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AI-Enhanced Integrated English Teaching for Cultivating Medical Students' Clinical Communication Competence

Li Kangbing[1*], Chandra Mohan Vasudeva Panicker [2], Lubna Ali Mohammed[3]

[1,2&3] School of Education, Lincoln University College, Malaysia

***Corresponding author: likangbingrc@163.com**

Abstract

Global education is rapidly transforming with the advancement of artificial intelligence (AI), and medical vocational education now faces new demands to cultivate talents with strong clinical practice and cross-cultural communication skills. Traditional medical English teaching in vocational colleges often lacks authentic clinical scenarios and interactive evaluation, making it difficult to effectively foster students' clinical communication competence—a core competency critical to patient safety and professional development. This study proposes a novel AI-enhanced integrated English teaching model, which differs from existing approaches by combining intelligent language tools, simulated clinical dialogue scenarios, and AI-driven formative assessment in a unified framework. Using a quasi-experimental design, the research recruited 86 medical vocational students, dividing them into an experimental group (n=43, receiving the AI-enhanced intervention) and a control group (n=43, receiving traditional teaching) over a 12-week intervention period. Data were collected through pre-intervention and post-intervention clinical communication tests, English proficiency assessments, and confidence questionnaires. The results show that the experimental group achieved statistically significant improvements in clinical communication confidence ($p<0.01$), English expression accuracy ($p<0.05$), and professional scenario application ($p<0.01$) compared to the control group. This model not only effectively enhances students' practical abilities but also provides a replicable, evidence-based pathway for transforming medical vocational English education in the AI era, offering valuable references for cultivating high-quality medical technical talents.

Keywords: Artificial Intelligence, Medical Vocational English, Integrated English Teaching, Clinical Communication Competence

Introduction

The rapid development of artificial intelligence has comprehensively promoted the innovative reform of modern education modes, and educational digitization and intelligentization have gradually become the mainstream development trend of global education (Brown, 2020). In the context of global educational reform, vocational education, which focuses on practical talent cultivation, has become a key area for the integration of AI technology and teaching practice, as it prioritizes the connection between classroom teaching and professional post demands. As an important branch of

vocational education, medical vocational education shoulders the important responsibility of cultivating applied medical talents for clinical medical institutions, public health centres and grassroots medical service stations, and its teaching quality is directly related to the overall level of regional medical and health services. With the frequent international medical exchanges, the gradual popularization of cross-border medical cooperation and the increasing number of foreign-related medical services, higher standards have been set for the comprehensive English application capabilities of medical practitioners, among which clinical communication competence is regarded as the basic professional literacy that medical staff must possess (Lee, 2021).

Clinical communication competence in English is not only a simple combination of language ability and professional knowledge, but also a comprehensive ability that integrates medical terminology application, cross-cultural communication awareness, doctor-patient communication etiquette and clinical scenario response. Qualified clinical English communication can effectively optimize doctor-patient communication efficiency, avoid information asymmetry between medical staff and patients, reduce medical disputes caused by poor communication, and fundamentally guarantee the quality and safety of clinical medical services (Wang & Zhang, 2022). In the modern medical service system, proficient clinical English communication ability has become an important indicator to measure the professional quality of medical vocational students, and it is also a core skill that determines their employment competitiveness and career development potential.

Nevertheless, the current medical English teaching system in most vocational colleges still has prominent drawbacks that restrict the improvement of students' clinical communication competence. Most teaching activities are dominated by textbook knowledge explanation, taking teachers as the core of teaching and students as passive recipients of knowledge. The teaching content is mostly limited to medical vocabulary memorization, grammatical analysis and reading comprehension of medical articles, completely ignoring the construction of real clinical communication situations and the cultivation of students' oral expression and practical application ability (Li et al., 2023). In addition, the teaching evaluation system is relatively single and lagging behind, mostly adopting the final written examination as the only evaluation method, which cannot fully reflect students' learning process, practical ability and comprehensive quality. Restricted by the above factors, students are unable to convert theoretical language knowledge into practical communication skills, and their comprehensive ability to cope with English communication scenarios in clinical work is generally insufficient, which cannot satisfy the talent training requirements of modern medical institutions, and the development needs of the global medical industry.

At present, plenty of studies have verified the positive role of artificial intelligence technology in language teaching, and intelligent teaching tools can make up for the deficiencies of traditional classroom teaching to a certain extent (Garcia, 2022). AI technology has unique advantages in creating immersive learning scenarios, providing personalized learning guidance, realizing real-time teaching feedback and diversifying teaching evaluation, which can effectively break the limitations of time and space in traditional teaching and build a more flexible and efficient teaching model. However, relevant academic research mostly focusses on theoretical exploration of AI-assisted language teaching, and there are few practical studies on constructing systematic AI integrated teaching models for medical vocational English courses. Most existing

research fail to combine the professional characteristics of medical vocational education, and there is still a lack of empirical research results to prove the practical application effect of this teaching mode on improving students' clinical communication competence. This research gap directly leads to the lack of scientific guidance and practical reference for the reform of medical vocational English teaching in the AI era, which leaves an important research space for this study.

Based on the above background and existing research deficiencies, this study takes medical vocational students as the research object, focuses on the pain points of traditional medical English teaching, and constructs an AI-enhanced integrated English teaching model suitable for medical vocational education. The study aims to fill the gap of empirical research in this field, verify the effectiveness of the teaching model through scientific experiments, and provide a feasible path for the reform of medical vocational English teaching.

Review of Related Literature

Research on Clinical Communication Competence in Medical Education

Clinical communication competence has long been a core research topic in the field of medical education worldwide. Scholars at home and abroad have conducted in-depth discussions on the connotation, importance and cultivation paths of clinical communication competence. Smith (2019) pointed out in the research on medical talent cultivation that clinical communication competence is a key competency that runs through the whole process of clinical work, including patient history collection, diagnosis and treatment plan explanation, health education and peer communication, and its level directly affects patient treatment compliance and medical service satisfaction. For medical vocational students, who are positioned to engage in frontline clinical work, the cultivation of clinical communication competence is more important than theoretical knowledge learning, as it is directly related to their ability to adapt to clinical posts quickly.

Lee (2021) conducted a survey on medical vocational students' clinical communication ability and found that more than 60% of students have insufficient ability to conduct English communication in clinical scenarios, and the main reasons are the lack of practical training opportunities and the disconnection between teaching and clinical practice. Wang & Zhang (2022) further emphasized that in the context of international medical integration, English clinical communication competence has become a necessary skill for medical vocational students, and traditional teaching modes that focus on theory and neglect practice have been unable to meet the current talent cultivation needs. These studies have fully clarified the importance of cultivating medical vocational students' clinical communication competence and pointed out the existing problems in current teaching, laying a theoretical foundation for this study.

Research on AI Application in Language Teaching

With the rapid development of AI technology, its application in the field of language teaching has become increasingly extensive, and many studies have confirmed the promoting effect of AI on language teaching efficiency and learning effect. Brown (2020) systematically sorted out the application scenarios of AI in vocational education, pointing out that intelligent language tools, virtual simulation systems and adaptive learning platforms can provide personalized learning services for students, stimulate students'

learning interest and improve their practical application ability of language. Garcia (2022) conducted an empirical study on AI-assisted English teaching and found that AI-driven teaching mode can effectively make up for the deficiency of traditional teaching in scenario construction and evaluation and significantly improve students' oral expression ability and learning initiative.

In the field of medical English teaching, some scholars have begun to explore the integration of AI technology and teaching practice. Li et al. (2023) proposed that AI technology can create realistic clinical communication scenarios for medical English teaching, solve the problem of insufficient practical teaching resources, and realize the whole-process tracking and evaluation of students' learning. However, the existing research is mostly in the exploratory stage, lacking a complete and systematic integrated teaching model, and there is a lack of quasi-experimental research to verify the actual effect of the model, which is the main breakthrough point of this study.

Research Gaps and Theoretical Basis of This Study

By combing the existing related literature, it can be found that the current research has achieved certain results in the importance of clinical communication competence and the application of AI in language teaching, but there are still obvious gaps: firstly, most studies focus on general English teaching or undergraduate medical education, and there is a lack of targeted research on medical vocational English teaching; secondly, the existing research on AI-assisted medical English teaching is mostly theoretical discussion, and there is a lack of empirical research with complete experimental design and data support; thirdly, there is no systematic integrated teaching model that integrates AI tools, clinical scenarios and formative evaluation for the cultivation of clinical communication competence.

This study takes constructivist learning theory and intelligent teaching theory as the theoretical basis. Constructivist learning theory emphasizes that students are the main body of learning, and knowledge is constructed by learners in specific scenarios through practical interaction, which provides a theoretical basis for the construction of clinical simulation scenarios in this study. Intelligent teaching theory holds that AI technology can optimize teaching links, realize personalized teaching and diversified evaluation, which guides the design of AI-enhanced integrated teaching model in this study. Based on the above theories and research gaps, this study carries out empirical research to fill the academic gaps in this field.

Research Questions

Research Objectives

The primary objectives of this research are as follows:

- To construct a complete and operable AI-enhanced integrated English teaching model suitable for medical vocational students, which integrates intelligent language tools, simulated clinical dialogue scenarios and AI-driven formative assessment, and fits the professional characteristics and talent cultivation goals of medical vocational education.
- To verify the actual influence of the AI-enhanced integrated English teaching mode on medical vocational students' clinical communication confidence, English expression accuracy and professional clinical scenario application ability through quasi-experimental research and clarify the effectiveness of the teaching model.

- To summarize the feasible implementation strategies and precautions of the AI-enhanced integrated English teaching mode in medical vocational English teaching and analyze the advantages and existing problems of the model in practical application.
- To provide scientific reference and replicable practical framework for the optimization and reform of medical vocational English teaching system and promote the cultivation of high-quality applied medical talents with strong cross-cultural clinical communication ability.

To achieve the above research objectives, this study puts forward the following core research questions:

- What are the specific deficiencies of traditional medical English teaching in cultivating medical vocational students' clinical communication competence, and how can the AI-enhanced integrated teaching model solve these problems?
- Compared with the traditional teaching mode, can the AI-enhanced integrated English teaching mode significantly improve medical vocational students' clinical communication confidence, English expression accuracy and professional scenario application ability?
- What are the practical application effects and promotion value of the AI-enhanced integrated English teaching mode in medical vocational English teaching, and what optimization suggestions can be put forward for its later application?

Methodology

Research Design

This study adopts a quasi-experimental research design, which is a commonly used empirical research method in the field of educational research. It is suitable for verifying the causal relationship between teaching intervention measures and teaching effects in real teaching scenarios. The study selects two parallel classes with no significant difference in initial English level and professional foundation as the experimental group and the control group respectively, conducts different teaching interventions, and compares the teaching effects of the two groups to verify the effectiveness of the AI-enhanced integrated teaching model.

A total of 86 sophomore students majoring in clinical medicine from a local medical vocational college in Henan, China were selected as the research participants. All research objects were in the same grade, with the same professional curriculum arrangement, consistent learning foundation and class learning environment, and they all took the same medical English course in this semester. Before the formal experiment, a pre-test of English proficiency and clinical communication ability was conducted on all students, and the independent samples t-test was used to analyze the pre-test scores. The results showed that there was no significant difference in the initial English learning level and clinical communication ability between the two groups ($p>0.05$), which met the requirements of quasi-experimental research. The control group contained 43 students, and the experimental group also included 43 students, ensuring the balance of the number of research objects in the two groups.

Conceptual Framework of AI-Enhanced Integrated Teaching Model

The AI-enhanced integrated English teaching model constructed in this study takes the cultivation of students' clinical communication competence as the core goal and integrates three core modules: intelligent language tool support, AI-simulated clinical scenario practice and AI-driven formative evaluation, forming a closed-loop teaching system of "teaching-learning-evaluating-feedback-improving".

- **Intelligent language tool module:** Mainly including AI vocabulary learning software, oral pronunciation correction system and medical English corpus, which provides students with personalized basic language knowledge learning, helps students master medical terminology and standard pronunciation, and lays a foundation for clinical communication.
- **AI-simulated clinical scenario module:** Based on real clinical work scenarios, the AI system constructs diversified simulation scenarios such as patient admission inquiry, diagnosis and treatment explanation, discharge health education, and peer medical handover. Students conduct interactive dialogue practice in the virtual scenario, and the AI system gives real-time prompts and corrections.
- **AI-driven formative evaluation module:** The AI system tracks and records students' daily learning performance, scenario practice performance, homework completion and other data in real time, conducts multi-dimensional evaluation, generates personalized learning reports, feeds back to students and teachers in time, and helps teachers adjust teaching plans and students improve their learning deficiencies.

Teaching Intervention Scheme

The whole teaching intervention period lasted for 12 weeks, and all teaching activities were carried out in accordance with the unified teaching progress and medical English teaching syllabus, ensuring the consistency of teaching content and teaching hours between the two groups.

- **Control Group:** Adopted traditional medical English teaching methods. Teachers mainly taught medical vocabulary, grammatical rules, textbook reading and translation in class, using blackboard writing and PPT as auxiliary teaching tools. After class, students completed written homework, and the evaluation was mainly based on the final written examination, with no special clinical communication practice and interactive evaluation.
- **Experimental Group:** Implemented the AI-enhanced integrated English teaching mode on the basis of consistent basic teaching content. In class, teachers used AI simulation system to carry out clinical scenario dialogue practice, guided students to conduct interactive communication; after class, students used intelligent language tools for autonomous learning, and the AI system carried out real-time formative evaluation and feedback. Teachers adjusted teaching links according to the feedback data to realize personalized teaching guidance.

Data Collection Methods

Unified pre-test and post-test evaluation were implemented for all students before and after the 12-week teaching intervention, and multi-dimensional data were collected to ensure the objectivity and comprehensiveness of the research results.

- **Clinical communication ability test:** Compile a standardized test paper for clinical English communication, including scenario dialogue, medical

terminology application, on-site response and other contents, to test students' English expression accuracy and professional scenario application ability.

- **Clinical communication confidence scale:** Adopt a mature Likert scale to investigate students' self-evaluation of clinical English communication confidence, including fear of communication, willingness to communicate, self-assessment of ability and other dimensions.
- **Learning effect questionnaire:** Distribute questionnaires to students in the experimental group to understand their learning experience and satisfaction with the AI-enhanced integrated teaching mode.

All collected data were sorted out and input into SPSS 26.0 statistical software for quantitative analysis to ensure the scientificity of data processing.

Analysis

In this study, descriptive statistics and inferential statistics were used to analyze the experimental data. Descriptive statistics were used to calculate the average score, standard deviation and other indicators of the two groups of students in pre-test and post-test; inferential statistics mainly adopted independent samples t-test to compare the differences in post-test scores between the experimental group and the control group,<0.05 was considered statistically significant,<0.01 was considered extremely statistically significant. All data units adopted international standard SI units in the whole research process, and the data analysis process was standardized and rigorous,

Findings and Discussion

Comparison of Pre-test Scores Between Experimental Group and Control Group

Before the teaching intervention, the pre-test scores of the two groups of students in clinical communication confidence, English expression accuracy and professional scenario application ability were compared, and the independent samples t-test results showed that there was no significant difference between the two groups ($p>0.05$). The specific data are shown in Table 1, which indicates that the initial level of the two groups is balanced, and the experimental results are credible.

Table 1: Comparison of Pre-test Scores Between Two Groups (Mean ± SD)

Evaluation Indicators	Control Group (n=43)	Experimental Group (n=43)	t value	p value
Clinical Communication Confidence	62.35±4.26	61.89±4.51	0.482	0.631
English Expression Accuracy	60.72±5.13	60.35±5.08	0.336	0.738
Professional Scenario Application	59.46±5.72	59.13±5.84	0.265	0.791

Comparison of Post-test Scores Between Experimental Group and Control Group

After 12 weeks of systematic teaching intervention, the post-test scores of the two groups were compared, and the results showed that the average scores of the experimental group in all three evaluation indicators were significantly higher than those of the control group, and the difference was statistically significant. The specific data are shown in Table 2. Table 2 Comparison of Post-test Scores Between Two Groups (Mean ± SD)

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Evaluation Indicators	Control Group (n=43)	Experimental Group (n=43)	t value	p value
Clinical Communication Confidence	67.58±4.83	78.62±5.26	9.854	0.000
English Expression Accuracy	65.31±5.42	72.47±5.69	5.923	0.000
Professional Scenario Application	64.29±5.91	76.35±6.14	9.107	0.000

From the data in Table 2, it can be seen that:

- In terms of clinical communication confidence, the average score of the experimental group was 78.62, which was significantly higher than 67.58 of the control group, and the difference was<0.01), indicating that the AI-enhanced integrated teaching mode can effectively relieve students' fear of clinical English communication and enhance their communication confidence.
- In terms of English expression accuracy, the average score of the experimental group was 72.47, higher than 65.31 of the control group, with a significant difference (<0.05), indicating that the model can help students master medical English terminology and standard expression more accurately.
- In terms of professional scenario application ability, the average score of the experimental group was 76.35, significantly higher than 64.29 of the control group, with an extremely significant difference ($p<0.01$), indicating that the model can effectively improve students' ability to apply English in real clinical scenarios. Satisfaction Survey Results of Experimental Group
- After the experiment, a satisfaction survey was conducted on the 43 students in the experimental group. The results showed that 90.7% of the students believed that the AI-enhanced integrated teaching mode was more interesting than traditional teaching, 86.0% of the students thought that the simulated clinical scenarios helped them improve their practical communication ability, and 88.4% of the students were willing to accept this teaching mode in subsequent courses. The survey results fully reflect that the teaching model is highly recognized by students and can effectively stimulate students' learning initiative

Analysis of the Reasons for the Effectiveness of AI-Enhanced Integrated Teaching Model

The experimental results show that the AI-enhanced integrated English teaching mode is significantly better than the traditional teaching mode in cultivating medical vocational students' clinical communication competence, and the reasons are mainly analyzed from the following aspects:

Firstly, the model solves the problem of lack of clinical scenarios in traditional teaching. Traditional medical English teaching is limited by single teaching form, students can only passively accept theoretical knowledge in class, lacking independent thinking and practical expression opportunities (Smith, 2019). The AI simulation scenario module creates an immersive clinical learning atmosphere for students, restores real work scenes such as doctor-patient communication and medical handover, allows students to conduct practical dialogue practice in a realistic environment, and shortens the distance between classroom learning and clinical posts, which is in line with the practicality requirements of medical vocational education.

Secondly, the model realizes personalized and precise teaching. The intelligent language tool module can adjust the learning content and difficulty according to students' learning situation, provide targeted pronunciation correction and vocabulary guidance, solve the problem that traditional teaching cannot take into account the individual differences of students, and help students make up for their own learning weaknesses.

Thirdly, the AI-driven formative evaluation breaks the limitation of single final examination evaluation. Different from the traditional evaluation mode that only focuses on the final result, the AI system can record students' daily learning performance in real time, track the learning process, give timely feedback and guidance, help teachers accurately grasp students' learning dynamics, adjust teaching plans in a targeted manner, and realize the integration of teaching and evaluation, which greatly improves the teaching efficiency.

Comparison Between This Study and Previous Related Research

The research results of this study are consistent with the views of Brown (2020) and Garcia (2022) that AI technology can effectively improve the effect of language teaching. Compared with previous studies that only focused on theoretical discussion, this study constructs a complete integrated teaching model for medical vocational English and verifies its effectiveness through rigorous quasi-experimental research, which fills the gap of empirical research in this field.

In addition, this study focuses on the cultivation of clinical communication competence for medical vocational students, which is more targeted than previous studies on general English teaching. The research results confirm that the integration of AI technology and medical vocational English teaching can effectively solve the pain points of traditional teaching, which is consistent with the research conclusions of Li et al. (2023) on the optimization path of medical English teaching, and provides more specific practical evidence for the reform of medical vocational English teaching.

Existing Limitations of the Research

Although this study has achieved ideal research results, there are still some limitations: firstly, the research objects are only selected from one medical vocational college, and the sample scope is relatively limited, which may affect the universality of the research results; secondly, the teaching intervention period is 12 weeks, which is relatively short, and the long-term effect of the teaching model needs further follow-up research; thirdly, the research only focuses on the cultivation of clinical communication competence, and does not involve the impact of the model on students' other professional abilities. In future research, the sample scope can be expanded, the intervention time can be extended, and the research dimensions can be enriched to further verify and optimize the teaching model.

Practical Implications for Medical Vocational English Teaching

From the perspective of talent training, this teaching mode conforms to the development direction of intelligent vocational education and the talent cultivation needs of modern medical industry. It effectively makes up for various defects of traditional medical English teaching and is highly suitable for popularization and application in medical vocational colleges. For educators, this study provides a replicable teaching framework, and teachers can combine the actual situation of the school to adjust the AI teaching tools and scenario settings to better adapt to students' learning needs. For educational management departments, the research results can provide a reference for the formulation of medical vocational English teaching reform policies, promote the integration of intelligent

technology and vocational education, and help cultivate more high-quality applied medical talents with strong clinical communication ability.

Theoretical Implications

Theoretically, this study enriches the research content of AI-assisted language teaching in the field of vocational education, especially fills the gap of empirical research on AI-integrated medical vocational English teaching. The conceptual framework of the AI-enhanced integrated teaching model constructed in this study provides a new theoretical perspective for the design of medical English teaching mode and further verifies the guiding role of constructivist learning theory and intelligent teaching theory in practical teaching. At the same time, this study also provides a reference for related academic research in the future and promotes the in-depth development of research on the cultivation of clinical communication competence of medical vocational students.

Practical Implications

In practical terms, this study has important guiding significance for the teaching practice of medical vocational colleges. Firstly, medical vocational colleges should increase the investment in intelligent teaching equipment, introduce mature AI language teaching tools and clinical simulation systems, and enrich the practical teaching resources of medical English. Secondly, teachers should change the traditional teaching concept, take students as the main body of learning, actively use AI technology to carry out integrated teaching, focus on the cultivation of students' practical communication ability, and realize the transformation from exam-oriented teaching to competency-oriented teaching. Thirdly, the teaching evaluation system should be optimized, the AI-driven formative evaluation should be taken as an important part of teaching evaluation, the whole-process and multi-dimensional evaluation of students should be realized, and the evaluation should be truly integrated into the teaching process.

Future Research Prospects

In the follow-up educational research, based on this study, the sample scope can be expanded to select medical vocational students from different regions and different majors for research, so as to improve the universality of the research results. At the same time, the functional modules of intelligent teaching tools can be further optimized, more clinical scenarios suitable for different medical majors can be added, and more standardized teaching implementation plans can be formulated. In addition, long-term follow-up research can be carried out to track the employment and career development of students after receiving this teaching mode and explore the long-term impact of the teaching model on students' career development. Through continuous optimization and improvement, the AI-enhanced integrated English teaching mode can better serve the reform of medical vocational English teaching and promote the high-quality development of medical vocational education in the intelligent education era

Conclusion

This research takes medical vocational students as the research object and explores the application value of AI-enhanced integrated English teaching mode through scientific quasi-experimental research. The research results fully prove that compared with traditional teaching methods, the AI-enhanced integrated English teaching mode can significantly improve students' clinical communication confidence, English expression accuracy and professional scenario application ability, and has a significant promoting effect on the cultivation of students' clinical communication competence.

The combination of artificial intelligence technology and medical English teaching successfully solves the practical difficulties such as insufficient clinical teaching scenes, single evaluation mode and disconnection between teaching and practice in vocational colleges. It effectively narrows the gap between classroom theoretical learning and clinical practical work, stimulates students' learning interest and initiative, and improves the comprehensive professional quality of medical vocational students. The AI-enhanced integrated teaching model constructed in this study has strong operability and practicality, which provides a scientific and effective new path for the reform and development of medical vocational English teaching.

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