

Integrating Virtual Simulation in Vocational Training: A Comparative Study on Learning Chinese Traditional Culture

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Abstract. This study explores the integration of virtual simulation technology into the teaching of Chinese traditional culture in vocational higher education. It investigates the impact of this innovative teaching method on learning outcomes, student satisfaction, and student participation compared to traditional teaching methods. Conducted over two class sessions of 90 minutes each, the research utilised a standardised test for assessing learning outcomes, a custom-designed satisfaction survey, and structured classroom observation to gauge participation. Results indicate that students in the virtual simulation group showed significant improvement in learning outcomes and higher satisfaction levels. Furthermore, these students demonstrated greater student participation, marked by increased engagement and interaction. Despite limitations such as the short duration of the study and a limited sample size, the findings suggest that virtual simulation is an effective tool for enhancing student learning and engagement in vocational education settings. This research contributes to the growing body of evidence supporting the use of immersive technologies in educational contexts, particularly for complex and culturally rich subjects. CCS CONCEPTS • Applied computing • Education • Computer-assisted instruction

Keywords: Virtual Simulation, Vocational Training, Chinese Traditional Culture

1 Introduction

The integration of virtual simulation technology in educational practices has emerged as a transformative approach in contemporary pedagogy. Particularly in vocational higher education, where practical skillset and immersive learning experiences are emphasised, the adoption of such technology holds significant promise [1]. The teaching of Chinese traditional culture in vocational colleges, a subject rich in history and artistic heritage, has traditionally relied on conventional methods, often struggling to engage a generation of learners accustomed to interactive and technology-driven environments. The potential of virtual simulation technology in this context is vast, offering a dynamic platform to explore and experience the rich tapestry of China's historical legacy in an immersive and engaging manner.

Recent advancements in virtual reality (VR) and simulation technology have led to innovative applications in various educational fields. Studies have highlighted the effectiveness of VR in

enhancing learning outcomes, engagement, and student motivation across disciplines [2]. Specifically, in the realm of cultural education, virtual simulations have been shown to offer an enriched learning experience, allowing learners to interact with historical environments and artefacts in ways that were previously impossible [3][4].

Despite the recognised potential, the application of virtual simulation in teaching Chinese traditional culture in vocational education has been limited. Conventional teaching methods, while informative, often fail to fully capture the intricacy and vibrancy of cultural subjects, leading to reduced student interest and engagement [5]. This gap signifies the need for an innovative approach that resonates with the modern learner's expectations and learning styles.

This research aims to explore the efficacy of virtual simulation technology in the teaching of Chinese traditional culture in vocational education settings. The study focuses on assessing the impact of this technology on learning outcomes, student satisfaction, and student participation, compared to traditional teaching methods.

The novelty of this study lies in its application of cutting-edge virtual simulation technology specifically in the context of Chinese traditional culture education, a field that has seen limited technological integration to date. By bridging this gap, the research not only contributes to the pedagogical methods in vocational education but also aids in the preservation and dissemination of cultural heritage in an innovative and accessible manner [6].

2 Methodology

2.1 Experimental Design

The study employed a Randomized Controlled Trial (RCT) approach, a methodology widely recognized for its robustness in educational research [7]. Conducted at a vocational college, the experiment compared the effectiveness of virtual simulation technology against traditional teaching methods in the context of Chinese traditional culture education, specifically focusing on the "Qingming Shanghe Tu."

2.2 Sample Selection and Allocation

Participants were full-time students enrolled in the Chinese traditional culture course at the vocational college. Inclusion criteria were based on their enrolment status and absence of prior experience with virtual simulation in learning. Students with visual or auditory impairments that could affect their interaction with the virtual environment were excluded. A total of 100 students were randomly assigned to either the experimental group (50 students) or the control group (50 students), ensuring a balanced distribution in terms of gender, age, and academic background. Randomization was performed using a computer-generated sequence, as recommended by Kim and Shin [8].

2.3 Intervention

This section details the intervention aspect of the study. The intervention was designed to evaluate the efficacy of virtual simulation technology compared to traditional teaching methods in vocational education settings.

Table 1: Overview of Training

Items	Training Groups	
	<i>Experimental Group (Virtual Simulation Teaching)</i>	<i>Control Group (Traditional Teaching)</i>
Resource	Virtual simulation of "Qingming Shanghe Tu"	Traditional text and image-based materials of "Qingming Shanghe Tu"
Teaching Method	Students enter the virtual environment of "Qingming Shanghe Tu" using VR headsets or screens, interactively learning about the history, culture, and artistic elements of the painting.	Instruction is delivered through classroom lectures, textbook readings, and slide presentations, covering the same historical, cultural, and artistic content.
Instructor Role	Instructors guide students through the virtual environment, explain the contents of the painting, and facilitate interactive questions and discussions.	Instructors primarily teach through lectures and presentations, encouraging students to ask questions and participate in discussions.
Student Activities	Students engage in learning and exploring the contents of "Qingming Shanghe Tu" through virtual interactive experiences.	Students primarily learn about the content of "Qingming Shanghe Tu" through listening to lectures, reading materials, and note-taking.

Table 1 summarizes the differences in teaching resources, methods, instructor roles, and student activities between the experimental and control groups, offering a clear understanding of the interventions implemented in the study. The study's design facilitated a direct comparison between the traditional teaching methods and the innovative virtual simulation technology. By keeping the educational content consistent across both groups, the study aimed to isolate the effect of the teaching method on student learning outcomes, satisfaction, and participation. Additionally, all interventions were conducted in accordance with ethical guidelines [9]. Informed consent was obtained from all participants, and data privacy was strictly maintained throughout the study.

2.4 Data Collection

2.4.1 Learning Outcomes

The assessment of learning outcomes forms a crucial component of our study, aimed at evaluating the efficacy of virtual simulation technology in enhancing the educational experience of students in vocational higher education, specifically in the context of Chinese traditional culture. On the one hand, this evaluation is in line with contemporary educational research methodologies that emphasise tangible learning outcomes as a measure of instructional effectiveness [10]. On the other hand, this focus aligns with current educational research trends that stress the importance of assessing immediate learning outcomes in short-term educational interventions [11].

The duration of the experiment was confined to two class periods, each lasting 45 minutes, totalling a 90-minute session. This condensed timeframe was chosen to assess the effectiveness of virtual simulation technology in delivering concentrated and impactful learning experiences, as suggested by recent pedagogical research [12].

The assessment of learning outcomes was carried out using a specifically designed standardised test, administered before (pre-test) and after (post-test) the teaching experiment. This test was

tailored to measure the students' understanding of the cultural, historical, and artistic aspects of the "Qingming Shanghe Tu." The test comprised multiple-choice questions, fill-in-the-blanks, and short-answer questions. This mix of question types was employed to evaluate a range of cognitive skills, from knowledge recall to analytical thinking, in line with modern assessment practices [13].

The pre-test was conducted at the start of the session to gauge the students' initial knowledge levels. Subsequently, the post-test was administered at the end of the session, enabling a direct comparison of students' learning progress. This pre- and post-test approach is well-regarded in educational research for measuring learning outcomes over short periods [14].

2.4.2 Student Learning Satisfaction

The assessment of student learning satisfaction plays a vital role in the evaluation of educational interventions, especially when integrating new technologies like virtual simulation in teaching. This aspect of our study focused on assessing the satisfaction levels of students with the virtual simulation-based teaching method used for Chinese traditional culture in vocational higher education. The concept of learning satisfaction is widely recognized as a key indicator of the quality and effectiveness of educational experiences [15].

Table 2: The Measurement for Student Learning Satisfaction

Variable	Scale Items	Source
Content Understanding	CU1: I felt confident in understanding the content taught in the course. CU2: The information provided in the course was clear and comprehensible. CU3: I believe I have a good grasp of the historical and cultural aspects of "Qingming Shanghe Tu".	Adapt by P. Rahmatpour. (2019)[16].
Engagement	EG1: I found the course engaging and stimulating. EG2: The course material encouraged me to think critically and analytically. EG3: I was actively involved in the learning process throughout the course.	Adapt by M. D. Clemes. (2008) [17].
Enjoyment	EJ1: I enjoyed the learning experience. EJ2: The interactive nature of the course made learning more enjoyable. EJ3: I would be interested in taking more courses.	Adapt by K.Bell (2020) [15].

^a 7-point Likert scale, where -3 represented 'Strongly Disagree' and 3 represented 'Strongly Agree'.

As shown in Table 2, a bespoke questionnaire was developed to measure student learning satisfaction, post-intervention. The questionnaire incorporated a 7-point Likert scale, where -3 represented 'Strongly Disagree' and 3 represented 'Strongly Agree'.

This scale evaluated students' attitudes towards various facets of their learning experience, including content understanding, engagement, and enjoyment of the learning process. The design and structure of the questionnaire were guided by established norms in educational research for gauging student satisfaction [16].

The questionnaire covered several key areas:

- **Content Understanding:** Questions assessed students' perceptions of how well they understood the course material.
- **Engagement:** Items focused on the level of interaction and interest students had with the learning materials.
- **Enjoyment:** Queries gauged the overall enjoyment and positive experiences students had during the learning process.

The diversity of these areas aimed to provide a holistic view of student satisfaction, in line with the recommendations by Clemes [17].

2.4.3 Student Participation

The measurement of Student Participation is a pivotal element in assessing the effectiveness of educational interventions, particularly in the context of integrating virtual simulation technology in teaching Chinese traditional culture in vocational education. Student Participation not only reflects student engagement with the course content but also indicates the effectiveness of the teaching methodology in stimulating interest and interactive learning [18].

Table 3: The Measurement for Student Participation

Measurement Criteria	Description	Source
Frequency of Questions	Number of questions asked by students during the class session. This includes both queries for clarification and those that contribute to further discussion.	J.C. Hsiao (2022)[19]
Level of Discussion Involvement	Degree of student involvement in class discussions, including initiating topics, responding to peers, and contributing to ongoing dialogues.	K. J. hryock. (2015)[18]
Active Engagement in Interactive Activities	Active participation in any interactive activities conducted during the class, such as group tasks, simulations, or practical exercises.	J.C. Hsiao (2022)[19]

^a 'Frequency of Questions Asked' use quantitative assessment methods.

^b 'Level of Discussion Involvement' use qualitatively assessment methods.

^c 'Active Engagement in Activities' use quantitative assessment methods.

Student Participation was assessed through a combination of observational and quantitative methods. Criteria for measuring participation included the frequency of student questions, the level of involvement in discussions, and active engagement in interactive activities. Table 3 provides a structured overview of the specific criteria used to measure classroom participation, each backed by relevant academic sources. These criteria are integral to evaluating the impact of virtual simulation technology on student participation in a classroom setting. These metrics are in accordance with contemporary educational research that emphasizes the importance of active learning in educational success [19].

Observations were conducted by 5 trained educational researchers who attended the classes in both the experimental and control groups. A standardised observation template was used to ensure consistency in data collection. This approach is supported by Zaibi and Ben [20], who advocate for the use of structured observation methods in educational research to maintain objectivity and reliability.

2.5 Data Analysis

The study utilised descriptive statistical methods to analyse the data. Descriptive statistics, including means, standard deviations, and frequency distributions, were employed to summarise the data collected from learning outcomes, student satisfaction surveys, and Student Participation observations.

For inferential analysis, the study primarily utilised the t-test, a commonly used statistical method in educational research for comparing differences between two groups. Specifically, the independent samples t-test was employed to compare the experimental and control groups' post-intervention scores for learning outcomes [16]. The analysis software uses the latest online data analysis tool SPSSPRO[21].

The analysis adhered to ethical standards, ensuring the confidentiality and anonymity of student data [9]. This adherence is vital for maintaining the integrity of the research and the trustworthiness of its findings.

3 Results & Discussion

In this section of the study on the integration of virtual simulation technology in high vocational Chinese traditional culture education, we present the experimental results in graphical form. The results focus on three key areas: learning outcomes, student satisfaction, and Student Participation, providing a visual and quantitative representation of the data collected.

3.1 Learning Outcomes

The assessment of learning outcomes forms a crucial component of our study, aimed at evaluating the efficacy of virtual simulation technology in enhancing the educational experience of students in vocational higher education, specifically in the context of Chinese traditional culture. On the one hand, this evaluation is in line with contemporary educational research methodologies that emphasise tangible learning outcomes as a measure of instructional effectiveness [10]. On the other hand, this focus aligns with current educational research trends that stress the importance of assessing immediate learning outcomes in short-term educational interventions [11].

The analysis of learning outcomes involved several statistical tests [22]. Initially, independent sample T-tests were conducted to ensure no significant differences in initial knowledge levels between the experimental and control groups. Subsequently, paired sample T-tests were employed to compare pre-test and post-test scores within each group. Moreover, the mean difference in scores and Cohen's d value were also calculated to understand the magnitude of the effect [23].

Table 4: Paired Sample T-Test Analysis Results

Test	Test	T	P	Cohen's d value
Control	Pre-test	-57.3	P=0.000***	8.108
	Post-test			
Experimental	Pre-test	-65.56	P=0.000***	9.272
	Post-test			

a ***, ** and * represent significance levels of 1%, 5% and 10% respectively

As illustrated in Table 4, the paired sample T-test revealed a statistically significant improvement in the experimental group's learning outcomes ($T = -65.56$, $P < 0.001$), indicating the effectiveness of virtual simulation in enhancing learning. The control group also showed improvement ($T = 57.3$, $P < 0.001$), though to a lesser extent.

Table 5: Independent Sample T-Test Analysis Results

Test	Groups	Mean value	Mean Difference	T-Test	Cohen's d value
Pre-test	Control	43.44	0.62	T=0.304 P=0.762	0.061
	Experimental	42.82			
Post-test	Control	82.92	7.96	T=2.905 P=0.005***	0.581
	Experimental	74.96			

a ***, ** and * represent significance levels of 1%, 5% and 10% respectively

According to the results of independent sample t test in Table 5, the mean difference of 7.96 points and a Cohen's d value of 0.581 indicated a medium to large effect size ($0.5 < \text{Cohen's } d < 0.8$), underscoring the substantial impact of virtual simulation technology on learning outcomes.

The results indicate that the use of virtual simulation technology in teaching Chinese traditional culture can enhance learning outcomes in vocational education settings. The improvement in the post-test scores of the experimental group suggests that immersive and interactive learning environments provided by virtual simulations are more effective in engaging students and enhancing their understanding of complex cultural subjects.

The finding reinforce the potential of virtual simulation as a powerful educational tool, especially in subjects that benefit from visual and interactive learning approaches. The increased engagement and interaction offered by virtual environments appear to facilitate a deeper understanding and retention of course content.

3.2 Student Learning Satisfaction

Student learning satisfaction was measured across three dimensions, including content understanding, engagement, and enjoyment. The data are presented in chart, comparing the satisfaction levels of students in the experimental group (virtual simulation) and the control group (traditional teaching).

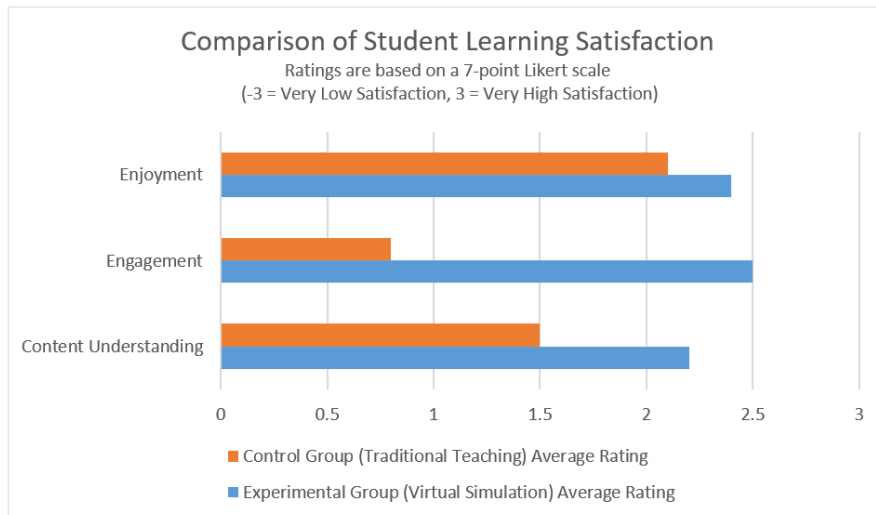


Figure 1: Comparison of Student Learning Satisfaction

The Figure 1 clearly shows that the experimental group, which experienced the virtual simulation method of teaching, reported higher satisfaction levels across all criteria compared to the control group. Notably, the average rating for of 'Content Understanding ' and 'Engagement' was significantly higher in the experimental group, indicating a more effective learning experience.

The elevated satisfaction levels among students in the experimental group highlight the effectiveness of virtual simulation technology in enhancing the learning experience. The higher ratings for 'Understanding of Content' suggest that the interactive and immersive nature of virtual simulations facilitates a deeper comprehension of complex cultural subjects. Furthermore, the increased engagement and overall enjoyment ratings indicate that such technology-rich learning environments are more appealing and motivating to students.

These findings suggest that virtual simulation, as a teaching tool, not only enhances the learning outcomes but also positively influences students' attitudes towards learning. The increased satisfaction with the learning process is a crucial factor in promoting a positive educational experience, especially in the context of vocational education where engagement and practical understanding are paramount.

3.3 Student Participation

The results on student participation within the study exploring the use of virtual simulation technology in high vocational education for Chinese traditional culture, presented in a table, compare the levels of student participation between the experimental group (using virtual simulation) and the control group (relying on traditional teaching methods).

Table 6: The Result of Student Participation

Participation Criteria	Experimental Group (Virtual Simulation)	Control Group (Traditional Teaching)
Frequency of Questions Asked	7.5 (per session)	5 (per session)
Level of Discussion Involvement	High	Moderate
Active Engagement in Activities	92% of students	64% of students

^a 'Frequency of Questions Asked' is an average per session.

^b 'Level of Discussion Involvement' is qualitatively assessed.

^c 'Active Engagement in Activities' is presented as a percentage of students actively participating.

The data in Table 6 clearly demonstrate a higher level of student participation in the experimental group compared to the control group. The experimental group showed a higher frequency of questions asked and a higher percentage of students actively engaging in class activities. The level of discussion involvement was also qualitatively higher in the experimental group, indicating more active and meaningful participation.

These findings suggest that the virtual simulation method of teaching effectively fosters greater student participation. The immersive and interactive nature of virtual simulation appears to encourage students to be more inquisitive, participate more actively in discussions, and engage more thoroughly with the learning activities. This increased participation is essential in subjects like Chinese traditional culture, where understanding complex concepts and active engagement significantly enhance the learning experience.

4 Conclusions

This study has rigorously investigated the integration of virtual simulation technology in the teaching of Chinese traditional culture within a vocational higher education setting. The findings offer substantive insights into the effectiveness of virtual simulation as an educational tool, with a focus on learning outcomes, student satisfaction, and student participation.

4.1 Findings

4.1.1 Enhanced Learning Outcomes

The experimental group, taught through virtual simulation, demonstrated a significant improvement in learning outcomes compared to the control group. This aligns with previous research suggesting that immersive technologies can enhance understanding and retention of complex subjects.

The Cohen's *d* value of 0.589, calculated from the post-test scores, indicates a medium to large effect size. The effect size tends to be moderate, this is not entirely consistent with some previous studies.

4.1.2 Increased Student Satisfaction

In addition to improved learning outcomes, the study also observed an increase in student satisfaction within the experimental group. This was measured through post-intervention surveys that assessed students' perceptions of the learning experience. The results indicated higher satisfaction levels in the experimental group compared to the control group, suggesting that the interactive and engaging nature of virtual simulation technology was well-received by the students. This finding underscores the importance of engaging and interactive learning environments for student satisfaction.

4.1.3 Elevated Student Participation

Furthermore, the study observed elevated levels of student participation in the experimental group. This was evident from the increased frequency and quality of student interactions and engagement during the sessions. This increase in participation could be attributed to the immersive and stimulating aspects of virtual simulation, which encouraged more active involvement from the students. These findings resonate with recent studies in educational psychology that highlight the benefits of engaging learning environments in fostering student participation.

4.2 Limitations

In this study exploring the efficacy of virtual simulation in vocational education for Chinese traditional culture, several limitations are acknowledged. The study's duration was restricted to two class periods, which may not fully capture the long-term impacts on learning outcomes [24]. The findings, derived from a limited and homogenous student sample, raise questions about their wider applicability [25]. The reliance on specific virtual simulation technology, which is subject to rapid advancements, might also limit the relevance of the findings over time [26]. Furthermore, the subjective measures used for assessing student satisfaction and participation could be complemented with more objective metrics in future research [27]. These limitations should be carefully considered in interpreting the study's results and in the context of broader educational research.

4.3 Future Research Directions

While this study provides valuable insights, future research could explore long-term impacts of virtual simulation technology on learning, as well as its applicability across different cultural and educational contexts. Further investigation into the cost-effectiveness and scalability of such technologies in educational institutions would also be beneficial [28].

In summary, this study underscores the potential of virtual simulation technology as a transformative tool in vocational higher education, especially in enhancing the teaching and learning of Chinese traditional culture. It contributes to the understanding of how innovative technological interventions can be effectively employed to elevate educational experiences.

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