of Nursing is a core course in nursing majors that covers multiple knowledge modules. It is not only the foundation for students' subsequent learning of clinical courses but also the key to cultivating their clinical thinking and professional operation abilities^[3]. However, the logical connections between the knowledge points of this course are hidden. Under the traditional linear teaching mode, students are prone to fragmented memory and find it difficult to independently construct a complete knowledge network^[4]. Limited by teaching time and energy, teachers can hardly accurately grasp each student's learning weaknesses, and after-class answering and personalized support lack timeliness. This has become a prominent problem that restricts the improvement of teaching quality.

At present, the knowledge graph is widely used in nursing teaching^[5-7], effectively solving the problem of scattered knowledge points and achieving good teaching results. However, most studies focus on the construction of the graph itself, with few combining platform tools to implement the whole teaching process. The application of artificial intelligence teaching assistants is also limited, mostly staying at the single level of answering questions^[8] and lacking in-depth integration with structured knowledge carriers. Based on the actual teaching of undergraduate Fundamentals of Nursing, this study plans the in-depth integration path of the knowledge graph and artificial intelligence teaching assistant, clarifying the teaching implementation plan that combines the two with the task engine. The aim is to provide a practical solution to solve the pain points of traditional teaching and promote the digitalization and precision development of nursing course teaching.

2. Research basis and platform support planning

2.1. Planning ideas of knowledge graph for Fundamentals of Nursing course

This study takes the 7th edition of *Fundamentals of Nursing* (published by People's Medical Publishing House) as the core textbook and is based on the undergraduate nursing professional teaching syllabus. It integrates a full set of course knowledge point videos recorded by the research group and other related resources, planning the construction framework of the knowledge graph for the Fundamentals of Nursing course. The focus is on clarifying the core modules and knowledge association logic of the knowledge graph, which lays a foundation for its subsequent integration and application with the artificial intelligence teaching assistant and task engine. By sorting out the core content of the course, five knowledge modules are determined: “Basic Theory and Occupational Protection, Comfort Care, Condition Observation and Recording, Clinical Treatment and Drug Administration, Special Populations and End-of-Life Care.” Combined with teaching practice, the core knowledge units of each module are disassembled to ensure the knowledge graph covers the course's core knowledge points and high-frequency clinical skills, making it suitable for both students' learning and teachers' teaching needs. Based on the characteristics of the Fundamentals of Nursing course, four core knowledge relationships are defined: “Inclusion, Predecessor Dependence, Clinical Application, and Complication Association.” The internal logic between knowledge units is sorted out to realize the association expression of “entity-relationship-entity” and “entity-attribute-attribute value.” For example, association relationships such as “Intravenous Infusion-Predecessor Dependence-Aseptic Technique” and “Axillary Temperature-Normal Range-36.0–37.0°C” are planned to clearly present the connections and application logic between knowledge points, helping students construct a systematic knowledge network. Each planned knowledge unit node is associated with corresponding resources—including knowledge point videos, clinical cases, and hierarchical exercises—from the Xuexitong resource library, forming an integrated network of “knowledge nodes-teaching resources.”

2.2. Planning of auxiliary function support for Xuexitong platform

This study relies on two modules of the Xuexitong platform: the artificial intelligence teaching assistant and the task engine. These two modules provide intelligent assistance and process guarantee for the teaching application of the knowledge graph, focusing on the implementation of the knowledge graph without deviating from the core of teaching or introducing complex technical operations.

2.2.1. Core auxiliary functions of artificial intelligence teaching assistant

The artificial intelligence teaching assistant is a teaching auxiliary tool that focuses on the teaching needs

of undergraduate Fundamentals of Nursing, mainly realizing three core functions. First, it provides accurate answering and resource association: it can quickly identify the core knowledge points in students' questions and automatically associate the corresponding nodes of the knowledge graph and supporting teaching resources, solving the problem of delayed after-class answering. Second, it simplifies the summary of learning situation data: it automatically collects basic data such as students' browsing of the knowledge graph, access to associated resources, and completion of exercises, forming intuitive learning situation feedback. Third, it pushes targeted resources: based on students' learning data, it pushes supporting resources for weak nodes in the knowledge graph to assist students in independent consolidation learning.

2.2.2. Process support function of task engine

The task engine is a teaching process management tool whose core function is to integrate the learning of the knowledge graph into standardized teaching tasks, realizing the implementation and tracking of the whole "pre-class–in-class–after-class" process. According to the teaching progress, teachers can release hierarchical learning tasks, clarifying the task objectives, completion time limit, and assessment requirements. The platform automatically tracks students' task completion status and counts relevant learning data, providing a basis for both the accurate assistance of the artificial intelligence teaching assistant and teachers' teaching adjustment, ensuring that the learning of the knowledge graph is not a mere formality.

3. Teaching application path of knowledge graph combined with artificial intelligence teaching assistant

3.1. Pre-class: Task engine-driven release of knowledge graph preview tasks

This stage aims to guide students to initially sort out knowledge logic and lay the foundation for classroom teaching. According to the teaching content of the next class, teachers can release targeted graph preview tasks in the Xuexitong task engine, specifying the key knowledge modules and core nodes that students need to focus on. For example, before explaining pressure ulcer care, students are instructed to learn the associated nodes of pressure ulcer risk factors, staging, and nursing measures, with a small number of basic cognitive questions embedded. When completing the tasks independently, students can browse the visual knowledge graph on their own to initially clarify the logical relationships between knowledge points. If they have questions, they can ask the artificial intelligence teaching assistant in real time, and the teaching assistant will automatically associate the corresponding nodes of the graph and explanation videos to provide immediate answers. The task engine automatically tracks students' graph browsing progress and task completion status, while the artificial intelligence teaching assistant summarizes students' high-frequency questions and unmastered knowledge points to form a simple preview feedback report. Based on this report, teachers accurately locate the key and difficult points of classroom teaching and optimize the teaching plan.

3.2. In-class: Knowledge graph as the core carrier

This stage combines the interactive assistance of the artificial intelligence teaching assistant to strengthen students' understanding and mastery of knowledge logic. First, the graph is explained visually: teachers can display the knowledge graph through Xuexitong screen projection, taking core nodes as the entry point to sort out the internal connections between knowledge points. For example, focusing on the core node of intravenous infusion, they can explain its predecessor dependence relationship with aseptic technique and its association relationship with various complications, helping students build a systematic knowledge framework

and break the limitations of traditional linear teaching. Second, case-driven graph exploration is carried out: case tasks combined with clinical practice—such as pressure ulcer prevention in elderly bedridden patients and intravenous infusion care in chemotherapy patients—are set. Students work in groups to find relevant knowledge points combined with the knowledge graph and analyze the nursing points in the cases. During group discussions, students can retrieve clinical cases and operation videos associated with the graph through the artificial intelligence teaching assistant to assist their analysis. Third, immediate testing and reinforcement are conducted: in-class quizzes are released through Xuexitong, with questions designed around the core association points of the graph. The artificial intelligence teaching assistant cooperates with the task engine to automatically correct and summarize the answering situation, quickly locating common mistakes in the class. Teachers can then conduct immediate reinforcement explanation combined with the knowledge graph and answer students' questions on the spot to ensure the mastery of core knowledge.

3.3. After-class: Precision assistance and tracking feedback

This stage aims to realize the consolidation and deepening of knowledge with the help of the precise assistance of the artificial intelligence teaching assistant and the tracking feedback of the task engine, making up for the lack of guidance in traditional after-class review. Teachers release hierarchical graph consolidation tasks through the task engine: basic-level tasks require students to sort out the graph logic of the knowledge modules learned in class and complete the supporting exercises of core nodes, while advanced tasks require students to analyze the cross-node associations in the knowledge graph combined with clinical cases to cultivate their knowledge application ability. When completing tasks, if students encounter confusion or forget knowledge points, they can access the corresponding nodes and resources of the knowledge graph again through the artificial intelligence teaching assistant. Based on students' task completion data, the teaching assistant pushes reinforcement resources for weak knowledge points, such as operation videos and case analyses. Teachers carry out targeted after-class tutoring according to the feedback and optimize the associated resources of the knowledge graph, forming a closed-loop after-class consolidation of “task completion–data feedback–precise tutoring–resource optimization.”

4. Teaching application value

The visual presentation of the knowledge graph makes the originally scattered and complex nursing knowledge logically clear^[9]. Students can intuitively see the connections between knowledge points, effectively avoiding fragmented memory and clearly understanding the internal logic and theoretical basis of each operation link. The immediate answering and targeted resource push of the artificial intelligence teaching assistant meet the personalized needs of students in independent learning, improving their learning initiative and efficiency. The process management of the task engine makes students' preview and review more targeted, avoiding the blindness of independent learning and cultivating good learning habits. At the same time, the learning mode that combines the knowledge graph with clinical cases helps students learn to retrieve knowledge from the graph to solve clinical problems, strengthening the connection between theory and practice and laying a foundation for the cultivation of clinical thinking.

The artificial intelligence teaching assistant greatly reduces teachers' after-class workload, allowing them to devote more energy to high-level teaching activities such as classroom teaching design, case analysis, and skill training. The learning situation feedback provided by the task engine and artificial intelligence teaching assistant

enables teachers to quickly and accurately grasp the learning weaknesses of the whole class, improving the pertinence and effectiveness of classroom teaching. At the same time, students' feedback on the use of resources associated with the knowledge graph provides a basis for teachers to optimize course resources, making the design of teaching resources more in line with students' learning needs and improving their practicality.

This study constructs a teaching mode of “knowledge graph + artificial intelligence teaching assistant + task engine,” which combines structured knowledge carriers, intelligent teaching assistance, and standardized process management. It realizes the mild integration of educational technology and nursing teaching, providing new ideas for the application of educational technology in nursing education.

5. Existing problems and optimization directions

It is reasonable to predict that problems may arise in the implementation of this mode. First, the knowledge graph planning may not be sufficiently adaptable to teaching practice. Second, the artificial intelligence teaching assistant has a limited ability to answer complex clinical questions. Third, students' acceptance of digital tools varies. Fourth, task design lacks flexibility and cannot meet personalized learning needs. To address these problems, in the future, we can further improve the feasibility and practicality of the scheme by continuously optimizing the knowledge graph planning combined with teaching feedback, improving the association logic of the artificial intelligence teaching assistant, strengthening students' guidance on digital learning, and designing hierarchical and flexible teaching tasks.

6. Conclusion

Based on the teaching pain points of Fundamentals of Nursing and the needs of digital reform, this study relies on the Xuexitong platform to plan and construct an integrated teaching mode—with “knowledge graph as the core, artificial intelligence teaching assistant as the auxiliary, and task engine as the guarantee.” This mode abandons the misunderstanding of “valuing technology over implementation” in traditional digital teaching, reducing the implementation threshold of digital reform of nursing courses. It can effectively solve the core pain points of traditional teaching, including knowledge fragmentation and insufficient personalized guidance, and provides new ideas for the teaching innovation of Fundamentals of Nursing as well as the digital reform of other medical basic courses. In the future, we can gradually promote the implementation of this planned scheme in combination with actual teaching scenarios, continuously optimizing and improving it based on teaching feedback to further verify the application effect of the mode and provide more solid support for the digital development of nursing education.

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Disclosure statement

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