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Construction and Cross-Course Promotion of Narrative Mode for Medical Ethics Education in Stomatology Technology Enabled by Generative AI: Taking "Digital Dental Restoration Technology" as an Example

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Abstract: To solve the problems of "disconnection between technology and ethics, separation between theory and practice" in medical ethics education for stomatology technology majors, this study focuses on the technical advantages of generative AI and the emotional penetration of narrative education, and constructs a four-in-one teaching mode: "generative AI empowerment – core of medical ethics narrative – digital tool support – cross-course promotion". Taking *Digital Dental Restoration Technology*, a core course for Grade 2024 stomatology technology majors, as the implementation carrier, this study develops AI-driven medical ethics narrative resources and carries out cross-major promotion and verification in the "Summary of Oral Diseases and Medical Marketing Practice." Practice shows that after the implementation of the core course, students' medical ethics cognition score increased by 38.7%, the correct rate of ethical decision-making in digital restoration technology reached 92.3%, and the recognition of red medical ethics spirit reached 94.5%; the adaptation satisfaction of promotion courses exceeded 88%. The research shows that the deep integration of generative AI and medical ethics narrative can realize the collaborative cultivation of "technical ability – medical ethics literacy – narrative expression". The constructed mode and resources have strong cross-course and cross-major promotion value, providing a systematic solution for the digital reform of medical ethics education in higher vocational medical majors.

Keywords: Generative AI; Stomatology technology; Medical ethics education; Narrative mode; Cross-course promotion

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1. Introduction

1.1. Research background

As a technical support major in the medical and health field, stomatology technology cultivates talents directly

involved in key links such as denture restoration and digital diagnosis and treatment scheme design. Their medical ethics literacy is directly related to patients' health rights and interests [1,2]. At present, there are three major pain points in medical ethics education for this major: first, medical ethics education is disconnected from digital technology courses. Core courses such as "Digital Dental Restoration Technology" focus on operational skills and ignore ethical decision-making in technology application; second, traditional medical ethics education is single in form [3], mostly relying on classroom lectures and case analysis, lacking immersive and interactive experience; third, the transformation of red medical ethics resources is insufficient [4], failing to form a narrative system suitable for digital teaching scenarios.

The rapid development of generative AI provides a new path for the reform of medical ethics education. With its functions of natural language interaction, virtual scene generation and personalized feedback, generative AI can transform abstract medical ethics norms into digital and situational narrative content, solving the problems of "dullness and formalism" in traditional education [5]. Based on this, this study takes "Digital Dental Restoration Technology" as the core implementation course, constructs a narrative mode of medical ethics education empowered by generative AI, and promotes it to relevant courses to realize the deep integration of medical ethics education and professional technology teaching.

1.2. Research significance

1.2.1. Theoretical significance

Construct the narrative mode framework of generative AI empowering medical ethics education, improve the digital theoretical system of medical ethics education in vocational education, fill the research gap of the integration of "artificial intelligence technology – medical ethics narrative – professional courses", and provide theoretical support for the digital reform of medical ethics education in similar majors.

1.2.2. Practical significance

Develop AI medical ethics narrative resources suitable for stomatology technology majors, solve the teaching problem of "emphasizing technology over medical ethics" in "Digital Dental Restoration Technology"; verify the universality of the mode through cross-course and cross-major promotion, and provide reusable medical ethics education strategies for courses such as "Summary of Oral Diseases and Medical Marketing Practice."

1.3. Research status at home and abroad

Domestic research mostly focuses on the integration path of medical ethics education and professional courses. Yang Xiaoqing et al. (2023) explored a new path of practical education of red medical spirit with "red + resources" as the carrier, "red + culture" as the core and "red + major" as the support [6]; Wen Chaoju (2024) proposed integrating red medical spirit into the teaching process of stomatology, but did not involve the technical empowerment of generative AI [7]; Li Wenjuan (2025) discussed the internal logic, value implication and practical path of integrating red medical spirit into medical students' medical ethics education [8]. Foreign researches focus on the application of AI in medical ethics education, such as the application of AI virtual patients in clinical ethical decision-making training, but does not combine red medical ethics narrative with the characteristics of higher vocational technical majors. In summary, existing research lacks the closed-loop research of "generative AI technology – medical ethics narrative system – digital professional courses", and this study fills this gap.

2. Theoretical basis and teaching mode construction

2.1. Core theoretical support

2.1.1. Educational application theory of generative AI

Generative AI realizes the intelligent generation of educational resources, virtual construction of teaching scenarios and personalized adaptation of the learning process through technologies such as natural language processing, computer vision and reinforcement learning. Its core advantages are "interactivity, immersion and generativity", which can meet the "situational, experiential and personalized" needs of medical ethics education [9].

2.1.2. Medical ethics narrative education theory

Taking narrative as the core, it transmits medical ethics values through storytelling, activates students' emotional identity, and achieves the educational effect of "educating people with events and influencing people with emotions" [10]. In stomatology technology majors, the medical ethics narrative needs to focus on "ethical scenarios in the application of digital technology".

2.1.3. Red medical spirit inheritance theory

The core connotation of red medical spirit includes "humanitarianism of healing the wounded and rescuing the dying, technological pursuit of excellence, and professional integrity of honesty for the people". Transforming it into digital narrative content can provide a value anchor for medical ethics education [11].

2.1.4. Cross-course promotion theory

Following the promotion logic of "deep cultivation in core courses – adaptation in similar courses – adjustment in cross-major courses", the teaching mode and resources maintain the core in different courses while adapting to the professional characteristics of the courses [12].

2.2. Core framework of teaching mode

Based on the research objectives, a "four-in-one" narrative mode of generative AI empowering medical ethics education is constructed.

2.2.1. Generative AI empowerment layer

Use AI virtual human technology to generate AI virtual red medical cases and restore the medical ethics deeds of red medical ancestors; use digital twin technology to build digital ethical scenarios and simulate high-frequency ethical scenarios in "Digital Dental Restoration Technology" [13]; implement intelligent ethical decision-making feedback based on AI natural language processing technology, evaluate students' ethical decision-making schemes in real time and provide personalized guidance.

2.2.2. Core layer of medical ethics narrative

Red medical spirit narrative focuses on exploring the connotation of red medical spirit related to stomatology technology [14]; technical ethics narrative focuses on the ethical boundary of digital restoration technology application; professional ethics narrative highlights the professional norms of stomatology technicians.

2.2.3. Digital tool support layer

Digital ethical decision-making sand table is a lightweight tool integrating Excel and AI technology, which

can quantitatively evaluate the effect of students' ethical decision-making; AI intelligent review system can automatically analyze students' virtual scenario decision-making process and provide targeted improvement suggestions; virtual simulation training platform can create an immersive ethical decision-making training environment for students.

2.2.4. Cross-course promotion layer

The core implementation course is "Digital Dental Restoration Technology" for stomatology technology majors [15], with deeply embedded mode and resources; similar promotion courses include "Summary of Oral Diseases" for Grade 2025 stomatology technology majors, adapting to the common medical ethics scenarios of stomatology; cross-major promotion course is "Medical Marketing Practice" for Grade 2025 pharmacy majors, adjusting narrative themes and scenarios, focusing on medical ethics in marketing links.

3. Implementation of core course: Mode landing in "Digital Dental Restoration Technology"

3.1. Implementation objectives

3.1.1. Knowledge objectives

Students master the core ethical norms in the application of digital dental restoration technology and understand the era connotation of red medical spirit.

3.1.2. Ability objectives

Accurately identify ethical conflicts and make decisions in line with medical ethics norms in AI-generated digital scenarios; use digital tools to complete ethical communication of restoration schemes.

3.1.3. Literacy objectives

From the professional concept of "technology-based, medical ethics-oriented", identify and be willing to practice the spirit of red medical ethics.

3.2. Teaching implementation process (Taking the chapter of "Digital Restoration of Complete Dentures" as an example)

Adopt the four-stage process of "AI narrative import – situational decision-making – intelligent review – practical extension".

(1) AI narrative import (10 minutes): Play AI virtual red medical case videos, and guide students to think about the inheritance of medical ethics in the digital era through AI interactive questions.

(2) Theoretical explanation (15 minutes): Combine AI cases to explain the core ethical norms in the digital restoration of complete dentures.

(3) Situational decision-making (15 minutes): Students enter the digital ethical scenario, complete communication through virtual interaction, and formulate ethically compliant restoration scheme adjustment suggestions.

(4) Intelligent review (5 minutes): The AI intelligent review system analyzes students' communication words and scheme adjustment logic, points out problems and provides optimization suggestions.

(5) Practical extension (after class): Students use AI tools to generate an "ethical communication word manual for digital restoration schemes" and conduct simulated drills in practical training courses.

3.3. Pre-evaluation of core implementation effect

Two classes (86 students in total) of "Digital Dental Restoration Technology" were selected for pilot implementation, and the resource adaptability and mode effectiveness were evaluated through a "pre-test-post-test" comparison. In terms of resource adaptability, 96.5% of students believed that AI virtual cases and digital scenarios "fit the course reality and help to understand technical ethics"; in terms of learning interest, 93.8% of students indicated that "they prefer to participate in AI-empowered medical ethics narrative activities compared with traditional case teaching"; in terms of preliminary ability improvement, the accuracy of students' decision-making in digital ethical scenarios increased from 56.3% before implementation to 82.1%.

4. Promotion practice and effect verification

4.1. Verification design

The verification objects of this study are the "Summary of Oral Diseases" class (4 classes, 152 students) of Grade 2025 stomatology technology majors and the "Medical Marketing Practice" class (3 classes, 118 students) of Grade 2025 pharmacy majors. Questionnaire survey (270 questionnaires issued, 265 valid questionnaires recovered, effective recovery rate 98.1%), skill test (ethical decision scenario test) and interview method were used to carry out verification around indicators such as resource adaptability satisfaction, medical ethics cognition improvement, correct rate of ethical decision-making, and cross-major promotion adaptability.

4.2. Verification results and analysis

4.2.1. Resource adaptability and learning effect

Table 1. Statistics of resource adaptability and learning effect of promotion courses (%)

Promotion Course	Resource Adaptability Satisfaction	Medical Ethics Cognition Improvement	Correct Rate of Ethical Decision-Making	Recognition of Red Medical Ethics Spirit
Summary of Oral Diseases	92.1	35.6	90.8	93.4
Medical Marketing Practice	88.9	32.3	87.3	91.5

As shown in **Table 1**, the resource adaptability satisfaction of the two promotion courses exceeds 88%, among which "Summary of Oral Diseases" has a satisfaction rate of 92.1% due to higher professional relevance; students' medical ethics cognition improvement exceeds 32%, and the correct rate of ethical decision-making exceeds 87%, indicating that the promotion resources are well adapted to the courses and the core logic of the mode has cross-course applicability.

4.2.2. Universality analysis of cross-major promotion

The two promotion courses belong to "stomatology technology (technical)" and "pharmacy (marketing management)" respectively, with significant differences in professional attributes. However, after the mode promotion, the recognition of red medical ethics spirit exceeds 91%, and the improvement of the correct rate of ethical decision-making is similar. In the interview, 86.7% of pharmacy students believed that "AI-generated marketing ethical cases fit the course reality, and the spirit of red medical ethics is also applicable in marketing

links", indicating that the core of the mode has cross-major promotion value.

4.2.3. Comparison with the implementation effect of core courses

Table 2. Comparison of implementation effect between core courses and promotion courses (%)

Course Type	Medical Ethics Cognition Improvement	Correct Rate of Ethical Decision-Making	Resource Immersion Satisfaction
Core Course	38.7	92.3	96.5
Similar Promotion Course	35.6	90.8	89.7
Cross-Major Promotion Course	32.3	87.3	85.2

As shown in **Table 2**, the core course has the best performance in all indicators due to more focused resources and in-depth technology application; although the promotion courses have simplified resource forms, they still maintain a high effect level, and the promotion effect of similar majors is better than that of cross-major, which is in line with the expected logic of "core deep cultivation, promotion adaptation".

5. Discussion and reflection

Based on the course "Digital Dental Restoration Technology," this study constructs a narrative mode of medical ethics education empowered by generative AI, develops characteristic teaching resources, and carries out cross-course and cross-major promotion verification in "Summary of Oral Diseases and Medical Marketing Practice." The practical results show that the mode can effectively improve students' medical ethics cognition, ethical decision-making ability and recognition of red medical ethics spirit, with high promotion value. In the future, it is necessary to further dig into the industry red resources, optimize the adaptability of promotion resources, and build a long-term evaluation system to provide strong support for cultivating high-quality medical and technical talents.

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