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Application of ChatGPT-Supported CUREs Teaching Model in Cultivating Research Skills Among Undergraduate Nursing Students in China

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Abstract

To investigate the effectiveness of the ChatGPT-supported CUREs teaching model in cultivating research capabilities among undergraduate nursing students, a total of 200 undergraduate nursing students scheduled to complete their clinical internships at a Grade A tertiary hospital (the top-tier) in a prefecture-level city in Sichuan Province in 2025 were selected as study participants. The ChatGPT-supported CUREs teaching model was implemented for these students to assess its impact on their comprehensive research capabilities and willingness to participate in teaching activities. Results showed that after the intervention, the scores on all dimensions of the comprehensive research competency questionnaire for nursing students in all groups were significantly higher than those before the intervention ($P < 0.05$); besides, the willingness to participate among nursing students after the intervention was significantly higher than before ($P < 0.05$). In conclusion, ChatGPT-supported CUREs teaching model could effectively enhance the comprehensive research capabilities and willingness to participate in teaching among undergraduate nursing students on clinical rotations. This aligns with the requirements for cultivating innovative nursing talents in the new era and is worthy of widespread clinical application on a larger scale.

Keywords: artificial intelligence, CUREs teaching model, undergraduate nursing education, research capability development

1. Introduction

With the increasing diversity of health needs and the rapid advancement of medical technology, the field of nursing has evolved from a purely technical discipline into a comprehensive, evidence-based profession (Lippe et al., 2025). Research competence, as a crucial component of core competencies for nursing professionals, serves as the cornerstone for driving innovation in clinical practice and enhancing the professional value of nursing (Chen et al., 2019). However, in current undergraduate nursing education in China, the cultivation of research competence is often integrated into theoretical courses with limited class time allocation. This approach is characterized by fragmented research instruction, a lack of practical scenarios, insufficient interaction between faculty and students regarding research, and weak student initiative in research participation (Du et al., 2023; Yi et al., 2024). Most undergraduate nursing students exhibit shortcomings such as underdeveloped research thinking, inadequate literature search and analysis skills, and non-standardized research design and thesis writing (Alkhaledi et al., 2024; Ghasemi et al., 2020), making it difficult for them to meet the developmental demands of nursing research innovation and evidence-based clinical practice in the new era.

The Course-Based Undergraduate Research Experience (CUREs) teaching model is an innovative approach that deeply integrates course instruction with research training (Fendos et al., 2022). Unlike traditional methods that rely solely on theoretical lectures and fragmented research training, this model uses courses as a vehicle and research projects as a driving force, enabling all students to systematically participate in the complete research process. It effectively addresses the shortcomings of traditional research education, such as narrow coverage and a lack of practical application, and offers significant advantages in cultivating students' scientific thinking, practical research skills, and interest in research exploration. It has been gradually adopted in the field of higher medical education (Delventhal & Steinhauer, 2020). However, in the practical application of undergraduate nursing education, the traditional CUREs model still faces certain limitations, including delayed feedback on research guidance, insufficient personalized instruction, low efficiency in integrating research resources, and students' pronounced reluctance toward research, all of which hinder the actual effectiveness of research-based education.

In recent years, breakthrough developments in large language model (LLM) technologies, exemplified by ChatGPT, have injected new momentum into educational innovation (Gan et al., 2024). Its powerful capabilities in natural language understanding, generation, logical reasoning, and knowledge integration enable it to serve as an "intelligent academic collaborator" or "personalized tutoring tool," offering key support for the application of the CUREs model in the nursing field. For example, it can assist students in efficiently retrieving and organizing literature, simulating research design and data analysis discussions, providing suggestions for paper writing and revision, and even simulating patient interactions to deepen insights into clinical problems (Montejo et al., 2024), thereby compensating to some extent for the shortcomings of traditional CUREs in terms of resources, immediate feedback, and personalized scaffolding.

Currently, practical research on the deep integration of ChatGPT technology with the CUREs teaching model for the systematic cultivation of research capabilities among undergraduate nursing students remains scarce, and a mature, scalable teaching system has yet to be established. Based on this, this study constructs an innovative ChatGPT-supported CUREs teaching model. By organically combining the advantages of AI-enabled technology with the comprehensive research experience offered by CUREs, we apply this model to undergraduate nursing education to investigate its impact on nursing students' research thinking, practical research skills, innovative capabilities, and motivation for research learning. The aim is to optimize the research-based education system for undergraduate nursing students, overcome the bottlenecks of traditional research teaching, and provide new pedagogical insights and practical references for cultivating innovative nursing talents in the new era.

2. General Information and Methodology

2.1 General Information

This study employed purposive sampling to select 200 undergraduate nursing students from the college who were completing their clinical internships at a Grade A tertiary hospital in a prefecture-level city in Sichuan Province in 2025. The sample consisted of 100 male and 100 female students respectively. Inclusion criteria: (1) Full-time fourth-year undergraduate nursing students who had completed basic medical courses and core nursing courses at the university and possessed foundational nursing knowledge; (2) Able to fully cooperate in completing the research skills training course, pre-course and post-course research skills assessments, and post-course satisfaction survey, and who have provided informed consent by signing the informed consent form. Exclusion criteria: (1) Participants who were absent for more than one-quarter of the total course duration during their internship and were unable to fully participate in course instruction and assessments; (2) Participants who had previously taken specialized courses in nursing research or had experience participating in complete research projects; (3) Students with concurrent cognitive or communication impairments who are unable to cooperate with questionnaire assessments and teaching practices; (4) Students who voluntarily withdraw from the study midway. The 200 students included in the study will be randomly divided into 5 learning groups of 40 students in each. Students in each group will conduct research project practices as a group unit; all teaching interventions, scale assessments, and questionnaire surveys will be completed during the students' clinical internship period. This study strictly adheres to medical research ethics principles in which the research protocol has been reviewed and approved by the hospital's Institutional Review Board. Throughout the study, students' rights to informed consent, participation, and privacy will be fully protected. All research data will be used exclusively for this academic study and for no other purposes.

2.2 Methodology

2.2.1 Pre-class Independent Study

The course is structured around group-based collaborative learning. Five groups independently select research topics related to nursing research. After determining their topics,

group members conduct pre-class independent study, systematically collecting relevant domestic and international literature, clinical research cases, industry standards, and expert opinions. They then identify the core theoretical concepts, current state of research, clinical application value, and existing research questions associated with their topics.

2.2.2 In-class Presentations

Based on their research findings, each group prepares for an in-class presentation. They synthesize the core content of the literature, classic research cases, and mainstream academic perspectives to draft a comprehensive presentation script. Additionally, considering the key learning objectives and challenges in nursing research, they design interactive segments, such as interactive Q & A sessions, group Q & A, and topic discussions, to ensure active student participation and a seminar-style learning environment.

2.2.3 Two-Way Faculty-Student Discussion

After each group completes its classroom presentation, the instructor will organize a collective discussion and two-way exchange with all students, focusing on each group's research topic and incorporating cutting-edge knowledge in nursing research as well as key points and challenges from the classroom presentations. The instructor corrects and supplements any theoretical misconceptions, errors in literature interpretation, or limitations in research thinking identified during student presentations, and systematically explains core concepts such as learning science theories, basic norms of nursing research, and research logic related to the topic. At the same time, the instructor guides students to engage in in-depth discussions on dimensions such as the rationality of research topic selection, the innovativeness of research content, the feasibility of clinical application, and existing research controversies, encouraging students to actively ask questions, exchange views, and clarify doubts.

2.2.4 Immersive Role-Playing

Once students have mastered foundational research theories and understood the current state of their research field, instructors guide them through a role transition, assigning them the identity of research investigators. Students simulate the research mindset and work patterns of professional researchers and conduct project-based research practice on learning science topics in small groups. Using the process of real research projects as a standard, students independently advance their research exploration throughout the entire process. This includes refining research directions, outlining research frameworks, conceptualizing research content, designing preliminary research plans, and identifying key challenges and difficulties in the research, thereby immersing themselves in the complete nursing research process.

2.2.5 Empowerment through ChatGPT Intelligent Study Companion

Instructors conduct knowledge workshops in a workshop format, introducing ChatGPT Intelligent Study Companion into collaborative research groups. They guide students in understanding its operational principles while providing interaction strategies, specifically "Prompt Engineering" to obtain comprehensive and accurate responses, students must clearly

define prompt elements, consisting of one required element and three optional elements. The "instruction" is the required element—the specific task the student wants the AI companion to perform. The three optional elements are: first, "background" (contextual information) to elicit better feedback; and the remaining two are "data input" and "data output" referring to the text data to be processed and the desired data format, respectively. When drafting prompts, students must use the "mandatory element + one or more optional elements" framework to interact with ChatGPT. Additionally, students should employ appropriate strategies to enhance the efficiency of the Q & A process. For example, when faced with scenarios that are difficult to describe, students can use the "example" strategy to provide illustrative cases; they can also use the "role-playing strategy" to add prompts that direct ChatGPT to assume specific roles, thereby generating content that better meets their needs.

2.2.6 Full-Process Supervision and Evaluation

Throughout the teaching cycle, instructors schedule regular group discussion sessions to monitor the progress of each group's research projects. They systematically review the challenges encountered by each group in project design, literature analysis, data organization, paper conceptualization, and human-AI collaboration, providing targeted, personalized guidance. This approach corrects deviations in students' research practices in real time and dynamically optimizes group research plans. Simultaneously, leveraging the comprehensive human-AI interaction data recorded in the ChatGPT backend, including the frequency of student questions, the standardization of prompts, the depth of research problem exploration, the efficiency of AI resource utilization, and the outcomes of research problem-solving, serves as the core basis for formative assessment of students' research learning. By integrating offline faculty supervision and evaluation, peer group evaluations, and student self-assessments, we establish a diversified evaluation system that combines human and AI-driven education together. This system dynamically monitors the growth of students' research capabilities, addresses specific weaknesses in their research skills, and continuously drives the efficient advancement of their project-based research learning.

2.3 Observation Indicators

2.3.1 Students' Comprehensive Research Competence

We used a self-developed questionnaire on students' comprehensive research capabilities to evaluate the research capabilities of two groups of undergraduate nursing students before and after the intervention. The questionnaire included four indicators: research knowledge, research interest, research self-efficacy, and research skills. This was used to assess the impact of the ChatGPT-supported CUREs teaching model on the comprehensive research capabilities of undergraduate nursing students. In the questionnaire, each dimension is scored out of 100 points, with higher scores indicating stronger comprehensive research capabilities.

2.3.2 Students' Willingness to Participate in the Teaching Model

We used a self-developed questionnaire on willingness to participate in the teaching model to survey the participation willingness of the two groups of undergraduate nursing students before and after the intervention. The questionnaire covered four dimensions: expected

performance and effort, attitude, social influence and facilitating conditions, and future participation willingness. The total score was 100 points, with higher scores indicating stronger student recognition, acceptance, and willingness to participate in the teaching model.

2.4 Statistical Methods

Data analysis for this study was conducted using SPSS 26.0 statistical software, with a significance level of $\alpha = 0.05$. Continuous variables such as age, which followed a normal distribution, were expressed as mean ± standard deviation; categorical variables such as gender were presented as frequency and percentage. Comparisons of baseline data between groups were performed using the chi-square test. The core indicators of this study—students' comprehensive research capabilities and willingness to participate in the teaching model—are both continuous variables. Comparisons of intervention effects between groups were performed using the independent samples t-test, with $P < 0.05$ indicating statistically significant differences.

3. Results

The baseline characteristics of the nursing undergraduate students included in the study are shown in Table 1.

Table 1. Baseline characteristics of nursing undergraduate students (x ± s)

Group	Sample Size	Gender		Age (years)	Mean (years)	Mean GPA
		Male	Female			
A	40	3	37	21-24	22.05±0.98	3.08±0.97
B	40	5	35	21-23	22.34±1.07	3.12±0.84
C	40	3	37	22-24	22.77±0.83	3.04±1.23
D	40	5	35	20-23	22.06±0.96	3.11±0.93
E	40	6	34	22-23	22.58±0.79	3.13±1.57

A comparison of the scores on each dimension of the Student Research Competency Questionnaire before and after the intervention revealed that, following the intervention, the scores on all dimensions were significantly higher for nursing undergraduates in all groups compared to those before the intervention ($P < 0.05$), as shown in Table 2.

Table 2. Comparison of scores on each dimension of the Student Research Competency Questionnaire before and after the intervention (x ± s; points)

Overall Research Capabilities	Timing of Intervention	A（n=40）	B（n=40）	C（n=40）	D（n=40）	E（n=40）
Research Knowledge	Before Intervention	72.23±5.23	71.66±6.72	70.99±6.66	71.83±7.91	72.06±8.75
	After Intervention	85.78±6.67＊	86.52±5.21＊	86.12±7.59＊	86.23±6.56＊	87.34±7.54＊
Research Interests	Before Intervention	80.45±6.29	82.41±4.53	81.54±6.34	82.54±6.87	82.95±7.38
	After Intervention	90.87±5.42＊	91.63±4.37＊	89.56±7.34＊	92.07±8.58＊	91.62±6.75＊
Research Self-Efficacy	Before Intervention	67.35±5.36	68.35±7.31	69.43±7.47	69.34±4.78	68.55±6.06
	After Intervention	81.24±6.23＊	80.66±5.24＊	80.34±6.45＊	83.55±5.87＊	82.08±7.58＊
Research Skills	Before Intervention	66.45±8.76	67.43±6.73	66.48±5.38	67.38±6.02	68.38±6.23
	After Intervention	79.39±5.36＊	78.53±8.34＊	80.42±6.37＊	78.95±6.23＊	80.24±7.33＊

Note: ＊ indicates $P < 0.05$ between groups before and after the intervention.

A comparison of questionnaire scores regarding students' willingness to participate in the teaching model before and after the intervention revealed that the willingness of nursing undergraduates in all groups was significantly higher after the intervention than before ($P < 0.05$), as shown in Table 3.

Table 3. Comparison of questionnaire scores regarding students' willingness to participate in the teaching model before and after the intervention (x ± s; points)

Group	Sample Size	Pre-intervention score for willingness to participate in the teaching model among nursing students	Post-intervention score for willingness to participate in the teaching model among nursing students	*t*	*P*
A	40	80.78±7.56	90.53±6.83	6.052	< 0.05
B	40	79.36±6.98	91.47±6.76	7.882	< 0.05
C	40	81.49±6.83	92.01±5.38	7.653	< 0.05
D	40	80.58±7.52	91.78±6.22	7.258	< 0.05
E	40	79.62±7.23	90.68±7.18	6.865	< 0.05

4. Discussion

4.1 The ChatGPT-supported CUREs Teaching Model Could Effectively Enhance the Comprehensive Research Capabilities of Undergraduate Nursing Students

Traditional undergraduate nursing research education is largely dependent on theoretical courses, suffering from issues such as fragmented content, a lack of practical components, and limited teacher-student interaction. Coupled with the fact that undergraduate nursing students generally lack experience with the complete research process, this often leads to a lack of solid mastery of research knowledge, weak abilities in literature review and research design, and a tendency to feel daunted by research tasks (O'Brien & Hathaway, 2018; Sullivan et al., 2024). In this study, the implementation of the ChatGPT-supported CUREs teaching model for undergraduate nursing students on clinical rotation effectively improved their comprehensive research capabilities in which the primary reason lies in the fact that the CUREs model uses real research projects as a vehicle, allowing students to participate throughout the entire process—from topic selection, protocol design, research implementation, to data analysis, breaking down the barriers between traditional classroom theory and practical research. This approach establishes a systematic research training platform, helping students develop a comprehensive research mindset. Furthermore, the integration of ChatGPT as an intelligent learning companion addresses the shortcomings of the traditional CUREs model. On the one hand, through interactive methods such as prompt engineering and role-playing, ChatGPT can assist students in quickly retrieving, synthesizing, and interpreting domestic and international literature, as well as analyzing the current state of research and identifying cutting-edge trends. This effectively reduces the difficulty of literature review and strengthens students' research knowledge base (Ravšelj et al., 2026); on the other hand, this intelligent tool provides real-time guidance and revision suggestions for stages such as research design, thesis writing, and logical structuring. By breaking down time

and space constraints, it enables personalized, round-the-clock research tutoring, addressing the issues of limited faculty guidance capacity and delayed feedback in traditional teaching (Cheng & Zhu, 2025). Simultaneously, immersive research practice combined with intelligent tool support gradually alleviates students' fear and resistance toward research. Through continuous experimentation and exploration, students gain a sense of accomplishment, leading to a significant enhancement in their research self-efficacy and a corresponding increase in their interest in actively pursuing research. Empowered by both the full-process practice and intelligent technology, students repeatedly hone practical skills such as literature analysis, research topic conception, and proposal writing, ultimately achieving a comprehensive enhancement of their overall research capabilities (Gerçek et al., 2025). Consequently, following the implementation of the ChatGPT-integrated CUREs teaching intervention, all participants demonstrated statistically significant ($P < 0.05$) improvements in their scores across four dimensions—research knowledge, research interest, research self-efficacy, and research skills—compared to pre-intervention levels, confirming that this teaching model effectively promotes the comprehensive research capabilities of undergraduate nursing students. This is also consistent with the findings of Amankwaa et al. (2025), regarding the integration of ChatGPT into nursing education.

4.2 The ChatGPT-supported CUREs Teaching Model Could Effectively Enhance nursing Undergraduates' Willingness to Participate in Research-Based Instruction

Traditional nursing research instruction tends to be monotonous and unengaging, primarily consisting of passive lectures, resulting in low student participation and a lack of motivation for active learning (Y. Wang et al., 2024). In this study, the implementation of the ChatGPT-supported CUREs teaching model among undergraduate nursing students effectively improved their willingness to participate in research-based instruction. The primary reason lies in the fact that this model is grounded in group collaboration and integrates diverse components such as pre-class independent study, in-class topic presentations, two-way teacher-student discussions, and immersive research practice together. This approach transforms the traditional rote-learning model, empowers students as active learners. Through group collaboration, idea exchange, and joint project creation, it fosters an interactive and inquiry-based classroom atmosphere, adequately stimulating students' enthusiasm for classroom participation (M. Wang et al., 2025). At the same time, the integration of artificial intelligence technology has added both enjoyment and convenience to scientific research learning. ChatGPT is flexible and responsive, capable of adapting to students' learning needs at different stages and assisting them in overcoming various challenges in scientific research. It simplifies complex research tasks, ensuring students no longer face research difficulties alone. Instead, a multifaceted learning environment is formed, combining in-person faculty supervision, real-time assistance from intelligent tools, and peer support within groups. This effectively reduces the learning burden and significantly enhances the learning experience (Thomae et al., 2024). From learning attitudes and social recognition to long-term participation willingness, students' approval ratings across all dimensions improved significantly, reflecting that this teaching model balances practicality with user experience and can continuously stimulate students' proactive engagement in

research and teaching activities. Consequently, post-intervention scores for willingness to participate in this teaching model were significantly higher across all groups compared to pre-intervention scores ($P < 0.05$). This indicates that the novel teaching model integrating ChatGPT with CUREs better aligns with the learning characteristics of contemporary undergraduate nursing students and has gained widespread recognition and acceptance among them.

5. Conclusion

Compared to traditional lecture-based or purely in-person CUREs instruction, the ChatGPT + CUREs integrated model achieves a deep fusion of artificial intelligence and research-based teaching. It establishes a new research training system based on human-machine co-education. Through diversified formative assessment methods—combining instructor evaluations, peer group evaluations, student self-assessments, and AI-driven data monitoring—it enables a comprehensive and objective understanding of students' learning progress, precisely identify individual research weaknesses, making instructional guidance more targeted, and forming a virtuous cycle of teaching—practice—assessment—optimization, which better aligns with the training requirements for innovative nursing talents in the new era. However, in practical application, this model still has aspects that need improvement: First, there are individual differences in students' mastery of prompt engineering and AI interaction techniques, which directly affect the effectiveness of AI tools. As a result, specialized training sessions can be added in future instruction to strengthen students' ability to use AI tools. Second, content generated by ChatGPT has certain biases and limitations and cannot fully replace professional guidance from instructors. Instruction protocols must consistently emphasize that AI serves only as an auxiliary tool, guiding students to critically evaluate information and uphold research rigor and academic integrity. Furthermore, the sample for this study was limited to interns at a Grade A tertiary hospital in a single region, resulting in limited coverage. In the future, the scope of the research could be expanded, the sample size increased, and long-term follow-up studies conducted to further validate the long-term effectiveness and efficiency of this teaching model. This would allow for the gradual refinement of teaching processes and implementation plans, thereby promoting the widespread adoption of this model in undergraduate nursing research education in the long run.

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Competing interests

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Obtained.

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The Publication Ethics Committee of the Macrothink Institute.

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Data availability statement

The data that support the findings of this study are available on request from the corresponding author. The data are not publicly available due to privacy or ethical restrictions.

Data sharing statement

No additional data are available.

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