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PAPER

The Impact of Scene Teaching in Smart Classrooms on Learners' Learning Performance and Effectiveness

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ABSTRACT

As a new teaching method, scene teaching in smart classrooms directly impacts the overall quality and efficiency of education. Two groups of first-year students were selected as the research subjects for a study on intelligent learning performance and outcomes in a smart classroom teaching scenario. The results indicate that the intelligent teaching mode can lead to better outcomes in learners' intelligent learning. It can improve learners' participation in intelligent learning and enhance their performance. Additionally, it highlights the significance and differences in learners' intelligent learning effects. However, the research process must prioritize the dominant role of students and teachers in teaching in smart classroom settings. It should also focus on upgrading software and hardware to enhance effective teaching and on the rational use of multimedia technology in smart classrooms to provide robust support for college students' intelligent learning.

KEYWORDS

smart classroom, scene teaching, intelligent learning, learning effect

1 INTRODUCTION

The rise of smart education has disrupted the traditional education model and significantly enhanced the quality of education. The rise of information technology [1] coincides with the emergence of intelligent education. With the help of information technology, educational culture has given rise to the emergence of intelligent education. The value and learning experience embedded in smart education [2] have transformed people's perceptions of education, making it a new model in the current landscape of educational development. This model is based on educational information technology, with an emphasis on the cognitive load of learners, expanding learning, and enhancing learning ability. Its ultimate goal is to cultivate intelligent talents for society. In educational culture [3], learners' grades are often considered the most critical. However, under this model, greater emphasis is placed on translating knowledge into practical skills. In this context, enabling lifelong

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learning through smart education has become a crucial driving force for continuously expanding and enhancing personal abilities. In the field of educational information technology, the implementation of smart classrooms has a profound impact on learners' cognitive performance and effectiveness. It can significantly enhance learners' cognitive performance and effectiveness and offers a new approach for the long-term advancement of college education. The concept of the smart classroom aligns with smart learning, as it embodies comprehensiveness, thoroughness, and expansiveness. It focuses on the continuous learning and skill improvement of college students. Furthermore, college education plays a crucial role in facilitating situational teaching in smart classrooms, and the inclusive nature of its educational environment fosters the development of this educational model. Therefore, to analyze the instructional impact of smart classrooms, this study conducts a detailed investigation to verify that smart classrooms can enhance the effectiveness of learners' intelligent learning.

2 LITERATURE REVIEW

Yang [4] researched the smart education teaching platform and conducted an analysis of its application test. The article discusses how to utilize the intelligent learning platform with big data to enhance the quality of education and cater to the needs of platform users. Yang et al. [5] proposed a recommendation system based on intelligent knowledge, which is applied in smart education to enhance the interaction between students and teachers, student participation, and learning quality. Liu et al. [6] pointed out that digital interaction technology in educational information technology has significantly enhanced learners' learning efficiency in intelligent education. Li et al. [7] conducted a comprehensive review of the current status and trends in intelligent education research. Jiang [8] proposed a method for smart educational resource scheduling based on model fusion, which achieved effective scheduling of smart educational resources. Guo et al. [9] emphasized that smart education is an inevitable and important trend for advancing education in the information age. Terzieva et al. [10] analyzed the role of the Internet of Things in smart education and discussed how IoT devices can enhance educational efficiency in operations. Murad et al. [11] utilized educational information technology to enhance the quality of education. Liu et al. [12] pointed out that, with the development of the Internet, smart campus education and online social platforms have become the primary means of establishing social relationships. From another perspective, it confirms the role of smart education in the field of education. Riekki et al. [13] outline a plan for research and education by systematically specifying scenarios, performance criteria, system models, research questions, and educational content. This approach aims to achieve common goals and develop a coherent project portfolio and educational curriculum. Chang et al. [14] conducted a questionnaire survey to assess the impact of online learning in various schools across different Asian countries during the COVID-19 pandemic. The chi-square test was used to analyze the differences between schools that closed classes and those that did not. The effectiveness of online learning for undergraduate students in 13 schools across seven countries and regions in Asia was assessed through a questionnaire-based online survey. Metzgar [15] pointed out that, while online learning may be the only realistic response to the health crisis, students have varying degrees of success with online learning. One specific group that may be susceptible to challenges with online learning is transfer students. Transfer students, who may have come from

smaller, in-person classes, are now thrown into a fully online environment. Diab-Bahman et al. [16] examined the correlation between academic performance and e-learning attendance in a study of 389 first-year and second-year undergraduate students who were online for the first time for three consecutive semesters within an academic year. The study also assessed the impact of final attendance on business management courses. The results indicated that attendance and a student's academic year had a statistically significant impact on their grades. Doncheva et al. [17] analyzed higher education institutions and conducted further research on the inclusiveness of smart education. In higher education, e-learning is delivered through recorded lectures, and online platforms have become an integral part of the overall system [18]. The study aimed to assess the quality of online learning platforms by applying a set of criteria from the perspectives of staff and students at higher education institutions in the Sultanate of Oman [19]. As online learning continues to expand, there are limitations to the current implementation of maker education in the classroom. The research aims to develop an online maker education course utilizing artificial intelligence tools. Moreover, responses to it must be determined to assess whether it helps improve learners' computational thinking and creative problem-solving skills [20]. This study examines the influence of online teaching and personalized instruction on students' abilities and academic achievement. Cheng et al. [21] investigated the use of online review practices to enhance student engagement. Students invest a substantial amount of time preparing for online review exercises before their initial attempt and between each subsequent attempt. Students engaged in a variety of learning activities while completing the online review exercises, and as a result, their comprehension of the topics improved. Oh et al. [22] studied the impact of online teaching methods on child-parent relationship therapy (CPRT). Akaaboune et al. [23] investigated the ways in which distance education enables educators to utilize technology for delivering lessons to students who are geographically separated from their teachers. As higher education expands, distance education enrollment continues to encounter the challenges of academic dishonesty. Li et al. [24] proposed exploring the online classroom teaching mode within the framework of active learning. Shan et al. [25] studied the online teaching approach of wireless network 'learning' smart classrooms in the background of artificial intelligence. In the existing relevant research, the development process of smart classrooms is analyzed, along with the performance and effectiveness of learners' intelligent learning. However, the analysis of learners' intelligent learning performance and effectiveness in the smart classroom considers only a few indicators.

3 METHODOLOGY

This study focuses on the learning performance and effectiveness of two first-year literature majors classes at our school. It aims to examine the research objects' progress in literature major courses. The test examines students' participation, intelligent learning performance, and variations in learning performance.

3.1 Model

This study aims to investigate the impact of scene teaching in smart classrooms on learners' intelligent learning performance and effectiveness. The research

adopts quantitative methods and utilizes multiple regression analysis to construct mathematical models. Factors are being analyzed. When constructing a multiple linear regression model, it is important to consider the influence of multiple factors on learners' intelligence, learning performance, and effectiveness. For instance, factors such as learners' characteristics (e.g., gender, age, and education), learning environment (e.g., classroom atmosphere and teaching resources), and teaching strategies may influence learners' cognitive learning performance and effectiveness.

First, the multiple linear regression model is constructed as follows:

$$y = \beta_0 + \beta_1 x_1 + \beta_2 x_2 + \cdots + \beta_n x_n + \varepsilon \tag{1}$$

In equation (1), y represents the multiple linear regression model; x_1, x_2, ..., x_n represents the influencing factors of smart classroom scene teaching on learners' intelligent learning performance and effectiveness, where $n = 1, 2, ..., n$; β_1, β_2, ..., β_n represents the regression coefficient; β_0 represents the intercept, and ε represents the error term.

Next, various factors that may influence learners' intelligent learning performance and effectiveness, including learners' personal traits, learning environment, and teaching methods, are identified. A multiple linear regression model is chosen, and then the verification value P is calculated using actual data. If the verification value P is high, the instructional approach in the smart classroom significantly impacts the learners' cognitive learning performance and effectiveness. Otherwise, the influencing factors should be further explored and optimized. By analyzing the multiple linear regression model and the verification value P, we can gain a better understanding of the impact of scene teaching in the smart classroom on learners' intelligent learning performance and effectiveness. This analysis can provide a scientific basis for teaching improvement and optimization. The verification value P is as follows:

$$P = 1 - \frac{SSE}{SST} \tag{2}$$

Where P is the verification value, and represents the sum of squares of the residual error of each sample, and SST represents the sum of squares of the deviation between the actual value of each sample and the actual mean.

Finally, the S-T curve is used to analyze whether the teaching method in the smart classroom can help learners maintain a stable state during the learning process and ensure maximum learning effectiveness. In smart classrooms, teachers guide students to actively participate in learning by creating teaching scenarios that enhance students' interest and enthusiasm. This teaching method can enhance students' learning outcomes and improve their innovative ability and overall quality. At this stage, akin to the plateau phase on the S-T curve, smart classroom scene teaching can assist learners in sustaining a consistent learning state and preventing fluctuations or declines in the learning process. At the same time, teachers can also assist students in gaining a better understanding and mastery of knowledge through various teaching methods, such as interactive activities and games. The stress-strain (S-T) curve is as follows:

$$Y = \frac{K}{\left|1 + e^{(-a(t-b))}\right|} \tag{3}$$

Where Y represents the analysis result of the S-T curve, t represents time, and represents a constant. The curve presents an S-shape and is typically divided into three stages: the rising period, the plateau period, and the falling period.

3.2 Research object

This study selected two first-year journalism majors at a university as the research subjects. The experimental group was designated as Class A, and the control group was designated as Class B. The teachers of the two classes are the same, using the same teaching materials and following the same course schedule. The number of students in the two classes is the same, but the ratio of male to female students is different. Based on equation (2), the scores of the entrance examinations for the two classes were tested using an independent sample t-test. The result showed that $P > 0.05$, indicating that no significant difference was found in the academic performance of the two classes before the experiment. Therefore, this study can be conducted. The details of the research subjects are shown in Table 1.

Table 1. Sample statistics of research objects

Sample Class	Gender	Number of People	Proportion%
Class A	male	17	34
	female	23	66
Class B	male	19	38
	male	21	62
Academic performance verification	$P > 0.05$		

3.3 Research scenarios and tools

In this study's scenario, Class A's course is taught using smart classroom technology, while Class B's course is taught in a traditional format. Classroom data and the actual teaching situation of the two classes. The primary records are displayed in Table 2.

Table 2. Details of intelligent teaching data in different classes

Data Category	Details	Note
Basic information	Attendance time, lecture method, course content, teaching materials used, lecture information	Difference between Class A and Class B
Process information	Classroom behavior, teaching objectives, implementation, and outcome evaluation	Difference between Class A and Class B

After establishing the research context, this tool utilizes the smart classroom feature on the Tencent video platform to conduct course research. In intelligent teaching, the form and content are processed separately, and the teacher's question is used as an example. In a smart classroom with multimedia capabilities, the traditional method of teachers giving lectures is replaced by integrating the information and outcomes of both teachers and students into the smart classroom environment. The representation model is depicted in Figure 1.

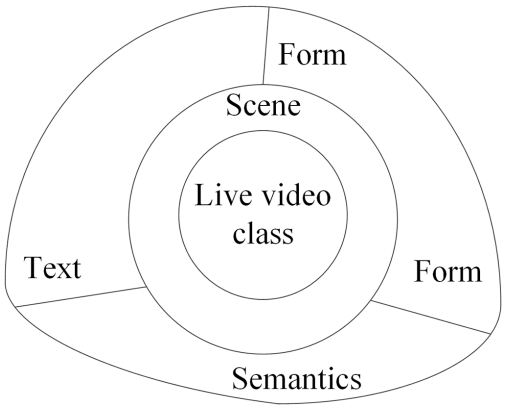

Fig. 1. Schematic diagram of the smart classroom teaching model

3.4 Data collection

The data for this study is all derived from actual smart classroom teaching data. The experiment lasted for three months. With a video resolution of 1920×1080 for high-definition teaching in the classroom, the duration of the smart classroom session is approximately 59 minutes. The number is 100, and all students' classroom performances are collected based on the access data from the Tencent video platform. The images have been processed. Based on the performance data collected from teachers and students in the smart classroom, along with the final student participation, intelligent learning performance, and learning performance differences among students in different classes, an analysis is conducted on the intelligent learning performance and effectiveness of the smart classroom for learners.

Based on the collected data, this study combines the calculated results of equation (3) to obtain the S-T curve and conducts the final impact research using S-T analysis. The S-T curve automatically assesses the performance of teachers and students in the smart classroom and helps analyze the strengths and weaknesses of the smart learning process in graphical form. The schematic diagram of the S-T curve structure is shown in Figure 2.

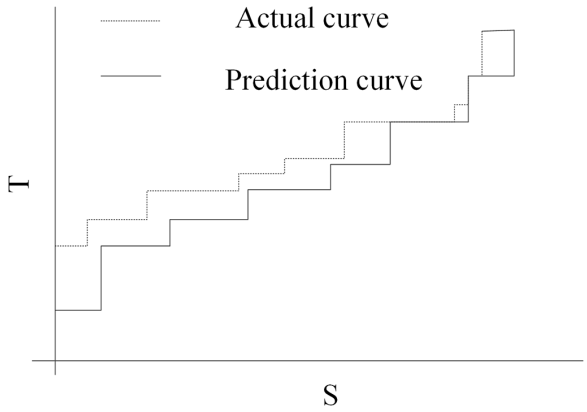

Fig. 2. Schematic diagram of S-T curve structure

This curve is used to analyze the final student participation, intelligent learning performance, and learning performance differences among students in different classes.

4 RESULTS ANALYSIS AND DISCUSSION

4.1 Results of student participation in smart classroom teaching of students in different classes

In this smart classroom, students in classes A and B use different teaching methods to study the course. During the learning process, the level of interaction between teachers and students reflects the students' engagement with this teaching method. In this analysis of student participation in journalism majors, the study primarily focuses on three dimensions: teacher guidance, smart classroom prompts, and student responses. The participation of students in two classes is analyzed separately within the context of three dimensions, and the intellectual abilities of students in different classes are compared. The results of student participation in classroom teaching are depicted in Figure 3.

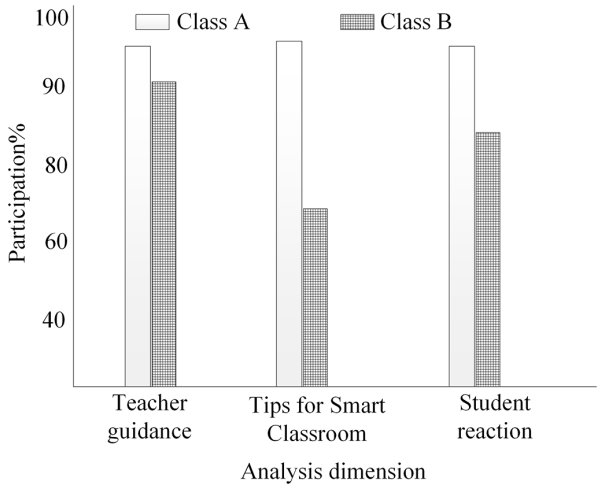

Fig. 3. Results of student participation in smart classroom teaching of students in different classes

From the results in Figure 3, a significant difference in student participation in smart classroom teaching is observed for students in classes A and B under the three-dimensional background of teacher guidance, smart classroom prompts, and student responses. Among them, students in class A have a student participation rate of over 90% in the three dimensions of teacher guidance, smart classroom prompts, and student responses. In contrast, class B students have the highest teacher guidance dimension, with approximately 90% among the three dimensions of teacher guidance, smart classroom prompts, and student responses. The other two dimensions are low, the prompting dimension of the smart classroom. The smart classroom has a significant impact on the participation of learners in smart learning.

4.2 Smart learning achievements of students in different classes of smart classroom teaching

Against the backdrop of a three-month smart classroom teaching program for students, this test was conducted on the journalism courses of students in classes A and B to assess the impact of different smart classroom teaching methods on students' academic performance. The results are presented in Table 3.

Table 3. The professional course scores of students in different classes in smart classroom teaching

Professional Grades/Points	Class A/Person	Class B/Person
90–100	15	5
80–89	22	15
70–79	10	20
60–69	3	6
<60	0	4

The results in Table 3 show that the test scores for the three-month smart classroom teaching in class A were below 60 points, and in class B, there were no students who scored in the three-month smart classroom teaching. Four people scored less than 60. In the 80–100 score range, 37 students are in Class A, and 20 students are in Class B, accounting for 74% and 40% of the total number of students, respectively. In the 70–79 score range, there are 13 students in Class A and 26 students in Class B, accounting for 26% and 52% of the total number of students, respectively. Class A's grades are in the high-scoring range, while the number of students in Class B falls within the 70–79 score range. The test scores from the three-month study in the smart classroom show relatively good results, confirming that the smart classroom can enhance students' academic performance and is feasible.

4.3 The differences in smarter learning achievements of students in different classes of smart classroom teaching

The above analysis highlights the impact of various smart classroom teaching methods on students' smart learning performance. Further analysis of the differences in smart learning performance among students in different smart classroom teaching classes emphasizes the potential for smart classrooms to enhance students' smart learning performance. The results are presented in Table 4.

Table 4. Results of differences in students' intelligence learning performance in different classes of students' smart classroom teaching

Comparison Item	Average		Standard Deviation		*P* Value	
Journalism professional grades/points	Class A	Class B	Class A	Class B	Class A	Class B
	87.50	75.26	5.29	6.47	0.00	0.12

In analyzing the differences in students' intelligence and learning performance across various classes in smart classroom teaching, the significance level value is set at 0.10. When the *P* value is less than the significance level, there is a significant difference at the response level. The results in Table 4 show that the *P* value of class A's smart classroom is 0.00, while the *P*-value for class B's smart classroom in teaching students' intelligent learning performance is 0.12. In contrast, for class A's $P < 0.10$, and class B's $P > 0.10$, the *P*-value for class A is less than 0.10 while for class B it is greater than 0.10. The smart classroom in class A significantly enhances students' cognitive learning performance and effectively improves their overall learning outcomes.

4.4 Management implications

First, attention needs to be paid to the subject position in the scene teaching of a smart classroom. Teachers and students are the primary participants in the smart classroom teaching environment. A variety of multimedia and smart classroom prompts should be used as key tools for auxiliary teaching in the smart classroom, instead of blindly relying on them to transfer knowledge. In the classroom, teachers should be attentive to the challenges and issues students face in their learning process and select appropriate intelligent classroom support media to address these issues based on individual differences. Therefore, the dominant role of students and teachers in the teaching scene of smart classrooms should be given attention.

Second, it is necessry to effectively upgrade the software and hardware for teaching in the smart classroom. The rapid development of the times has accelerated the pace of advancement in information technology. In smart classrooms, various software, hardware, and equipment are utilized for teaching, including electronic platforms for students, teachers, and homework assignments. The entire process of teaching should be effectively integrated to form a comprehensive knowledge system. Software and hardware are utilized to support teachers' mobility in explanations, diversify teaching methods, improve classroom and class interaction, and enhance students' interest in learning. The multimedia technology in the smart classroom is continuously upgraded and updated, but some older hardware and software often fail to meet the learning needs of students. Therefore, keeping up with the pace of the times, rapidly upgrading software and hardware, and meeting the teaching needs of smart classrooms are essential in this evolving era.

Third, rational use of multimedia technology in smart classrooms. In the context of smart classrooms, the use of multimedia technology facilitates teaching and enables students to enhance their interest in learning through interactive and intelligent methods. The emergence of this technology represents a teaching mode that cannot be compared with the traditional approach. However, this medium cannot completely replace traditional teaching methods. The primary purpose of using this medium is to enhance the impact that the original teaching mode is difficult to achieve. Therefore, multimedia technology must be used in smart classrooms for effective teaching and learning. Technology is a tool that assists in teaching and plays a secondary role in students' intelligent learning. Utilizing this technology can make a profound impression on students and help them enhance their ability to reason with perceptual knowledge. However, it should not be overused, as it may hinder students' ability to think critically and solve problems effectively. In the realm of intelligent teaching, this technology should be integrated with effective teaching methods to enhance students' academic performance and the overall effectiveness of intelligent learning.

5 CONCLUSION

In the continuous evolution and reform of social education, lifelong learning remains the ultimate goal of education. With the changes in the social environment, smart teaching methods have become a crucial approach to education. As a results, smart classrooms were developed. This new teaching method has effectively increased students' interest in learning and transformed the traditional teaching

approach. This study examines the performance of intelligent learning and the impact of smart classroom teaching on learners. By defining the research object as the smart classroom environment and establishing test indicators, this study analyzes the impact of intelligent learning in smart classrooms. The guided teaching mode offers three suggestions to support college students' active learning and enhance their academic performance.

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