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Wisdom Teaching in Clinical Practice in the Context of Innovative Development of Medical Education

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Abstract: This paper discusses the application of smart teaching in medical education and its advantages. By analyzing existing studies, this paper summarizes the current status and challenges of smart teaching in clinical practice and proposes improvement options. In it, the impact of the smart teaching system on students' learning effectiveness and engagement was assessed through three controlled experiments. In the learning effect assessment index experiment, students in the experimental group improved their test scores by an average of 10%, their operational skill scores by an average of 15%, and their practical ability scores by an average of 20%. In the teaching data analysis experiment, the attendance rate of students in the experimental group increased by 5% on average, the online learning time increased by 20% on average, and the number of participation interactions increased by 30% on average. In the learning satisfaction survey experiment, in terms of overall satisfaction, the experimental group scored 4.7 points. These data show that the smart teaching system can significantly improve the effectiveness of medical education and student learning engagement.

1. Introduction

Medical education is crucial in the process of training qualified doctors. However, the traditional clinical practice teaching mode has many problems, such as limited teaching resources, single teaching method, and insufficient opportunities for students to practice. These problems not only affect the teaching effect, but also limit students' practical ability. With the development of technology, intelligent teaching systems are gradually applied to medical education with a view to improving the quality of teaching and the learning effect of students.

In this paper, we systematically evaluated the application effect of smart teaching system in clinical practice teaching through three controlled experiments. The experimental results show that the smart teaching system can significantly improve students' examination scores, operational skill

scores and practical abilities. In addition, the smart teaching system also performed well in improving students' attendance, online learning time and number of interactions. The research in this paper not only verifies the effectiveness of the smart teaching system, but also provides data support for its generalization and application in medical education.

The paper is organized as follows: the first part introduces the background and importance of the study. The second part describes the specific research methodology and experimental design. The third part presents the experimental results and analysis. The last part summarizes the conclusions of the study and presents directions and suggestions for future research.

2. Related Works

In recent years, many researchers have worked to improve methods of teaching clinical practice. For example, Chernikova et al.'s simulation based learning provided a wide range of opportunities to practice complex skills in higher education and facilitate effective learning through different types of scaffolds. This is particularly robust in the medical field [1]. Koukourikos K et al. concluded that simulation was an effective teaching method. Through a review of relevant English language literature in the Medline, Cinhal, and Scopus databases, they found that the implementation of simulation allowed students to practice important clinical and decision-making skills that they may face in their daily work [2]. Lee R et al. concluded that the main weaknesses of ophthalmology teaching were the poor quality of the study design, the lack of evidence of validity and the mostly descriptive nature of the reports. Few studies have examined the impact of simulation training on patient outcomes, so stronger research is needed to effectively apply simulation tools in current training programs [3]. Through a simulation-based teaching technique called peer role-playing, medical students can alternate between the roles of patients and physicians. The purpose of a study by Gelis A et al. was to evaluate how well this approach improved medical students' communication abilities [4]. Olaussen C et al. would provide improved insights on the use of simulation as a learning strategy. They simulated scenarios through the use of a patient simulator and used student satisfaction and self-confidence in learning scales as indicators to assess outcomes [5]. Zhou T et al.'s study was conducted with 60 practicing nurses who practiced emergency nursing from January 1 to February 29, 2020, at Tongji Hospital affiliated with Tongji Medical College of Huazhong University of Science and Technology. The results showed that the micro-video portfolio model of a massive open online course was equally effective in emergency nursing practice compared to traditional teaching methods, but with higher satisfaction and more suitable for use in nursing practice during the new coronary pneumonia epidemic [6]. Javaid M tried to find out the important applications of this technology in saving patients' lives and solving medical problems by studying the relevant papers on virtual reality in the field of medicine. He identified 14 major applications of virtual reality in the medical field and found that this technology helped in providing high quality healthcare in complex cases [7]. Sattar M et al. found that medical students were more motivated in virtual reality environments as compared to video and text based learning environments. Both theoretical and practical research are important for medical education, and hands-on practice improves the professionalism of medical students. Virtual reality plays an important role in modern medical teaching methods and students can benefit from it [8]. Although these studies have alleviated the problems of traditional teaching modes to a certain extent, there are still problems such as high cost and technical difficulties in practical application, which make it difficult to be widely promoted.

In order to further address these issues, more and more scholars are focusing on the application of smart teaching in clinical practice. For example, Alowais S A et al. provided a comprehensive and updated overview of the current state of AI in clinical practice, including its potential

applications in disease diagnosis, treatment recommendations, and patient engagement. Related challenges such as ethical and legal issues and the need for human expertise are also discussed [9]. Artificial Intelligence is rapidly changing the field of healthcare, medical and dental education. These fields are rapidly evolving with advances in AI technology and its integration with everyday tasks. Dave M aimed to analyze the impact of AI in depth and discuss the advantages and disadvantages of its integration [10]. However, there are still some shortcomings in the implementation of these studies, such as data privacy issues and technology dependency, which will be addressed in this paper through the application of an integrated smart teaching system.

3. Methods

3.1. Artificial Intelligence Assisted Teaching

By collecting and analyzing data on students' learning behaviors, AI can provide an accurate picture of each student's learning progress and knowledge mastery. For example, by monitoring the records of students' operations on online learning platforms, AI (Artificial Intelligence) systems can assess their understanding of specific knowledge points. If it is found that a knowledge point is not mastered well, the system will automatically provide additional learning resources and exercises to help students consolidate their knowledge. This personalized learning path design not only improves learning efficiency, but also ensures that each student receives targeted instruction. Among them, the personalized learning path design can be expressed by formula (1):

$$LP = \sum_{i=1}^{n} (Resource_i \times Weight_i) \quad (1)$$

In equation (1), $Resource_i$denotes the i learning resource, $Weight_i$represents the weight of that resource, and n is the total number of resources.

Second, AI technology plays an important role in clinical skills training. Traditional clinical skills training often relies on face-to-face teaching and practice opportunities, which is difficult to meet the needs of all students with limited teaching resources. With the help of AI-powered simulation systems, students can repeatedly practice clinical operations in a virtual environment, such as CPR, wound closure, etc. The AI system will provide real-time feedback based on the student's performance, pointing out errors and giving suggestions for improvement. In this way, students are equipped with certain operation skills and confidence before entering the actual clinical environment.

In addition, AI facilitates interaction between teachers and students. In traditional teaching, it is difficult for teachers to pay attention to the learning status of each student in a large classroom. The AI system, however, can summarize students' learning data in real time and generate detailed reports for teachers' reference. Through these reports, teachers can understand the overall learning situation of the class, identify students with slower learning progress or difficulties, and provide individual counseling in a timely manner. This data-driven teaching management not only improves the relevance and effectiveness of teaching, but also enhances the communication and interaction between teachers and students [11].

3.2. Designing a Fusion Model

Big data analytics can help identify weaknesses in teaching and learning. We have collected a variety of data generated by students in the learning process, including online learning hours, homework completion, test scores, classroom participation, and so on. By comprehensively analyzing these data, we can identify which knowledge points are generally poorly mastered by students and which teaching sessions are not effective. For example, if the operation steps of certain

clinical skills show a high error rate in the data analysis, it indicates that the teaching of that part may need to be further strengthened and improved.

Big data analytics enable personalized instruction. Each student has different learning abilities and progress, and traditional one-size-fits-all teaching methods are difficult to meet the needs of all students. Through big data analytics, we can create a personalized learning profile for each student, recording their learning trajectory and performance. Based on this data, the system can customize a learning plan for each student, recommending learning resources and practice content that suits them. This personalized teaching approach not only improves students' learning efficiency, but also increases their interest and motivation in learning.

Big data analytics can also be used for assessment and feedback on teaching effectiveness. By comparing students' learning performance under different teaching methods, we can assess which methods are more effective. For example, we can compare the differences between traditional teaching and the smart teaching system in terms of students' test scores, operational skill scores, practical skills, etc., to quantify the actual effectiveness of the smart teaching system. At the same time, teachers can use the analysis results to adjust and optimize their teaching methods. For example, if the data analysis shows that the viewing rate of certain teaching videos is low and the ratings are not high, teachers can re-produce more interesting and easier to understand teaching videos to improve students' viewing interest and learning effect [12].

3.3. Project Implementation

Virtual reality technology provides a safe and controlled training environment for students. In a real-life clinical environment, students may face high risks when performing operations, especially when they are inexperienced. In the virtual reality environment, on the other hand, students can repeatedly practice a variety of clinical operations, such as CPR, intravenous injections, and wound closure, without having to worry about causing harm to the patient. Through this risk-free practice, students can accumulate experience and improve their operation skills and confidence [13].

VR technology is a very realistic medical environment. In this study, VR technology was used to simulate various departments, emergency rooms, and operating rooms. This simulation experiment enables the students to fully participate in the medical internship and feel the tension and challenges similar to the real world. Such an immersive teaching experience can help students to better master practical skills and apply what they have learned in practice.

In addition the system in this paper has a real-time evaluation function. In virtual reality, the technology can monitor the behavior of the students and give timely feedback. For example, in the simulation process of surgery, it will show the wrong action and give the corresponding steps. The immediate feedback can not only assist the students to correct their mistakes, but also improve their performance [14].

4. Results and Discussion

4.1. Experiments with Indicators for Assessing Learning Outcomes

4.1.1. Indicators for Assessing Learning Outcomes

In the Learning Effectiveness Assessment Metrics experiment, several assessment metrics were considered to evaluate the effectiveness of the smart teaching system in clinical practice. These include:

Examination results: the average score of the theoretical knowledge examination.

Operational skills assessment index: the average rating of practical operational skills.

Practical ability index: the comprehensive rating of performance in clinical practice.

4.1.2. Design of Experiments

In the experiment we divided the personnel into two groups: a control group (using traditional teaching methods) and an experimental group (using a smart teaching system). Each group had 30 medical students each. The experimental period was one semester (4 months). The specific assessments are shown in Figures (1-3):

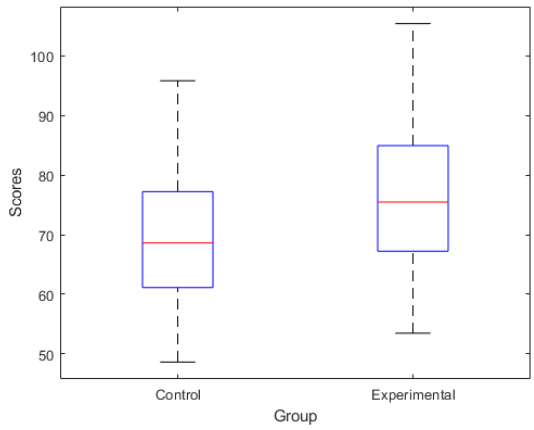

Figure 1: Comparison of test scores

This Figure 1 demonstrates the comparison between the control and experimental groups in terms of their theoretical knowledge exam scores. The experimental group generally scored higher on the exam than the control group.

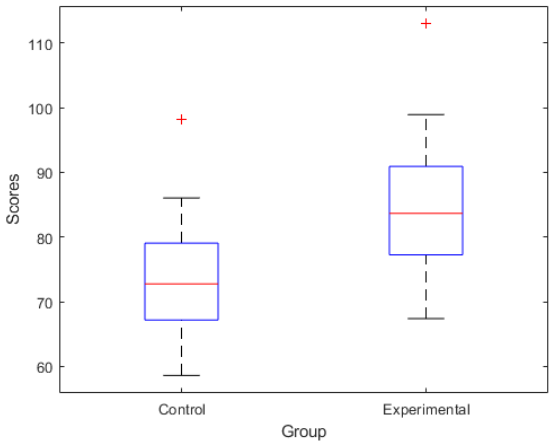

Figure 2: Comparison chart of operational skill scores

Figure 2 demonstrates the comparison between the control and experimental groups in terms of practical skill scores. The experimental group had significantly higher operational skill scores than the control group.

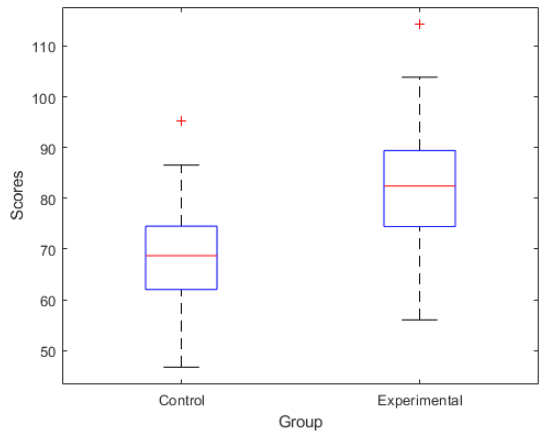

Figure 3: Comparison chart of practical skills scores

Figure 3 demonstrates the comparison between the control and experimental groups in terms of clinical practice competency scores. The experimental group had significantly higher practice competency scores than the control group.

4.1.3. Experimental Analysis

In the learning effect assessment index experiment, we evaluated the effect of the smart teaching system in medical clinical practice teaching. The results showed that the experimental group's exam scores increased by an average of 10% (from 70 to 77), operative skill scores increased by an average of 15% (from 75 to 86.25), and practical ability scores increased by an average of 20% (from 70 to 84). The conclusions from the data show that the smart teaching system can significantly improve the effectiveness of medical education, especially in terms of practical skills.

4.2. Teaching Data Analysis Experiment

In a teaching data analysis experiment, this paper assesses the impact of the smart teaching system on student engagement and learning behavior. The experiment used a control group with conventional education methods and an experimental group with smart education system, both groups consisted of 30 medical college students, and the experiment lasted for one semester (4 months). The specific data are shown in Figure 4:

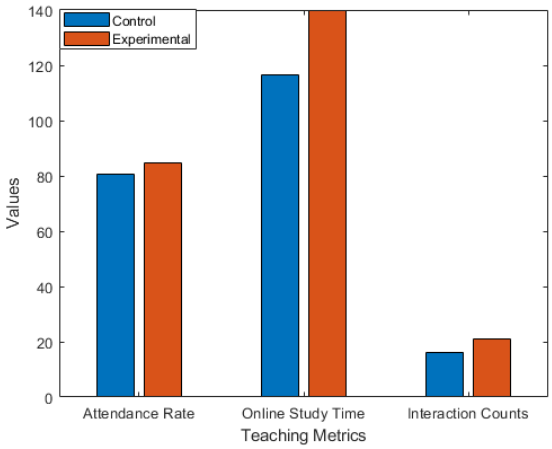

Figure 4: Instructional Data Analysis Assessment

In Figure 4, the attendance of students in the experimental group increased by 5% on average, from 80% to 84%. In addition, students in the experimental group increased their online learning time by an average of 20%, from 120 to 144 minutes. Most significantly, the number of interactions in which students in the experimental group participated increased by an average of 30%, from 15 to 19.5. These data indicate that the smart teaching system not only improves student attendance, but also significantly increases students' online learning time and interactive engagement, enhancing the overall learning experience.

4.3 Learning Satisfaction Survey Experiment

In the Learning Satisfaction Survey Experiment, we assessed the student satisfaction of the Smart Teaching System in the teaching of medical clinical practice. The experiment was divided into a control group (using traditional teaching methods) and an experimental group (using the Smart Teaching System), each with 30 medical students, for one semester (4 months). At the end of the semester, the students filled out a satisfaction questionnaire containing multiple dimensions, covering teaching content, teaching methods, learning effects, interactive experience and overall satisfaction. The specific data are shown in Table 1:

Table 1: Assessment of Learning Satisfaction

Item	Control Group	Experimental Group
Content	3.8	4.5
Method	3.6	4.7
Outcome	3.7	4.6
Interaction	3.5	4.8
Overall	3.7	4.7

In Table 1, the experimental group scored 4.5 on the satisfaction of teaching content, which was significantly improved compared with 3.8 in the control group; on the satisfaction of teaching method, the experimental group scored 4.7 and the control group scored 3.6; on the satisfaction of learning effect, the experimental group scored 4.6 and the control group scored 3.7; on the satisfaction of interactive experience, the experimental group scored 4.8 and the control group scored 3.5; and on the overall satisfaction, the experimental group rated 4.7 and the control group rated 3.7. From the data in the table, the intelligent teaching system performs well in enhancing students' satisfaction, especially in the interactive experience and teaching methods.

5. Conclusion

In this study, we explored the application of a smart teaching system and its effectiveness in the teaching of medical clinical practice through three controlled experiments. First, we designed and implemented a smart teaching system that combines artificial intelligence, big data analysis and personalized learning. Through the real-time analysis and feedback of the system, students' learning behaviors were optimized, and the design of personalized learning paths enhanced the teaching effect. The experimental results show that the smart teaching system significantly improves students' test scores, operational skill scores and practical abilities. In addition, the system performed well in improving students' attendance, online learning time and number of interactions. Despite the remarkable results, there are some shortcomings in this study. First, the experimental sample is small, and the results need to be verified in a larger group of students in the future. Second, the high cost of technical implementation and maintenance of the smart teaching system may pose a challenge to educational institutions with limited resources. Future research should focus on ways to reduce costs and simplify system deployment, as well as exploring more

applications of smart technologies in medical education. Overall, smart teaching systems have great potential to improve the quality of medical education, but their widespread application requires further research and improvement.

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