

# **The Learning Management Using the Virtual Reality Technology to Improve Learning Achievement for Secondary 5 (Grade 11) Students**

**Heng Tao,**

**Rossarin Jermtaisong and Puripun Lert-o-pas**

Rajamangala University of Technology Thanyaburi, Thailand

Corresponding Author, E-mail: rossarin\_j@rmutt.ac.th

\*\*\*\*\*

## **Abstracts**

VR technology was a new and innovative approach to constructing virtual reality spaces that had become a crucial tool in the field of education. It created fresh and captivating learning environments for students, offering increased interactivity and immersion, which stimulated the imagination and promoted improved learning outcomes. The continuous development of VR technology brought forth new opportunities and challenges to the art education industry. The objectives of this research were to: 1) compare the learning achievement of Secondary 5 (Grade 11) students before and after the learning management using the traditional approach, 2) compare the learning achievement of students before and after the learning management using the Virtual Reality (VR) technology, and 3) compare the academic performance of students studying through the traditional approach and those studying through the VR technology. The research sample consisted of two classes 2 classes of 30 students in each class of Secondary 5 (Grade 11) students at the second middle school of Sichuan Province, China, in the 2022 academic year, selected by cluster random sampling. The research instruments consisted of: 1) the learning management plans based on the traditional approach, 2) the learning management plans based on VR technology, and 3) a learning achievement test. Mean, standard deviations, and t-test were used for data analysis. The research results showed that: 1) the learning achievement of students after learning management based on the traditional approach was higher than before at the statistical significance level of .05., 2) the learning achievement of students after learning management based on the VR technology was higher than the before at the statistical significance level of .05., and 3) the learning achievement of students studying through the VR technology was higher than those studying through the traditional approach at the statistical significance level of .05.

**Keywords:** The Learning Management; The Virtual Reality Technology; Learning Achievement

## **Introduction**

In recent years, with the rapid development of science and technology, more and more modern science and technology have been applied to education and promoted education's modernization, informatization, and intellectual development (Gu Xiaoqing, 2016 : 5-13). In this context, to maximize the value of various advanced technologies, multiple technologies should be flexibly applied according to the characteristics of different disciplines (Huang Ronghuai, 2016 : 37-42). As a new technology, Virtual Reality technology (VR) can be constructed by computer software and hardware equipment for a virtual reality space (Steuer, 1992 : 73-93). It successfully simulates actual and made-up scenes with the help of

contemporary information technology, such as network technology and cloud computing technology (Cao fan, 2019 : 36-37). Users can conduct human-computer interaction with simulated scenes in this virtual reality space (Zhong Huan, 2020 : 6-7). This feature promotes VR technology as new technical support in the field of education to create different learning environments for learners, enhance learning interest and interaction, and ensure learning effectiveness (Gao Erdong, 2016 : 113-115). Compared with other disciplines, the art discipline has relatively high requirements for students' aesthetic ability (Xie Zisheng, 2020 : 130-131).

Teachers will need to provide an aesthetic environment by using verbal description and guidance, picture display and viewing, multimedia scene creation, and other methods in order to effectively grow students' aesthetic ability (Li Can, 2018 : 74-77), to accomplish the purpose of aesthetic ability training while subtly influencing students' aesthetic traits through a nice atmosphere (Li Hui, 2021 : 92-93). The use of virtual reality (VR) technology in art instruction will alter the way that traditional teaching situations are created, allowing students to have a more "personal experience" (Chen Xiaolang, 2022 : 171-180). so as to enhance students' acceptance of art teaching information, cultivate students' aesthetic ability, creative ability and imagination ability, comprehensively improve the effect of the art teaching and achieve the goal of the art teaching. With the continuous maturity of VR technology, its technical advantages in the field of art teaching are becoming more and more prominent (Huang Qing, 2020 : 8-9). Compared with the traditional approach, VR technology cannot only create a teaching environment more in line with the needs of the art teaching and create a good teaching atmosphere through virtual reality space (Pan Yi, 2020 : 8-10). but also cultivate students' art aesthetic ability, creative ability, and imagination ability through rich teaching contents. This will lead to the achievement of the basic goal of the art teaching and cultivating students' comprehensive quality and ability and constructing a good foundation for students' future learning and development (Pei Xiaoyang, 2017 : 2-3).

From a theoretical point of view, most of the application achievements of the existing VR technology in the field of education focus on the "main subjects" such as Chinese and Physics, while there are relatively few studies on the subject fields such as art and music that can cultivate sentiment and cultivate students' innovative ability and aesthetic ability (Li Xiaoping, 2018 : 97-105), and relevant studies are limited to art appreciation. In addition, the research on the combination of the traditional approach and VR technology in art teaching is slightly insufficient (Li Binbin, 2018 : 105-110). Therefore, if the research focuses on art teaching and combines a traditional approach with VR technology to effectively improve the traditional approach, the existing research results can be supplemented and significantly improve (Kim, et al., 2021 : 4139-4140).

From a practical point of view, VR technology can improve more comprehensive and reasonable teaching resources for art teaching. The combination of relevant teaching resources and the traditional approach cannot only expand the teaching content in the traditional approach (Lan Yueyun, 2021 : 144-147), but also change the boring teaching status of the traditional approach, enhance the interest in art teaching, stimulate students' interest in art learning, transform students' passive learning into active learning, improve the effect of the art teaching and achieve the basic goal of art teaching (Sun Peng, 2017 : 61-65). At the same time, VR technology can also cultivate students' art aesthetic ability, creative ability, and imagination, cultivating students' comprehensive quality in many aspects including constructing a good foundation for students' future learning and development (Song Gang, 2018 : 69-72).

In addition, VR technology can also allow students to master personal experience in drawing, and paintings, visit "inaccessible places" in past teaching, solve problems such as teaching abstract content in traditional art teaching (Zhang Dan, 2020 : 133-134), enhance the interaction between students and course materials, deepen students' understanding of Art learning, and finally improve students' art performance (Li Tian, 2017 : 66-74). There are relatively more research results on Virtual Reality (VR) technology in subject teaching at home and abroad, but most of the research results are concentrated in the field of knowledge subjects, while there are relatively few research results in the field of Art (Zhang Zhendong, 2018 : 3-4). In fact, the combination of Virtual Reality (VR) technology and the traditional approach can effectively expand the traditional contents and solve the abstract problem of traditional art teaching (Zhang Zhendong, 2018 : 3-4), which is more conducive to enhance students' understanding and in-depth understanding of art, strengthen students' learning effectiveness, improve students' academic performance, and cultivate students' comprehensive quality (Ming Jiang, 2021 : 93-99). Therefore, studying the application of Virtual Reality (VR) technology and traditional approach in middle school art teaching will bring about a certain research value (Gao Erdong, 2016 : 113-115).

This study aimed to improve the learning achievement of students at secondary school with Virtual Reality (VR) technology learning management which can effectively expand Virtual Reality (VR) technology and improve the students' learning achievement.

## Research Objectives

1. To compare the pre-and post-learning achievement of students studying through the traditional approach.
2. To compare the pre-and post-learning achievement of students studying through VR technology.
3. To compare the academic performance of students studying through the traditional approach and those with VR technology.

## Research Methodology

This research is experimental research of two groups: the experimental group using VR technology and the control group using the traditional approach. The details of the research methodology are as follows:

**1. Population and Sample:** The population of this study was 150 Secondary 5 (Grade 11) students at the second middle school in Sichuan Province, China, in the 2022 academic year. The research sample was 60, selected by cluster random sampling, divided into 2 classes with 30 students in each class.

### 2. Variables:

- 1) Independent Variable in this research is the learning management based on the traditional approach and the VR technology
- 2) Dependent Variable in this research is the learning achievement on Color Landscape Painting in the Color Landscape course.

**3. Research Instrument:** The research instruments were as follows:

- 1) The traditional approach learning management plan. The plan consists of 3 steps: 1) the introduction, 2) teaching, and 3) the conclusion stage. The course is Color Landscape Painting (20 hours), which includes the following components: 1) Composition (5 hours), 2)

Treatment of reality and fiction (5 hours); 3) Comparison and application of complementary colors (5 hours), 4) Painting methods (5 hours). The IOC (Index of Item Objective Congruence) learning management plan based on the traditional approach was equal to 1.00.

2) The learning management plan based on the VR technology, the process consists of 5 steps: 1) introduction of VR technology, 2) VR technology for teaching, 3) analysis and practice of VR technology application, 4) conclusion of using VR technology in teaching, and 5) VR technology assessment. The lesson entitles Color Landscape Painting (20 hours), which includes the following components: 1) Composition (5 hours), 2) Treatment of reality and fiction (5 hours); 3) Comparison and application of complementary colors (5 hours), 4) Painting methods (5 hours). The VR technology showed the IOC (Index of Item Objective Congruence) at 1.00.

3) An achievement test was used to assess learning achievement on Color Landscape Painting in the Color Landscape course. The test contained 25 multiple-choice questions and each of them has 4 options for the pre-test and post-tests in the experimental group and control group. The test showed the IOC (Index of Item Objective Congruence) at 1.00, the difficulty between 0.40 - 0.80, discrimination between 0.50 - 0.80, and the reliability of Cronbach's alpha coefficient was 0.985.

**4. Data Collection:** This process was done as follows:

1) Preparation Steps: Contact to obtain the official documents of the second middle school in Sichuan Province, China. The person in charge of the educational institution was required to assist and cooperate, and the researcher had to be permitted to collect data from the sample group. The experimental group and control group consisted of two classrooms randomly selected from the students of the second middle school of Sichuan Province in 2022, the cluster random sampling was introduced. Explain the process of learning management for the experimental group and control group. The students understand their roles and responsibilities in learning.

2) Experimental Steps: Before the learning management, the pre-test for the control group and experimental group were used to assess learning achievement in the Art subjects on Color Landscape Painting. Collect data from the two groups: the experimental group using the traditional approach and the control group using the VR technology. After the learning management, the post-test was used to assess learning achievement.

3) Summary Steps: Analyze the scores through basic statistics and statistics mentioned in hypothesis testing.

**5. Data analysis**

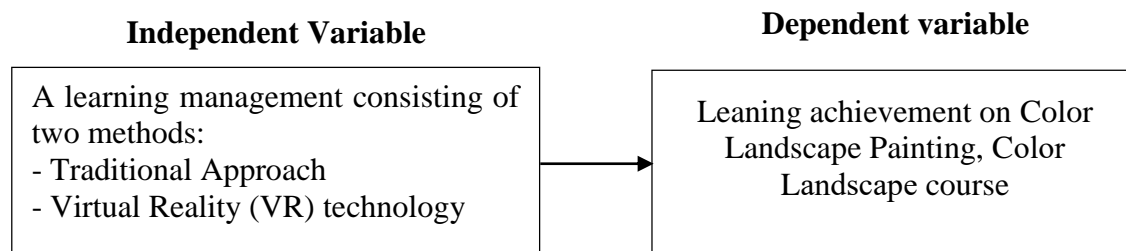
1) To compare the pre-and post-learning achievement of students studying through the traditional approach, the dependent samples t-test was implemented and analyzed.

2) To compare the pre-and post-learning achievement of students studying through the VR technology, the dependent samples t-test was implemented and analyzed.

3) To compare the learning achievement of students studying through the traditional approach and those studying through VR technology, the independent samples t-test was implemented and analyzed.

## Research Conceptual Framework

Virtual Reality (VR) and Virtual Environments (VE) were two commonly used terms in the computer community to describe computer-generated simulated environments. However, there were other terms that referred to the same concept, such as Synthetic Experience, Virtual Worlds, Artificial Worlds, and Artificial Reality (Pantelidis, 1993 : 23-24). VR technology was a new and innovative way of building virtual reality spaces using computer software and hardware equipment. With the help of modern information technologies like network and cloud computing, VR technology could effectively simulate real and non-real scenes, allowing users to interact with the simulated environment. VR comprised a specific set of technologies, such as headsets, gloves, and walkers (Jane, 2022 : 46-54). VR was a computer-based technology that simulated the visual, auditory, and other sensory aspects of complex environments (Vorderer & Klimmt, 2004 : 388-408). The process of learning management using Virtual Reality (VR) technology in this study consisted of five steps: 1) introduction of VR technology, 2) VR technology for teaching, 3) analysis and practice of VR technology application, 4) conclusion of using VR technology in teaching, and 5) VR technology assessment.



**Figure 1** Research Conceptual Framework

## Research results

**1. The data analysis comparison of pre-and-post-learning achievement of students studying through the traditional approach.**

**Table 1** The data analysis comparison of pre-and-post-learning achievement of students studying through the traditional approach.

Learning management through the traditional approach	n	$\bar{x}$	s	t	df	Sig.
Before	30	10.20	1.532	10.251*	29	0.000
After	30	11.73	1.701			

Table 1 shows that the after mean score of students was higher than the before statistical significance at the .05 level ( $\bar{x}=11.73$ ,  $S=1.701$  and  $\bar{x}=10.20$ ,  $S=1.532$ ). This showed that the traditional approach was effective in improving students' learning achievement.

## 2. The data analysis comparison of pre-and-post-learning achievement of students studying through VR technology.

**Table 2** The data analysis comparison of pre-and-post-learning achievement of students studying through VR technology.

Learning management through the VR technology	n	$\bar{x}$	s	t	df	Sig.
Before	30	10.30	2.120	7.100*	29	0.000
After	30	13.83	2.102			

Table 2 shows that the after mean score of students was higher than the before statistical significance at the .05 level ( $\bar{x}=13.83$ ,  $S=2.102$  and  $\bar{x}=10.30$ ,  $S=2.120$ ). This showed that the VR technology was effective in improving students' learning achievement.

## 3. The data analysis comparison of students studying through the traditional approach and those studying through VR technology.

**Table 3** The data analysis comparison of students studying through the traditional approach and those studying through VR technology.

Learning Management	n	$\bar{x}$	s	t	df	Sig. (2-tailed)
Learning management using the traditional approach	30	11.73	1.701	-4.254*	58	0.000
Learning management using the VR technology	30	13.83	2.102			

According to Table 3, It is obviously seen that learning management through VR technology showed a higher mean than the traditional approach ( $\bar{x}=13.83$ ,  $S=2.102$  and  $\bar{x}=11.73$ ,  $S=1.701$ ) statistical significance at the .05 level. This can be stated that VR technology played a significant role in learning management and resulted in the students' achievement undoubtedly.

## Discussion

1. The data analysis comparison of pre-and-post-learning achievement of students studying through the traditional approach, it was found that the after mean score of students was higher than the before statistical significance at the .05 level. This may result from the traditional approach designed to implement pedagogical strategies that achieve learning outcomes. Zuo Xiaoru (2004 : 24-28) mentioned in "Practice and Exploration of Reforming Traditional Teaching Modes and Developing Comprehensive Art Activities" that their scores have also improved after implementing the traditional approach. Similarly, Shi Anhong (2012 : 34-35) explained in "Research on the Transformation of Traditional Teaching Models and New Curriculum Teaching in

High School Fine Arts" that the teaching concepts existed in the past, and they were outdated and finally separated from social needs. The teaching methodology is single and students' participation is low, which leads to narrow and shallow teaching objectives, ignoring students' personalities and other issues. Thus, the author explores how art teachers can use modern teaching methods to transform traditional approaches into a series of new curriculum teaching methodologies, content, and goals. Overall, middle school art education aims to cultivate and develop the overall quality of students, pay attention to developing their aesthetic perception ability, imagination, and performance, and promote the development of students' personalities and overall growth. The traditional approach has a crucial impact in this regard, as it can lead to improved learning outcomes, as shown in the results of this study. Based on the results, it is recommended that traditional approaches continue to be used and implemented in middle school art education. Additionally, art teachers can experiment with and apply contemporary teaching techniques to reshape conventional ways into a variety of fresh curriculum methodologies, objectives, and objectives. They can better cultivate and develop students' general qualities, encourage their artistic prowess, and support their overall development by doing this.

2. Data analysis results comparing the learning achievement of students before and after learning management using VR technology revealed that the learning achievement of students after using VR technology was higher than before, with a statistically significant difference at the level of .05. This may result from VR technology uses computer software and hardware equipment to build a virtual reality space with the support of modern information technology such as network technology and cloud computing technology to effectively simulate real and non-real scenes Cao fan (2019 : 36-37) Users can interact with simulated scenes in this virtual reality space, promoting VR technology as new technical support in the field of education, creating different learning environments for learners, enhancing learning interest and interaction, and ensuring learning effectiveness Gao Erdong (2016 : 113-115) VR technology may improve students' overall ability in many areas and establish a solid foundation for their future learning and development. It can also cultivate students' artistic aesthetic ability, creative ability, and imaginative capacity Song Gang (2018 : 69-72). These findings are consistent with the research results of Zhang Yan (2022 : 87-95) on virtual reality teaching, which focused on virtual reality teaching theories and case application evaluation systems. Yan found that students' academic performance after using scientific VR technology methods to learn management is higher than before learning. Also, Gu Yaqi and Wang Lirui (2022 : 109-113) have an effective theoretical framework for user-centered virtual technology research, discovering the possibility of providing students with a virtual technology environment, and the advantage of using VR technology to optimize their performance.

3. Data analysis results comparing the learning achievement of students with learning management using the traditional approach and using VR technology showed that the mean score of students after studying with VR technology was higher than those using the traditional approach, with a statistically significant difference at the level of .05. This may result from VR technology can improve comprehensive and reasonable teaching resources for art teaching, expanding teaching content in the traditional approach and changing the boring teaching status of the traditional approach, enhancing the interest of art teaching, stimulating students' interest in art learning, and transforming students' passive learning into active learning, improving the effectiveness of the art teaching and achieving the basic goal of art teaching Sun Peng (2017 : 61-65). In order to achieve the goal of art teaching, VR technology will transform the traditional teaching situation creation mode and create a virtual environment for students to achieve a "personal experience." This will increase students' acceptance of art teaching information and



cultivate their aesthetic, creative, and imaginative abilities. As VR technology continues to develop, its technological advantages in the area of art instruction are becoming more and more obvious Huang Qing (2020 : 8-9). In comparison to the traditional teaching method, VR technology can not only create a learning environment that is better suited to the needs of art instruction and foster a positive learning environment through virtual reality space Pan Yi (2020 : 8–10), but it can also develop students' artistic aesthetic ability, creative ability, and imaginative ability through rich teaching contents, achieving the fundamental goal of art instruction and developing students' all-round quality and ability Pei Xiao Yang (2017 : 2-3). These findings are consistent with the research results of Pantelidis (1993 : 23-24).

## Suggestions

### 1. Suggestions for applying the research results

1) It is recommended to set the correct virtual boundaries of the device in advance before conducting learning management using VR technology. Both HTC Vive and Oculus Rift headsets have virtual boundary systems that allow teachers to set them themselves, so teaching can be conducted in a relatively safe space and avoid harming students or surrounding objects. However, a common problem that new teachers are prone to commit is setting virtual boundaries too close to objects in the real environment, which is incorrect.

2) It is recommended that teachers control the number of frames accurately when making animated courseware for students to use, and let the student's inner ear tell him that he is sitting still when his eyes perceive that his simulated brush is flying in the air. After prolonged VR technology experience, this sense of detachment often leads to nausea or dizziness.

3) It is recommended that each student uses the VR technology course experience for up to 15 minutes each time. It is also recommended that teachers set up more than two versions of virtual scenes for different learning scenarios before class to provide to students.

### 2. Suggestions for future research

For further research, the topic should focus on: 1) Learning management using VR technology to improve other skills or competencies, and 2) Learning management using VR technology in combination with teaching techniques to improve the learning achievements and skills of students.

## References

- Cao, f. (2019). *Overview of research and development status of VR technology at home and abroad*. China Science and technology information. (05), 36-37.
- Chen, X. L., & Liu, G., & Li, S. (2022). Reform of educational aesthetics practice based on virtual reality technology -- establishment of new situational teaching model. *Journal of Southwest University, Social Science Edition*. 48 (1), 171-180.
- Gao, E. D. (2016). *Virtual reality technology brings changes to visual art*. Art research, (3), 113-115.
- Gu, X. Q. & Wang, C. L. & Wang, F. (2016). *Has the role of information technology changed: Research on the influence of educational informatization*. Research on audio visual education. 37 (10), 5-13.
- Gu, Y., & Wang, L. (2022). *Practice and Thinking of Virtual Reality Art from the Perspective of Availability*. Art Research. (02), 109-113.



- Huang, Q. (2020). *Research on the application of virtual reality technology in cultural communication activities -- Comment on the application of vr virtual technology in culture and art teaching activities*. Chinese scientific papers. 15(10), 8-9.
- Huang, R. H., & Zhang, J. B., & Jing, Q. X. et al., (2016). *Global education informatization development strategy facing the 2030 education development agenda -- an interpretation of the action framework for education objectives of the Qing dao declaration*. Research on open education. (1), 37-42.
- Jane, S., (2022). Virtual reality technology: A review of its applications in different fields. *Journal: Advanced Technology and Research*. 8 (11), 46-54.
- Kim, H. J., & Kim, J. H., & Lee, Y. J. (2021). *Effects of VR art museum education on students' creativity and art appreciation*. Sustainability. 13 (7), 4139-4140.
- Lan, Y. Y., & Liang, S. (2021). *VR education and its reform*. Zhejiang Social Sciences. (5), 144-147.
- Li, C., & Ma, L. (2018). A Study on the Construction of Artistic Environment in Primary School Art Education. *Journal of Hubei Open Vocational College*. 27 (3), 74-77.
- Li, T., & Geng, X. P. (2017). *VR perception of the art world*. New art. 38 (10), 66-74.
- Li, H. (2021). *Strategies for cultivating students' aesthetic ability in Art Teaching*. Research on primary school teaching. (19), 92-93.
- Pantelidis, V. S. (1993). *Virtual reality in the classroom*. Educational Technology. 32 (4), 23-24.
- Pan, Y. (2020). *Research on the application of VR digital virtual simulation teaching in architectural space design -- Comment on the application of VR virtual technology in culture and art teaching activities*. Exploration of higher education. (9), 8-10.
- Pei, X. Y. (2017). *Demand and application of virtual reality technology in modern environmental art design*. Automation and instrumentation. (6), 2-3.
- Steuer, J. (1992). Defining Virtual Reality: Dimensions Determining Telepresence. *Journal of Communication*. 42 (4), 73-93.
- Shi, A. H. (2012). *Research on the Transformation of Traditional Teaching Mode and New Curriculum Teaching of High School Fine Arts*. Advanced Academic Forum. (17), 34-35.
- Sun, P. (2017). *Artists should actively negotiate with virtual reality technology that can emphasize consciousness. Theoretical reflection on the application of virtual reality [VR] in Chinese contemporary art*. New art. 38 (10), 61-65.
- Song, G. (2018). *New forms of Contemporary Art - on the sociological basis of VR, AR and Mr art*. Art research. (1), 69-72.
- Ming, J., & Liu, Y. B., & Wu, N. Z. (2021). *Distributed teaching based on VR: theoretical model and implementation strategy*. Research on audio visual education. 42 (1), 93-99.
- Vorderer, P., & Klimmt, C., & Ritterfeld, U. (2004). *Enjoyment: At the heart of media entertainment*. Communication Theory. 14 (4), 388-408.
- Xie, Z. S. (2020). Thanks for the gift, Discussion on Teaching Strategies of art appreciation in Senior High School under the background of core literacy. *Chinese Journal of education*. (S01), 130-131.
- Zhang, D. (2020). *Application of virtual reality technology (VR) in education and Teaching*. China audio visual education. (3), 133-134.

- Zhong, H., & Ma, X. F. (2020). *Educational virtual community: a new position of discipline service in colleges and universities from the perspective of wisdom*. Library science research. (14), 6-7.
- Zhang, Y., & Li, D. C., & Gong, Y. Y. (2022). Research on the construction of virtual reality teaching quality evaluation index system. *Journal of Hebei University of Economics and Trade (Comprehensive Edition)*. 22 (02), 87-95.
- Zhang, Z. D. (2018). *Research on the application of virtual reality technology in art education in the digital context*. Sichuan drama. (12), 3-4.
- Zuo, X. R. (2004). *Reformed the traditional teaching mode and conducted practical and exploratory comprehensive art activities*. Advanced Academic Forum. (15), 24-28.