International Journal of Basic and Applied Sciences, 14 (5) (2025) 797-804

SPC

International Journal of Basic and Applied Sciences

Website: www.sciencepubco.com/index.php/IJBAS
https://doi.org/10.14419/kqy4n403
Research paper

Design and Development of A Personalized Experiential Virtual Reality System for Costume History Learning

Xin Xiao, Kien Tsong Chau *, Wan Ahmad Jaafar Wan Yahaya

Centre for Instructional Technology and Multimedia, Universiti Sains Malaysia, Penang, Malaysia
**Corresponding author E-mail: chaukientsong@usm.my*

Received: July 25, 2025, Accepted: September 15, 2025, Published: September 22, 2025

Abstract

This study investigated the comparative effectiveness of a Personalized Experiential Virtual Reality (PE-VR) system and a Normal Virtual Reality (NVR) system in enhancing undergraduate students' learning achievement and engagement. A total of 30 undergraduate students participated in the experiment. Learning achievement was assessed using pre- and post-tests and analyzed with ANCOVA, while engagement was evaluated with a standardized questionnaire and analyzed using ANOVA. After controlling for pre-test scores, the results indicated that students in the PE-VR condition achieved significantly higher post-test scores than those in the NVR condition (Mean Difference = 15.522, p=0.001). Students in the PE-VR condition also demonstrated significantly higher levels of engagement than their counterparts in the NVR condition (Mean Difference = 17.533, p=0.001). These findings offer empirical evidence that the PE-VR system can overcome the limitations of traditional instruction and enhance history education in higher education settings.

Keywords: *Personalized Experiential; Virtual Reality; Learning Achievement; Learning Engagement; Costume History; Undergraduate.*

1. Introduction

In the 21st century, the rapid advancement of information and communication technologies (ICT) has fostered the development of diverse innovations that have been progressively integrated into the education sector, thereby fostering pedagogical innovation and transforming teaching models. However, traditional teaching methods are increasingly inadequate to address the diverse needs of students raised in an information-rich environment. In response, innovative tools such as augmented reality (AR) and virtual reality (VR) have been widely implemented in educational contexts, receiving positive feedback from students (Ibrahim et al., 2021; Lim & Lim, 2020).

Historically, history education has relied predominantly on traditional lecture-based methods, with minimal integration of technological tools, leading to classrooms that frequently lack interactivity and meaningful contextual engagement (Wa Ima et al., 2023). Consequently, students often demonstrate low learning achievement, reduced engagement, and increased cognitive load during the learning process (Perrotta & Bohan, 2013; Warrick, 2021; Baghaei & Riasati, 2013).

Systematic reviews have consistently highlighted the potential of VR to enhance learners' motivation, engagement, and knowledge retention (Radianti et al., 2020). Similarly, meta-analyses on technology-enhanced learning have demonstrated that games, simulations, and virtual worlds were effective in improving learning achievement compared with traditional methods (Merchant et al., 2014). R provides contextual overlays that blend digital information with physical environments, thereby supporting situated learning experiences (Akçayır & Akçayır, 2017). Gamification, on the other hand, employs reward mechanisms and competitive elements to enhance learners' motivation and engagement (Hellín et al.,2023). While these approaches offer important contributions, they often fall short in delivering the deep immersion and experiential learning opportunities afforded by VR.

In contrast, VR technology can create highly immersive and interactive learning environments that simulate a sense of physical presence, thereby deepening learners' content comprehension, fostering positive emotional responses, and significantly enhancing engagement (Zhang et al., 2023; Sun et al., 2022; Parong & Mayer, 2021; Al-Ansi et al., 2023). Building on this foundation, the personalized experiential VR (PE-VR) learning system developed in this study goes further by combining VR's immersive affordances with personalization and experiential learning principles, enabling students not only to engage with content but also to navigate the learning environment according to their individual preferences and needs. This positions the PE-VR system as a distinct contribution beyond existing AR or gamification approaches.

2. Problem Statement

A primary challenge confronting history education is the consistently low level of student engagement. Owing to the abstract and theoretical character of historical studies, teaching practices continue to rely heavily on teacher-centered strategies, characterized by minimal technological integration and outdated assessment practices, which collectively restrict active student participation (Ibrahim et al., 2021; Wa Ima et al., 2023). Such conventional approaches typically require students to read or recite textbook content with minimal contextual adaptation and limited opportunities for meaningful interaction (Inda et al., 2020). Within this traditional framework, instructors function as the central transmitters of information, while learners assume a largely passive role, restricted to listening and note-taking, with limited opportunities to develop creative thinking or pursue deeper inquiry (Ahmad et al., 2014; Wa et al., 2023). When pedagogical strategies fail to relate historical knowledge to students' everyday experiences, instruction often devolves into rote memorization rather than encouraging critical reflection on the broader significance of historical events. As a result, student motivation and active engagement in history lessons continue to be notably low (Perrotta & Bohan, 2013).

A further obstacle confronting students in history classrooms is insufficient interaction with learning materials. Research indicates that when history instruction lacks creative approaches, students' interest in the subject tends to decline sharply (Baghaei & Riasati, 2013). Requiring students to commit to memory lists of notable individuals, dates, and occurrences without appreciating their broader relevance may discourage learning and prove counterproductive. Historical knowledge should not be confined to rote memorization but should instead be interpreted and contextualized for deeper comprehension. Unfortunately, conventional pedagogical methods often remain outdated and ineffective, thereby failing to foster interactive learning environments that develop students' analytical abilities (Ahmad et al., 2014). As such, there is an urgent need to cultivate historical thinking skills, which are vital for enhancing learning achievement and encouraging inquiry-based learning. Scholars in history education consistently emphasize that overcoming these barriers necessitates the adoption of innovative teaching strategies specifically designed to stimulate active participation and critical engagement (Ahmad et al., 2014).

The final challenge is the comparatively low learning academic among undergraduates in Chinese costume history courses. The traditional teaching approach, which primarily relies on the one-way transmission of knowledge, poses considerable barriers to students' active and deep engagement with the material. This passive learning model often leads to disengagement and boredom, which, in turn, undermines students' motivation and overall academic achievement. As a result, many students fail to attain satisfactory learning outcomes in their studies of Chinese costume history (Liu, 2024; Niu, 2016; Chen, 2019; Li, 2024).

These challenges highlight the urgent need to develop an experiential VR learning system to enhance university students' achievement and engagement. Such a system can help students adopt appropriate learning strategies tailored to their individual learning characteristics, thereby increasing learning achievement and engagement. By doing so, it can effectively overcome the limitations of traditional teaching methods and conventional multimedia learning, providing students with an optimized learning experience and improved learning outcomes.

3. Research Objectives

The primary aim of this study is to investigate the extent to which a personalized experiential virtual reality (PE-VR) learning system can enhance university students' learning achievement and engagement within the context of a costume history course. In addition, the study seeks to provide empirical evidence on how the PE-VR system addresses long-standing instructional limitations by offering a more integrative and interactive approach to teaching costume history. To this end, the effectiveness of the PE-VR system is systematically compared with that of a conventional virtual reality (NVR) learning system. Based on these aims, the study pursues the following specific objectives:

1) To examine the effect of the PE-VR system on undergraduates' learning achievement in Chinese costume history.
2) To evaluate the impact of the PE-VR system on undergraduates' learning engagement in Chinese costume history.

4. Research Hypotheses

This study aims to develop a personalized experiential learning system. Since there is currently no similar study available for reference, the null hypothesis assumes that the system does not affect learners. The significance level adopted for this study is 0.05 (α=0.05).

1) H_{O1}: There is no significant difference in learning achievement scores (LA) between undergraduates applying the PE-VR system and those applying the NVR system.
2) H_{O2}: There is no significant difference in learning engagement (LE) between undergraduates applying the PE-VR system and those applying the NVR system.

5. Conceptual Framework

T This quantitative study employed a 2 by 2 quasi-experimental factorial design involving a non-equivalent control group, incorporating pre-test and post-test measures to evaluate the effectiveness of the PE-VR system (see Figure 1, Conceptual Framework). The study comprised two groups: the experimental group, which used the PE-VR system, and the control group, which used the NVR system. Both groups underwent their respective interventions and participated in pre-test and post-test assessments.

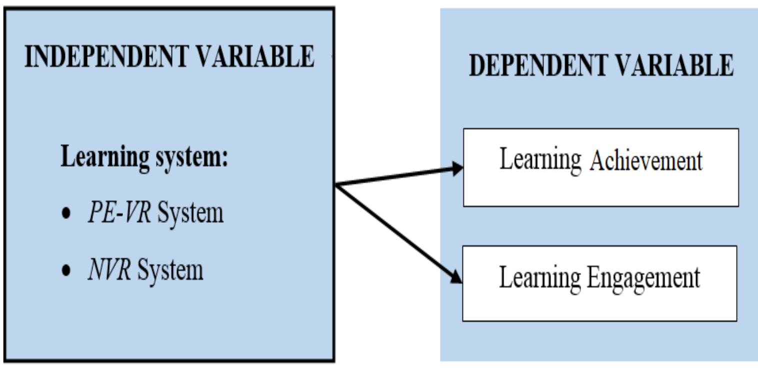

Fig. 1: The Conceptual Framework.

6. Theoretical Framework

Figure 2 shows a theoretical framework that outlines the distribution of the relevant theories and clearly illustrates their interrelationships.

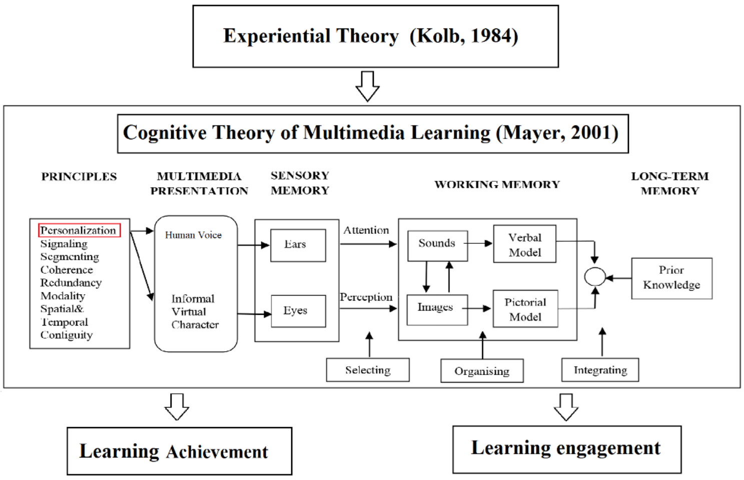

Fig. 2: The Theoretical Framework.

The integrated concept of personalized experiential learning constitutes the central focus of this study and provides essential theoretical guidance for developing the personalized experiential VR learning system. The pedagogical theories supporting this study, namely Kolb's Experiential Learning Theory (1984), Mayer's Cognitive Theory of Multimedia Learning (2001), and Mayer's Personalization Principle (2009), jointly establish a robust foundation for the conceptualization of personalized experiential learning. These theories not only underpin the design rationale of the personalized experiential VR learning system but also enrich and expand its theoretical implications.

7. The Concept of A Virtual Reality Learning System

The PE-VR system is a desktop-based virtual reality platform specifically developed to support student learning. It offers personalized functions and tailored learning experiences that can be accessed directly through a laptop. Figure 3 shows the concept of the PE-VR system. The PE-VR consists of personalized features and experiential interaction functions. The system features a virtual tutor with conversational language and real human voices, realistic 3D ancient Chinese scenes, 3D costume displays, and 3D try-on videos, fully integrated within the PE-VR platform. The virtual tutor, named Lina, facilitates learners' personalized exploration of costume history in an ancient Chinese context, encompassing 3D clothing displays, 3D try-on videos, texts, images, audio, and quizzes.

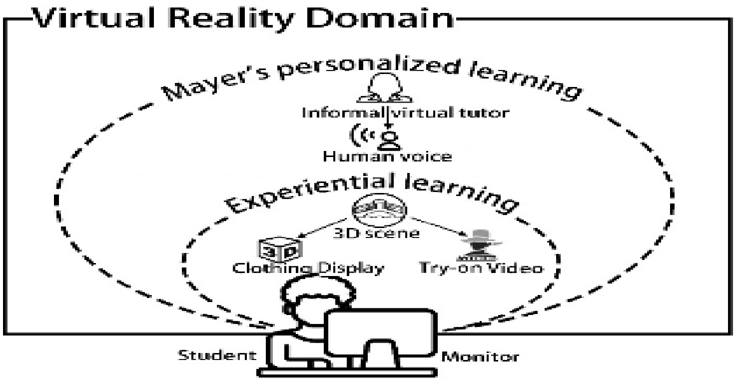

Fig. 3: The Concep of PE-VR System.

Figure 4 presents the interface design of the PE-VR system, which prominently presents learning content from seven different dynasties on its main page. When learners select the button corresponding to the Song Dynasty, they are immediately immersed in a 3D, realistic ancient environment, where they can actively interact with a virtual tutor. Within this virtual setting, the virtual tutor delivers learning content using conversational language combined with a natural human voice, enhancing the sense of presence and engagement (Mayer, 2001; 2009). At the same time, students can examine the design features of historical costumes from multiple angles through the 3D costume display feature, allowing them to transform abstract historical information into concrete, visual experiences. Furthermore, the system provides 3D try-on video demonstrations, which present the costumes from the front, side, and back, offering learners a more comprehensive and multidimensional understanding of the clothing, as shown in Figure 5. These 3D functions were entirely developed based on 3D models and 3D backgrounds, providing learners with a comprehensive and intuitive concrete experience (Kolb, 1984).

Fig. 4: The Main Page Interface of the PE-VR System.

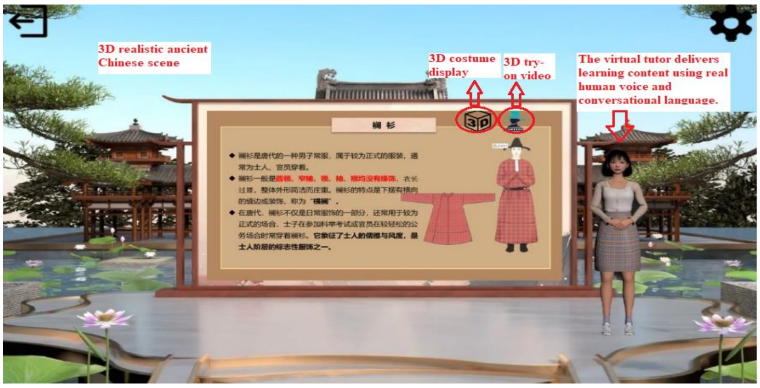

Fig. 5: The Song Dynasty Interface of the PE-VR System.

8. Research Design

This study employed a quasi-experimental research design with a non-equivalent control group and a pre-test, post-test structure to investigate the effectiveness of the interactive PE-VR system, as shown in Figure 6. It explores whether there are significant differences between the PE-VR system and the NVR system for university students, with a primary focus on their effects on learning achievement and learning engagement. The students were 30 first-year undergraduate students from a university in Jiangxi Province, China. They were selected through stratified sampling and randomly assigned to an experimental group (PE-VR system) or a control group (NVR system), with 15 students in each group. Two distinct learning modes served as interventions in this study, with identical learning content and scope for both groups.

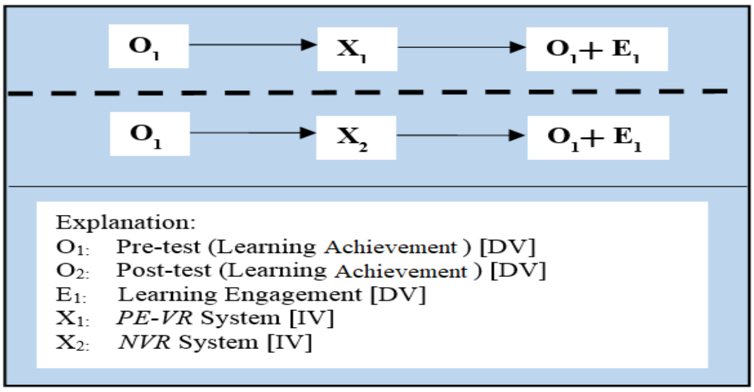

Fig. 6: The Research Design.

8.1. Research procedure

Before conducting the study, we adhered to ethical guidelines for studies involving human participants. All participants provided informed consent, ensuring they understood the purpose and procedures of the study and their right to withdraw at any time. Confidentiality was maintained by anonymizing all collected data and using it solely for study purposes. This experimental study consisted of four main stages: introduction, pre-experiment, intervention during the experiment, and post-experiment. The study lasted seven days.

On the first day, students were briefed on the study protocol and trained to operate the learning systems. Students were informed that they would complete a pre-test and post-test on learning achievement, as well as a learning engagement scale, according to the designated schedule. The pre-test was then administered to assess baseline academic achievement.

From Day 2 to Day 6, the experimental group used the PE-VR system, while the control group used the NVR system to study Chinese costume history. Students could not freely navigate between modules and were required to complete the five modules in sequence. During this period, students could consult instructors at any time for technical or learning issues; the instructors served as guides and facilitators throughout the learning process.

On the final day, after completing all learning activities, all students took the post-test assessing academic achievement and completed the learning engagement scale, thereby concluding the experiment.

8.2. Intervention tools

This study employed the learning engagement questionnaire developed by Reeve and Tseng (2011), which assesses students' engagement with the PE-VR system across four dimensions: agentic, behavioral, cognitive, and emotional engagement. The questionnaire consists of 22 items and has a reported Cronbach's alpha of 0.82, indicating high reliability.

To measure participants' prior knowledge of Chinese costume history, the study used the Basic Knowledge of Chinese Costume History Questionnaire, developed by the Department of Costume History at a technical university in China, as both the pre-test and post-test instrument. This questionnaire consists of 25 items covering fundamental topics in Chinese costume history and has a Cronbach's alpha of 0.75, indicating good reliability.

9. Data Analysis

This study employed SPSS version 27 to analyze the data obtained from the intervention. To test the hypothesis that different learning systems influence undergraduates' learning achievement and engagement, analysis of covariance (ANCOVA) and one-way analysis of variance (ANOVA) were performed. All statistical tests were conducted at a significance level of 0.05 ($p < 0.05$), with pre-test achievement scores (Pre-PS) treated as a covariate.

The sample consisted of 30 students, evenly distributed between the two learning systems. Fifteen students (50%) were assigned to the PE-VR group, and 15 students (50%) were assigned to the NVR group, as shown in Table 1.

Table 1: Descriptive Statistics for Variables

Variable		Frequency (N=30)	Percentage (%)
Learning System	PE-VR	15	50
	NVR	15	50

10. Results

10.1. Testing of hypothesis HO1

H_{O1}: There is no significant difference in learning achievement scores (LA) between undergraduates applying the PE-VR system and those applying the NVR system.

An ANCOVA was conducted in SPSS to examine the effect of different learning systems (PE-VR and NVR) on learning achievement. As shown in Table 2, Levene's test for equality of error variances was non-significant, $F(1, 28) = 3.17$, $p = 0.086$. This suggests that the variability of scores across groups was approximately equal, satisfying the assumption of homogeneity required for subsequent ANCOVA analyses.

Table 2: Levene's Test of Equality of Error Variances[a]

F	df1	df2	Sig.
3.167	1	28	0.086

Tests the null hypothesis that the error variance of the dependent variable is equal across groups.
a. Design: Intercept + Pretest +Group.

As shown in Table 3, a one-way ANCOVA controlling for pretest scores indicated a significant effect of learning system on students' Post-LA, $F(1, 27) = 6.87$, $p = 0.014$. This suggests that the type of learning system significantly influenced students' outcomes. Pretest scores also significantly predicted Post-LA, $F(1, 27) = 15.37$, $p=0.001$, confirming the importance of baseline achievement. The overall model accounted for 47.8% of the variance in Post-LA ($R^2 = 0.478$, Adjusted $R^2 = 0.439$).

Table 3: Tests of Between-Subjects Effects Dependent Variable: Post-LA

Source	Type III Sum of Squares	df	Mean Square	F	Sig.[a]
Corrected Model	6426.993[a]	2	3213.496	12.360	0.000
Intercept	5875.561	1	5875.561	22.599	0.000
Pretest	3996.993	1	3996.993	15.374	0.001
Learning System	1786.360	1	1786.360	6.871	0.014
Error	7019.674	27	259.988		
Total	105300.000	30			
Corrected Total	13446.667	29			

a). R Squared = 0.478 (Adjusted R Squared = 0.439).

As shown in the Estimates and Pairwise Comparisons results (Table 4), after controlling for a Pre-LA of 22.17, the adjusted mean Post-LA for the PE-VR System was 63.094, whereas the adjusted mean for the NVR System was 47.572. This indicates that the mean Post-LA in the PE-VR System was significantly higher than that in the NVR System, with a mean difference of 15.522, which was statistically significant ($p<0.05$).

Table 4: Estimates and Pairwise Comparisons

Estimates Dependent Variable: Post-LA				
Learning System	Mean	Std. Error	95% Confidence Interval	
			Lower Bound	Upper Bound
PE-VR	63.094[a]	4.175	54.527	71.661
NVR	47.572[a]	4.175	39.006	56.139

a. Covariates appearing in the model are evaluated at the following values: Pre-LA=22.17.

Pairwise Comparisons				
Dependent Variable: Post-LA				
(I)Learning System	(J) Learning System	Mean Difference (I-J)	Std. Error	Sig.[b]
PE-VR	NVR	15.522*	5.922	0.014
NVR	PE-VR	-15.522*	5.922	0.014
Based on estimated marginal means				

*. The mean difference is significant at the 0.05 level.
b. Adjustment for multiple comparisons: Least Significant Difference (equivalent to no adjustments).

In conclusion, Pre-LA had a significant effect on Post-LA. After controlling for Pre-LA, there was a significant difference in Post-LA between the learning systems (PE-VR and NVR), with the PE-VR group performing significantly better than the NVR group. Therefore, hypothesis Ho_1 was rejected.

10.2. Testing of hypothesis HO2

H_{O2}: There is no significant difference in learning engagement (LE) between undergraduates applying the PE-VR system and those applying the NVR system.
An ANOVA was conducted in SPSS to examine the effect of different learning systems (PE-VR and NVR) on learning engagement. As shown in Table 5, Levene's test for engagement was non-significant, $F(1, 28) = 0.096$, $p=0.759$, suggesting that the variability of engagement scores was approximately equal across the two groups. Thus, the assumption of homogeneity of variances was satisfied, and the ANOVA could be appropriately conducted.

Table 5: Levene's Test of Equality of Error Variances[a,b]

F	df1	df2	Sig.
0.096	1	28	0.759

Tests the null hypothesis that the error variance of the dependent variable is equal across groups.
a). Dependent variable: Engagement.
b). Design: Intercept + learning system.

The results of a one-way ANOVA demonstrated a significant effect of learning system on students' engagement, $F(1, 28) = 12.67$, $p=0.001$, $p<0.05$, indicating that students in different learning systems exhibited significantly different levels of engagement, as shown in Table 6. The model accounted for approximately 31% of the variance in engagement scores ($R^2 = 0.312$, Adjusted $R^2 = 0.287$).

Table 6: Tests of between-Subjects Effects

Dependent Variable: LE					
Source	Type III Sum of Squares	df	Mean Square	F	Sig.[a]
Corrected Model	2305.633[a]	1	2305.633	12.671	0.001
Intercept	201228.300	1	201228.300	1105.853	0.000
Learning system	2305.633	1	2305.633	12.671	0.001
Error	5095.067	28	181.967		
Total	208629.000	30			
Corrected Total	7400.700	29			

R Squared=0.312 (Adjusted R Squared=0.287).

The results of the pairwise comparisons using the Bonferroni correction are shown in Table 7. It shows that there was a significant difference in learning engagement between the PE-VR and NVR systems (Mean Difference=17.533, $p=0.001$, $p<0.05$). This indicates that undergraduates who used the PE-VR system demonstrated significantly higher learning engagement compared to those in the NVR system.

Table 7: Pairwise Comparisons

Pairwise Comparisons Dependent Variable: LE				
(I)Learning System	(J) Learning System	Mean Difference (I-J)	Std. Error	Sig.[b]
PE-VR	NVR	17.533*	4.926	0.001
NVR	PE-VR	-17.533*	4.926	0.001

Based on estimated marginal means
*. The mean difference is significant at the 0.05 level.
b. Adjustment for multiple comparisons: Least Significant Difference (equivalent to no adjustments).

The Univariate Test Table (Table 8) confirms that the results in the Pairwise Comparisons Table are significant ($p=0.001$, $p<0.05$).

Table 8: Univariate Tests

	Sum of Squares	df	Mean Square	F	Sig.
Contrast	2305.633	1	2305.633	12.671	0.001
Error	5095.067	28	181.967		

In summary, there was a significant difference in learning engagement between the two learning systems (PE-VR and NVR), with the PE-VR group demonstrating significantly higher engagement than the NVR group. Therefore, Hypothesis H_{O2} was rejected.

11. Conclusion and Discussion

This study evaluated the effectiveness of a personalized experiential virtual reality (PE-VR) system compared with a normal virtual reality (NVR) system in the context of higher education. By examining students' learning achievement and engagement, the research provides evidence that personalization and experiential features can substantially enhance the quality of learning. The results highlight not only the pedagogical advantages of integrating personalization principles into VR environments but also the potential challenges and areas for further exploration. The following discussion is organized into three parts: first, a summary of study findings; second, the limitations and future directions; and third, the significance of the study.

11.1. Summary of study findings

The results of the ANCOVA indicated that, after controlling for the effect of Pre-LA, the PE-VR system significantly outperformed the NVR system in enhancing learning achievement. Specifically, the mean Post-LA for the PE-VR group was 64.33, which was substantially higher than that of the NVR group (M=46.33). This difference can be attributed to the personalized and experiential learning features integrated into the PE-VR system, which effectively support learners in improving their achievement. Consistent with the findings on learning achievement, the ANOVA results further demonstrated that the PE-VR system also led to significantly higher levels of learning engagement than the NVR system. The mean engagement score for the PE-VR group was 90.67, compared to 73.13 for the NVR group. This difference can be explained by the personalized and experiential elements embedded in the PE-VR environment, which actively stimulate undergraduates' engagement. Taken together, these results highlight that the personalized and experiential features of the PE-VR system not only enhance students' achievement but also promote greater engagement throughout the learning process.

11.2. Limitations and future directions

Despite the encouraging findings, this study inevitably has several limitations that warrant careful consideration. First and foremost, the relatively small sample size (N = 30) constrains the extent to which the results can be generalized. While the study provides preliminary evidence supporting the effectiveness of the PE-VR system, the limited number of participants not only reduces statistical power but also heightens the possibility of sampling bias. In addition, the participants were recruited exclusively from a single cohort of undergraduate students, which further narrows the representativeness of the sample. Such homogeneity restricts the applicability of the findings to diverse educational contexts or student groups with different academic backgrounds, cultural experiences, or learning preferences.

To enhance the generalizability of future research, it is imperative to employ larger and more diverse samples. Broadening participant recruitment to include students from different academic disciplines, institutions, and cultural contexts would not only strengthen external validity but also generate more comprehensive insights into the effectiveness of immersive learning systems such as the PE-VR. Moreover, future investigations should examine potential subgroup differences, for instance, gender, prior technological experience, or individual learning preferences, in order to better understand moderating effects that may shape the outcomes of personalized experiential learning. Such analyses would provide a more nuanced perspective on how different learner characteristics influence engagement and achievement in VR-based environments.

Beyond these methodological refinements, future research could extend the application of the PE-VR system to other subject domains, such as art history or science education, to explore its adaptability and pedagogical versatility. Another promising direction lies in examining the scalability of the system within diverse educational contexts, including museums, cultural heritage sites, and online platforms, where immersive and personalized experiences can enrich informal and lifelong learning. Such inquiries would not only broaden the system's relevance but also provide critical insights into its potential for widespread integration into formal and informal learning ecosystems.

11.3. Significance of the study

This study underscores the pedagogical significance of implementing a personalized experiential virtual reality (PE-VR) system, demonstrating its clear advantage over a normal virtual reality (NVR) system in enhancing students' learning achievement and engagement. By integrating adaptive personalization with immersive experiences, the PE-VR system allows instructional content and learning pace to be dynamically adjusted according to learners' needs and progress, thereby fostering deeper understanding, supporting active knowledge construction, and sustaining motivation. In contrast, the NVR system, which relies on a uniform delivery model, lacks the flexibility and interactivity required to meet diverse learner needs, ultimately restricting opportunities for meaningful learning. The contribution of this study lies in providing empirical evidence for the educational benefits of personalized and experiential VR technologies, thereby advancing both the field of educational technology and instructional design. Moreover, the findings offer practical implications for educators and institutions seeking to modernize curriculum delivery through emerging technologies, highlighting that systems emphasizing personalization and experiential engagement can enhance motivation, reduce cognitive barriers, and promote sustained learning engagement, ultimately leading to improved academic outcomes.

References

[1] Ahmad, A. R., Seman, A. A., Awang, M. M., & Sulaiman, F. (2014). Application of multiple intelligence theory to increase student motivation in learning history. *Asian Culture and History*, *7*(1). https://doi.org/10.5539/ach.v7n1p210.

[2] Akçayır, M., & Akçayır, G. (2017). Advantages and challenges associated with augmented reality for education: A systematic review of the literature. Educational Research Review, 20(1), 1–11. https://doi.org/10.1016/j.edurev.2016.11.002.

[3] Al-Ansi, A. M., Jaboob, M., Garad, A., & Al-Ansi, A. (2023). Analyzing Augmented Reality (AR) and Virtual Reality (VR) recent development in education. *Social Sciences & Humanities Open*, *8*(1), 100532. https://doi.org/10.1016/j.ssaho.2023.100532.

[4] Baghaei, S., & Riasati, M. (2013). An investigation into the relationship between teachers' creativity and students' academic achievement: A case study of Iran EFL context. *Middle-East Journal of Scientific Research*, *14*(12), 1576-1580.

[5] Chen, H. (2019). Reform of the teaching model of the "History of Chinese and Foreign Clothing" course in higher vocational colleges under the background of the cultural and creative industry. *Educational Modernization*, *(92)*, 134–135.

[6] Hellín, C. J., Calles-Esteban, F., Valledor, A., Gómez, J., Otón-Tortosa, S., & Tayebi, A. (2023). Enhancing student motivation and engagement through a gamified learning environment. *sustainability*, 15(19), 14119. https://doi.org/10.3390/su151914119.

[7] Ibrahim, A., Al-Rababah, A. I., & Bani Baker, Q. (2021). Integrating virtual reality technology into architecture education: The case of architectural history courses. *Open House International*, *46*(4), 498-509. https://doi.org/10.1108/OHI-12-2020-0190.

[8] Inda, S., Sarkadi, S., & Nurzengky, I. (2020). The effect of CTL learning model and learning style on the historical learning outcomes. *Harmoni Sosial: Jurnal Pendidikan IPS*, *7*(1). https://doi.org/10.21831/hsjpi.v7i1.29734.

[9] Kolb, D. A. (1984). *Experiential learning: Experience as the source of learning and development*. New Jersey: Prentice-Hall. ISBN: 9780132952613.

[10] Li, X. (2024). Research on the teaching reform of the "History of Chinese and Foreign Clothing" course in applied universities. *Western Leather*, *(16)*, 84–86.

[11] Lim, K. Y. T., & Lim, R. (2020). Semiotics, memory and augmented reality: History education with learner generated augmentation. *British Journal of Educational Technology*, *51*(3), 673-691. https://doi.org/10.1111/bjet.12904.

[12] Liu, T. (2024). Reform and practical innovation of the teaching model of the "History of Chinese and Foreign Clothing" course. *Mass Art and Literature*, *(7)*, 162–164.
[13] Mayer, R. E. (2001). *Multimedia learning. Psychology of learning and motivation, 41*, 85-139. ISBN: 9780125433419. https://doi.org/10.1016/S0079-7421(02)80005-6.
[14] Mayer, R. E. (2009). *Multimedia learning* (2nd ed.). Cambridge: Cambridge University Press. 108-117. Cambridge University Press.
[15] Merchant, Z., Goetz, E. T., Cifuentes, L., Keeney-Kennicutt, W., & Davis, T. J. (2014). Effectiveness of virtual reality-based instruction on students' learning outcomes in K-12 and higher education: A meta-analysis. *Computers & Education*, *70*(70), 29–40. https://doi.org/10.1016/j.compedu.2013.07.033.
[16] Niu, L. (2016). Teaching reform and discussion of "History of Chinese and Foreign Clothing" in higher education institutions: A case study of the Ming Dynasty adult ceremony situational teaching. *Journal of Zhejiang Textile and Garment Vocational and Technical College*, *(3)*, 38–40.
[17] Parong, J., & Mayer, R. E. (2021). Learning about history in immersive virtual reality: Does immersion facilitate learning? *Educational Technology Research and Development, 69*, 1433-1451. https://doi.org/10.1007/s11423-021-09999-y.
[18] Perrotta, K., & Bohan, C. (2013). "I hate history": A study of student engagement in community college undergraduate history courses. *Middle-Secondary Education and Instructional Technology Faculty Publications*. https:// scholarworks.gsu.edu/msit_facpub/21/.
[19] Radianti, J., Majchrzak, T. A., Fromm, J., & Wohlgenannt, I. (2020). A systematic review of immersive virtual reality applications for higher education: Design elements, lessons learned, and research agenda. *Computers & Education*, *147*(0360-1315), 103778. Sciencedirect. https://doi.org/10.1016/j.compedu.2019.103778.
[20] Reeve, J., & Tseng, C.-M. (2011). Agency as a fourth aspect of students' engagement during learning activities. *Contemporary Educational Psychology*, *36*(4), 257-267. https://doi.org/10.1016/j.cedpsych.2011.05.002.
[21] Sun, J. C.-Y., Ye, S.-L., Yu, S.-J., & Chiu, T. K. F. (2022). Effects of wearable hybrid AR/VR learning material on high school students' situational interest, engagement, and learning achievement: The case of a physics laboratory learning environment. *Journal of Science Education and Technology*, *32*(1), 1-12. https://doi.org/10.1007/s10956-022-10001-4.
[22] Wa, I., Pattiasina, J., & Sopacua, J. (2023). Model to increase motivation and learning outcomes in learning history. *Journal of Education and Learning*, *17*(2), 206–214. https://doi.org/10.11591/edulearn.v17i2.20703.
[23] Warrick, A. (2021). Strategies for reducing cognitive overload in the online language learning classroom. *International Journal of Second and Foreign Language Education*, *1*(2), 25-37. https://doi.org/10.33422/ijsfle.v1i2.124.
[24] Zhang, Y., Ahmed, A., Liang, H. N., & Baghaei, N. (2023). Exploring the transformative potential of virtual reality in history education: A scoping review. In H. Xie, C. L. Lai, W. Chen, G. Xu, & E. Popescu (Eds.), *Advances in web-based learning – ICWL 2023. ICWL 2023. Lecture Notes in Computer Science* (Vol. 14409, pp. 130–143). Springer, Singapore.