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The Research on using Virtual Reality Technology to Improve the grades of Environmental Design Students

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Abstract

Background and Aim: This study takes the application of virtual reality technology in the teaching of environmental design as the object of research and is expected to achieve the following research objective: This study aims to evaluate the impact of virtual reality technology on students' creativity, logic, expression, and grades in environmental design course.

Materials and Methods: This paper investigates the application of virtual reality technology in environmental design teaching using literature methods, experimental methods, and mathematical statistics. This study used a control group for comparison. Two groups of 37 third-year environmental design students at Sichuan University of Media and Communications in China were assigned to either an experimental group utilizing virtual reality technology or a control group employing traditional teaching methods. After 8 weeks of experimental study, we completed the experimental procedure. The experimental data was also analyzed and interpreted in depth using Jamovi 2.4.8. The collected information was mainly analyzed using descriptive statistics and t-tests. The following conclusions were drawn through the statistics and analysis of the experimental results.

Results: Creativity, logic, expression, and performance were selected as experimental indicators to test the ability of environmental design students. Significant differences were confirmed through paired and independent sample t-tests. 1. In the comparison between the pre-test of the experimental group and the post-test using VR, the paired t-test results showed a significant difference between the student's creativity, logic, expression, and achievement in the pre-test and post-test ($p<0.001$). 2. In the comparison between the experimental and control groups, the independent t-test showed a significant difference between the two groups of students in terms of creativity, logic, expression, and achievement after 8 weeks of instruction ($p<0.001$). Students in the experimental group showed a 19.6% higher improvement in creativity scores than those in the control group, an 18.4% higher improvement in logic scores, and a 23% higher improvement in expression scores.

Conclusion: These results suggest that integrated VR technology in environmental design education can significantly enhance learning outcomes. 1. The creativity, logic, expressiveness, and grades of students in the experimental group improved after using VR when compared to the pre-test and post-test. 2. The experimental group compared to the control group showed more significant improvement in creativity, logic, expressiveness, and grades of the students in the experimental group compared to the control group.

Keywords: Virtual reality technology; Environmental Design; Higher education.

Introduction

In the rapidly evolving field of environmental design, educators continually seek effective methods to enhance student creativity, logic, and expressiveness. Integrating virtual reality (VR) technology in educational settings offers a promising avenue to achieve these goals.

Environmental design is defined as focusing on the design of spaces inside and outside of buildings, particularly in two areas: architectural landscape and interior design. Environmental design students need to be creative, logical, and expressive. Students' ability to understand and control space directly affects teaching effectiveness. Finding teaching techniques that can improve the creativity, logic, expression, and performance of environmental design students is the responsibility and goal of college teachers (Lei, 2011). At present, students majoring in environmental design in China are facing complex and heavy academic pressure and employment pressure, and traditional modeling, image rendering, and other means of expression and traditional teaching processes cannot better help students quickly understand space and

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create space (Freina & Michela, 2015). Therefore, there is a great need for tools that can help improve their creativity, logical thinking skills, expression, and performance.

Virtual reality technology can solve the problem of the difficulty of describing spatial design displays in teaching environmental design through its immersive, intuitive, and interactive features. Virtual reality technology can provide students with a more immersive and effective learning environment in terms of vision, hearing, and touch (Stansfield et al., 2000).

Meinhold, (2020) defines virtual reality systems as interactive virtual spaces based on devices such as computers, software, and peripherals. These systems immerse the user in a computer-generated environment to create and experience a virtual world. Virtual Reality (VR) technology is how users experience this virtual world. Virtual reality technology can create realistic perceptual experiences by affecting the human senses.

Virtual Reality technology utilizes modern technology to enhance disciplines, opening up new avenues for artistic development with the potential to revolutionize traditional art and design education (Gebken et al., 2010). Research exploring how to integrate virtual reality technology into various disciplines is on the rise. Currently, virtual reality technology is increasingly being used to visualize theoretical knowledge (Raja, M. & G. G. Priya, 2021). For example, traditional aesthetic knowledge is visualized through virtual reality technology to improve students' aesthetic quality and cognitive level (Liu & Phongsatha, 2022). However, there is a lack of actual cases of research using virtual reality technology not only in the teaching of environmental design but also in the process of designing and creating the works of environmental design students (Chen, 2021). Based on the available information it is concluded that there is a lack of practical application of virtual reality technology in environmental design education.

This study aims to apply virtual reality technology to environmental design courses as a way to improve students' creativity, reasoning, expression, and academic ability. It is different from the most traditional teaching of environmental design courses, in which both teachers and students learn and create through modeling and rendering, which lacks immersion and interactivity, making this experiment somewhat creative and unique (Page et al, 2007).

Objectives

Main objective

To study the impact of virtual reality technology on the personal competence of environmental design students.

Subsidiary objectives

1. To determine the level of improvement in creativity, logic, expression, and grades of environmental design students after using virtual reality technology.

2. To determine the difference in the level of improvement in creativity, logic, expression, and grades between students using virtual reality technology and traditional teaching methods.

Literature review

Environmental Design

This experiment investigates the potential of virtual reality technology to improve the creativity, logic, and expressiveness of environmental design students. Therefore, it is necessary to understand the content of the environmental design program. The environmental design program in Chinese higher education was defined by Professor Shuyang Zheng of Tsinghua University. There are broad and narrow definitions of environmental design. Environmental design in the broad sense refers to the use of ecological concepts to guide artistic design. In the narrow sense, the concept of environmental design focuses on the design of spaces inside and outside of buildings, especially in the two aspects of architectural landscape and interior design. Therefore, students need to have a strong spatial perception, which is very important for learning environmental design knowledge and creating environmental design works.

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Virtual Reality (VR) Technology

Environmental design students need to have strong spatial perception ability, and virtual reality technology can precisely help students better understand and perceive space. Meinhold, (2020) redefined virtual reality systems as interactive virtual spaces based on devices such as computers, software, and peripherals. Users can immerse themselves in the virtual world created by this computer system. Virtual Reality (VR) technology is how users can experience this virtual world. Virtual reality technology can create realistic perceptual experiences by affecting the human senses. The more senses that are stimulated, the more immersive the experience will be. The more senses that are stimulated, the more immersive the experience will be (Biocca Frank, 1992). Virtual reality systems typically stimulate the visual, auditory, tactile, and kinesthetic sensory systems, including balance and dampness (LaValle, 2023). All this literature indicates that virtual reality technology has multiple advantages for environmental design students, therefore, this experiment aims to improve students' spatial creativity, logic, and expression by introducing virtual reality technology into environmental design courses.

Application of Virtual Reality Technology in Environmental Design Course

According to the summary of the collection of existing information, it is found that most of the applications of virtual reality technology in art design-related courses use virtual reality technology to enhance the visualization of artistic knowledge and students' understanding of knowledge. These studies are very necessary for students to learn the complex art processes and techniques in the pre-design stage of art, which can make students more intuitive to understand art to understand design. However, there is little research on the application of virtual reality technology in the process of art design, and most students can quickly experience the art environment created by virtual reality technology as an experience, but it is difficult to create virtual environments using virtual reality technology as a user. The reason for this may be that not many studies have focused on specific experiments with virtual reality technology for environmental design. Therefore, this experiment focuses on the single discipline of virtual reality technology applied to environmental design in the hope of finding ways for students to use virtual reality technology more quickly to create design works.

The software used in this experiment includes AutoCAD, Sketchup, Vray, and Pano2vr. Traditionally, only the first three types of software are used in the teaching of environmental design, i.e. AutoCAD, Sketchup, and Vray. After sketching the work plan, the students use AutoCAD to do the two-dimensional layout design, then use Sketchup to do the modeling, and finally use Vray to render the effect. Finally, Vray was used to render the rendering. This is shown in Figure 1.

Figure 1 Traditional environmental design teaching.

The environmental design method using virtual reality technology adds the use of Pano2vr based on the traditional three steps. Pano2vr is a software for making a virtual reality space environment. It can convert 360° panoramas rendered by Vray into virtual reality scenes and create a fully interactive virtual environment in the scene. The process is shown in Figure 2.

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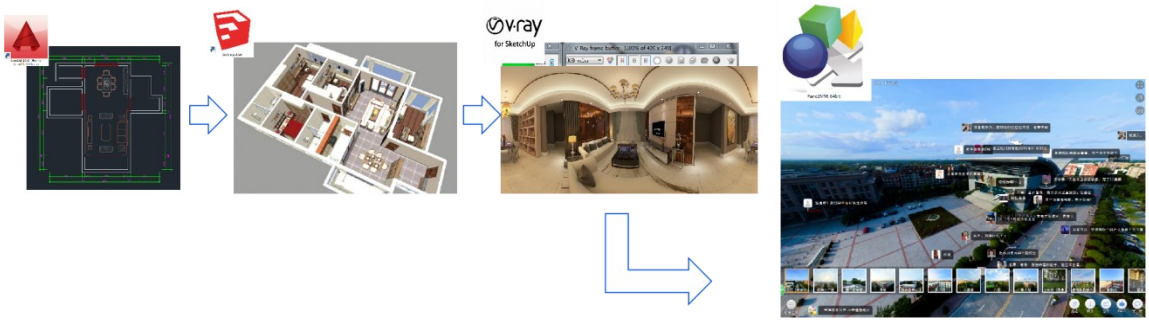

Figure 2 The VR environmental design teaching.

At the same time, students can use VR glasses and joysticks together to create immersive design works. The works can be viewed on computers or mobile devices, and student works can be seamlessly integrated into existing websites (He, 2022).

This experiment was conducted in the computer laboratory of the Environmental Design Department of Sichuan Media College. The laboratory has computers equipped with course software and accessories required for the experiment, mainly PICO 4 Pro and HTC VIVE Pro 2 2.0 (VR head-mounted display), headphones, and game controllers.

Creativity

The cultivation of students' creativity is mentioned in the talent training programs of environmental design majors in many universities in China. Creative thinking and design ability are the core qualities that are indispensable for students majoring in environmental design in the professional field. Environmental designers need to be able to propose innovative design concepts and transform them into feasible solutions. Creative thinking helps designers see different angles of problems and find innovative design inspiration. At the same time, a high level of design ability means that they can effectively put these ideas into practice and create environmental designs that meet customer needs and sustainability principles. Creativity is the ability to generate new ideas and think creatively. In the view of some scholars, creative people are those who can respond quickly to tiny prompts. This is well reflected in environmental design. Generally speaking, creative people tend to have rich imaginations and a wide range of interests. Similarly, students' creativity can also be released to a certain extent through certain tools or technical capabilities, and virtual reality technology is likely to be one of the effective tools.

Logic

Logic has a very important application in the teaching of environmental design majors. Specifically, logic can help students better understand design problems, solve problems better, and improve their design level.

Logic refers to the situation where the development process conforms to the logical system, has logical properties, and follows logical rules (Hubbard & Ruppel, 2023). In the process of creating spatial works, logic determines the speed and accuracy of students in determining size and proportion. Logic involves research and reasoning problems. It is also a test of students' ability to see the big picture, and quickly identify and solve problems. The immersive characteristics of virtual reality technology may help students discover scale problems in design more quickly and improve the logic of students' works.

Expressiveness

The proficiency of environmental design students can be reflected by their effective expression ability. This includes using language, graphics, and actions to clearly and comprehensively convey one's thoughts, feelings, concepts, and intentions so that others can understand, experience, and master them (Lansdown & Simon,1995). For art design, the expression refers to the aesthetic qualities displayed by art design works, such as artistic conception, rhythm, rhyme, and taste (Hospers, 1971). The talent training programs for environmental design majors in many universities require students to master environmental design methods and have comprehensive design expression capabilities using hand drawing and computer multimedia. Students must have strong spatial expression capabilities, be able to vividly and accurately express design intent using sketches, drawings, models, renderings, and computer graphics technology, and master the basic ability to use various technical means to carry out indoor and outdoor environmental

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design. Virtual reality technology is a more expressive technical means than traditional hand drawing and model expression.

According to the above literature, there are relatively few studies on the application of virtual reality technology in environmental design education, and most of the studies are about knowledge visualization. There are very few studies on the application of virtual reality in the design process of environmental design students. In addition, through the literature on the characteristics of virtual reality technology, it is found that virtual reality technology is likely to have a positive impact on the creativity, logic, and expressiveness of environmental design students. Therefore, the purpose of this study is to explore the potential of virtual reality technology in improving the creativity, logic, and expressiveness of environmental design students, aiming to bridge the gap between traditional and modern teaching methods.

Conceptual Framework

This study aims to evaluate whether virtual reality technology is suitable for teaching environmental design courses to improve students' creativity, logic, expression, and grades. The researchers conducted a literature review on environmental design education, virtual reality technology theory, and the application of virtual reality technology in environmental design education. According to the talent training plans of environmental design majors in many universities, students need to have creativity, logic, and expression skills. At the same time, according to the characteristics of virtual reality technology, it is found that these three variables may be affected. Therefore, this experiment examines the impact of virtual reality technology (VR) on three variables: creativity (H1), logic (H2), and expression (H3). The conceptual framework is shown in Figure 3.

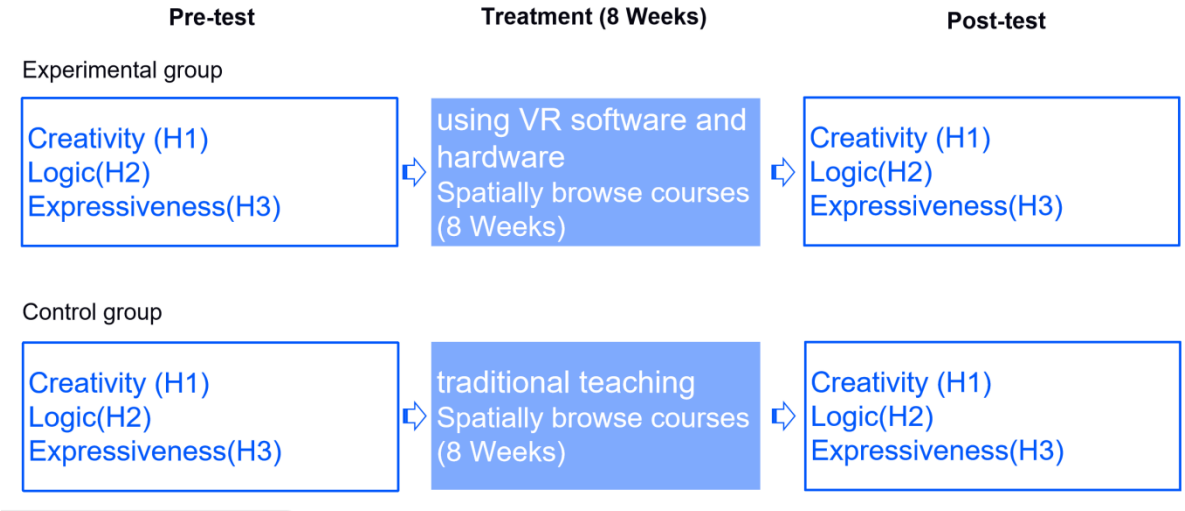

Figure 3 Conceptual Framework

Research hypothesis

This study tested students' spatial design abilities from three aspects: creativity, logic, and expressiveness. Creativity is a very important ability of designers in the scheme creation stage. Creativity is the ability to generate new ideas and think creatively. Logic refers to the situation where the creative process conforms to the logical system, has logical properties, and follows logical rules (Hubbard & Ruppel, 2023). Expressiveness involves using language, graphics, and actions to clearly and comprehensively communicate one's ideas, feelings, concepts, and intentions so that others can understand, experience, and master them (Lansdown & Simon,1995). According to the scoring criteria compiled by Sichuan Media College for many years, the comprehensive score of these three aspects can reflect students' spatial design abilities. Therefore, this paper proposes the following hypotheses:

$H_0 1$: The application of virtual reality technology in environmental design teaching cannot improve students' creativity.

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H_a1: The application of virtual reality technology in environmental design teaching improves students' creativity.

$H_0 2$: The application of virtual reality technology in environmental design teaching cannot improve students' logic.

H_a2: The application of virtual reality technology in environmental design teaching improves students' logic.

$H_0 3$: The application of virtual reality technology in environmental design teaching cannot improve students' expressiveness.

H_a3: The application of virtual reality technology in environmental design teaching improves students' expressiveness.

$H_0 4$: The application of virtual reality technology in environmental design teaching cannot improve total scores.

H_a4: The application of virtual reality technology in environmental design teaching improves total score.

$H_0 5$: There is no difference in creativity between students using virtual reality technology and traditional teaching methods.

H_a5: There is a difference in creativity between students using virtual reality technology and traditional teaching methods.

$H_0 6$: There is no difference in logic between students using virtual reality technology and traditional teaching methods.

H_a6: There is a difference in logic between students using virtual reality technology and traditional teaching methods.

$H_0 7$: There is no difference in expressiveness between students using virtual reality technology and traditional teaching methods.

H_a7: There is a difference in expressiveness between students using virtual reality technology and traditional teaching methods.

$H_0 8$: There is no difference in total scores between students using virtual reality technology and traditional teaching methods.

There is a difference in total scores between students using virtual reality technology and traditional teaching methods.

Methodology

This study aims to explore the impact of virtual reality technology on students' spatial design course grades, using a quasi-experimental study and a quantitative research method. The data were collected and analyzed by the scores of the works of two groups of students, the experimental group and the control group. The teacher used different teaching strategies in these two groups of students. The experimental group used the virtual reality technology teaching strategy, and the control group used the traditional teaching strategy.

Population and Sample Size

The population is the juniors in the universities in China. These samples come from 137 junior students majoring in environmental design at Sichuan Media College in Chengdu, Sichuan Province, China, aged approximately 19-21 years old. These junior students have a certain professional foundation after two years of professional study and receive the same education. Both groups of students in this experiment are from the class taught by the researcher, so they know the experimenter's situation better, which facilitates the reasonable conduct of the experiment. This experiment uses G Power software to determine the required sample size. G Power is specially created for behavioral research and provides accurate power analysis for

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most statistical experiments ((Erdfelder et al, 1996). The results show that at least 26 samples are needed for each group, and a total of 52 samples are needed.

Sampling Method

Purpose sampling is a technique for selecting samples based on predetermined goals and criteria (Miles & Huberman, 1994). Because the participants of this experiment need to have basic design skills to better compare the differences between traditional and virtual reality technology teaching, purpose sampling is used. The samples come from the third year of college and two classes taught by the researcher. There are 37 students in each class, a total of 74 people, which meets the sample size requirements.

Research Instrument and Validity

The researchers used the scoring criteria of the space browsing course of Sichuan Media University as the standard for evaluating students' space design ability. This scoring standard has been used for many years and has been reviewed and modified by many teachers.

Data Collection and Analysis

Data were collected in two stages. The first stage is the ethical research process. Consent will be obtained from all participants. Each participant received a consent form that explained its purpose, that participation is voluntary and confidential, and that they have a right to withdraw. (Fontana & Frey, 2000) . To ensure anonymity, this experiment was specifically numbered for each participant, and it was ensured that the numbering information was kept separate from the actual identity information. The second stage is the experimental procedure. Separate data collection efforts for student grades were conducted for the pre- and post-lab tests. Students completed a design exercise on a small site assigned by the instructor during the first week and sent an electronic version of their homework to the instructor upon completion. The teacher scored the homework and the individual scores, and the total scores were put into JAMOVI for data collection. Students complete a full program design for a teacher-assigned site between weeks two and eight. Teachers scored and the individual scores and totals were placed into JAMOVI for data collection. This is shown in Table 2.

This study utilized descriptive statistical analyses to present demographic information and other data, including means and standard deviations. Hypotheses one through four were tested using paired samples t-tests, while hypotheses five through eight were tested using independent samples t-tests. All data analysis in this study was conducted using Jamovi software version 2.3.18 on a Windows computer.

Results

Demographic Information

The experiment had a total sample size of 74 participants, consisting of 29 males (39.2%) and 45 females (60.8%). Among the participants, twenty-three people, or 31.1% of the total, were 20 years old. Fifty-one people, or 68.9% of the total, were 21 years old. Please refer to Table 1 for more detailed information.

The experimental group comprised 37 participants, including 17 males (46%) and 20 females (54%). Among the participants, twelve people, or 32% of the total, were 20 years old. Twenty-five people, or 68% of the total, were 21 years old.12 were 20 years old (32%) and 25 were 21 years old (68%). In the study, there were a total of 37 participants in the control group. Of these, 12 were male (32%) and 25 were female (68%). Furthermore, 11 were 20 years old (30%) and 26 were 21 years old (70%). Please refer to Table 2 for further details.

Table 1 List of Demographic Information of Samples

Variable	Category	Frequency	Percentage
Gender	Male	29	39.2%
	Female	45	60.8%

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	Total	74	100%
Year of Study	Year 3	74	100%
Age	20 Years of age	23	31.1%
	21 Years of age	51	68.9%
	Total	74	100%

Table 2 List of Demographic Information of Samples (Group analysis)

Experimental group		
Gender	**Number**	**Percentage**
Male	17	46%
Female	20	54%
Age	**Number**	**Percentage**
20 Years of age	12	32%
21 Years of age	25	68%
Control group		
Gender	**Number**	**Percentage**
Male	12	32%
Female	25	68%
Age	**Number**	**Percentage**
20 years old	11	30%
21 years old	26	70%

Differences Between the Pretest Scores

To ensure that the experimental group and the control group were comparable at the beginning of the experiment, we collected the scores before the test for comparison. Four independent sample t-tests were used to compare the creativity, logic, expression, and total scores of the two groups of students. The following table shows the results of the data analysis.

Table 3 Independent t-test for pretest scores between the two groups

		Statistic	**df**	**p**
Total score- Pretest	Student's t	0.316	72	0.753
Creativity-Pretest	Student's t	0.638	72	0.525
Logic-Pretest	Student's t	0.154	72	0.878
Expression-Pretest	Student's t	0.153	72	0.879

Independent samples t-test was used to test the test grades of the two groups of students before the experiment. The result of the test is t (72) = 0.316, p = 0.753, which is not different in statistical significance. Secondly, the t-test results for the scores of the two groups of students in Creativity, t (72) = 0.638, p = 0.525, did not differ in statistical significance. Thirdly, the t-test results of the scores of the two groups of students in the area of logic, t (72) = 0.154, p = 0.878, did not differ in statistical significance. Finally, the t-test results of the scores of the two groups of students in the area of expressiveness, t (72) = 0.153, p = 0.879, did not differ in terms of statistical significance. Therefore, it was concluded that the differences between the two groups did not affect the results.

Descriptive Statistics

This study aims to explore the effectiveness of using virtual reality technology teaching methods on the performance of students majoring in environmental design. The study included a control group and an experimental group and conducted pretests and post-tests to evaluate students' performance in creativity,

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logic, expression, and total scores. By analyzing the descriptive statistics, it was found that the mean score of the control group in the pretest was 68.6 points, and the mean score of the post-test increased to 76.6 points. The mean score of the experimental group in the pretest was 68.9 points, which increased to 90.4 points in the post-test. We compared the standard deviation of the pretest and post-scores to test the dispersion of the pretest and post-scores. The standard deviation of the total score of the control group decreased from 5.28 to 4.36, and the standard deviation of the total score of the experimental group decreased from 3.32 to 2.78. This shows that after the experiment, the scores of students in the experimental group were closer to the mean. After the experiment, the experimental group outperformed the control group in all items of the post-test (Total score: 90.4, Creativity: 26.9, Logic: 25.7, Expression: 27.7), as shown in Table 4. These analyses show that the use of virtual reality technology teaching methods has a positive impact on the performance of environmental design students and is superior to traditional teaching methods.

Table 4 Descriptive statistics

	Group	N	Mean	SD
Total score-Pretest	Experimental group	37	68.9	3.32
	Control group	37	68.6	5.28
Total score-Post-test	Experimental group	37	90.4	2.78
	Control group	37	76.6	4.36
Creativity-Pretest	Experimental group	37	20.1	1.05
	Control group	37	19.8	1.77
Creativity-Post-test	Experimental group	37	26.9	1.05
	Control group	37	22.5	1.64
Logic-Pretest	Experimental group	37	19.3	1.17
	Control group	37	19.2	1.78
Logic-Post-test	Experimental group	37	25.7	1.02
	Control group	37	21.7	1.5
Expression-Pretest	Experimental group	37	19.6	1.19
	Control group	37	19.5	1.79
Expression-Post-test	Experimental group	37	27.7	1.1
	Control group	37	22.5	1.48

Hypotheses Testing

This experiment uses paired sample t-tests to test hypotheses 1-4 and the differences between the pretest and post-test of the experimental group variables. The results are shown in Table 5. In terms of creativity, the experimental group had a mean score of 20.1 in the pretest with a standard deviation of 1.05, and a mean score of 26.9 in the post-test with a standard deviation of 1.05. The paired sample t-test showed a significant mean difference of 6.89 ($p<.001$) between the two tests. In terms of logic, the experimental group had a mean score of 19.3 in the pretest with a standard deviation of 1.17, and a mean score of 25.7 in the post-test with a standard deviation of 1.02. The paired sample t-test showed a significant mean difference of 6.46 ($p<.001$) between the two tests. In terms of expressiveness, the experimental group had a mean score of 19.6 in the pretest with a standard deviation of 1.19, and a mean score of 27.7 in the post-test with a standard deviation of 1.1. The paired sample t-test showed a significant mean difference of 8.14 ($p<.001$) between the two tests. In terms of total scores, the experimental group had a mean score of 68.9 in the pretest with a standard deviation of 3.32, and a mean score of 90.4 in the post-test with a standard deviation of 2.78. The paired sample t-test showed a significant mean difference of 21.49 between the two tests ($p<.001$). Therefore, based on the results of the paired sample t-test, we rejected the null hypotheses $H_0 1$, $H_0 2$, $H_0 3$, and $H_0 4$.

Table 5 Paired sample t-test between pretest and post-test of experimental group variables

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			statistic	df	p	Mean difference	SE difference
Creativity-Post-test	Creativity-Pretest	Student's t	106.6	36	< .001	6.89	0.0647
Logic-Post-test	Logic-Pretest	Student's t	53.8	36	< .001	6.46	0.12
Expression-Post-test	Expression-Pretest	Student's t	73.5	36	< .001	8.14	0.1107
Total score-Post-test	Total score-Pretest	Student's t	170.1	36	< .001	21.49	0.1263

This experiment uses independent sample t-test hypothesis 5-8 to verify whether the virtual reality technology teaching method can improve students' performance better than the traditional teaching method. For the accuracy of the experiment, this experiment conducted an independent sample t-test on the improvement of the post-test minus the pre-test scores of the two groups of students. In terms of creativity, the average improvement score of the experimental group was 6.89, with a standard deviation of 0.393. The average improvement score of the control group was 2.62, with a standard deviation of 0.681. The independent sample t-test showed that there was a significant mean difference between the two groups (mean difference = 6.89, p< .001). In terms of logic, the average improvement score of the experimental group was 6.46, with a standard deviation of 0.73. The average improvement score of the control group was 2.51, with a standard deviation of 0.768. The independent sample t-test showed that there was a significant mean difference between the two groups (mean difference = 6.46, p< .001). In terms of expressiveness, the average improvement score of the experimental group was 8.14, with a standard deviation of 0.673. The mean score of the control group was 2.92, with a standard deviation of 0.829. The independent sample t-test showed that there was a significant mean difference between the two groups (mean difference = 8.14, p< .001). In terms of total scores, the mean score of the experimental group was 21.49, with a standard deviation of 0.768. The mean score of the control group was 8.05, with a standard deviation of 1.598. The independent sample t-test showed that there was a significant mean difference between the two groups (mean difference = 21.49, p< .001). Therefore, based on the independent sample t-test conducted, we rejected the null hypotheses $H_0$5, $H_0$6, $H_0$7, and $H_0$8. We concluded that there were significant differences between the two groups in various aspects, and virtual reality technology teaching was more effective than traditional teaching methods.

Table 6 Descriptive statistics of the variable improvement of the experimental group and control group

	Group	N	Mean	Median	SD	SE
Improve-Creativity	Experimental group	37	6.89	7	0.393	0.0647
	Control group	37	2.62	3	0.681	0.112
Improve-Logic	Experimental group	37	6.46	6	0.73	0.12
	Control group	37	2.51	2	0.768	0.126
Improve-Expression	Experimental group	37	8.14	8	0.673	0.1107
	Control group	37	2.92	3	0.829	0.136
Improve-Total score	Experimental group	37	21.49	21	0.768	0.1263
	Control group	37	8.05	7	1.598	0.263

Table 7 Independent sample t-test of the variable improvement of the experimental group and control group

		Statistic	df	p
Improve-Creativity	Student's t	33	72	< .001
Improve-Logic	Student's t	22.6	72	< .001
Improve-Expression	Student's t	29.7	72	< .001
Improve-Total score	Student's t	46.1	72	< .001

Table 8 shows the summary of the results of the hypotheses testing in the study.

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Table 8 Summary of Hypothesis testing and results

Hypotheses	Statement	Result after Analysis
$H_0$1	The application of virtual reality technology in environmental design teaching cannot improve students' creativity.	Rejected
$H_0$2	The application of virtual reality technology in environmental design teaching cannot improve students' logic.	Rejected
$H_0$3	The application of virtual reality technology in environmental design teaching cannot improve students' expressiveness.	Rejected
$H_0$4	The application of virtual reality technology in environmental design teaching cannot improve students' total scores.	Rejected
$H_0$5	There is no difference in creativity between students using virtual reality technology and students receiving traditional instruction.	Rejected
$H_0$6	There is no difference in logic between students using virtual reality technology and students receiving traditional instruction.	Rejected
$H_0$7	There is no difference in expressiveness between students using virtual reality technology and students receiving traditional instruction.	Rejected
$H_0$8	There is no difference in total scores between students using virtual reality technology and students receiving traditional instruction.	Rejected

Discussion

The results of this experiment support 8 hypotheses and form this experimental model. According to data analysis, students who use virtual reality technology have significantly improved their scores in all aspects of pre-test and post-test, and the improvement is more significant than that of students who use traditional teaching methods. This section finds and speculates that the reasons why students make greater progress using virtual reality technology include (1) virtual reality technology helps students create more interactivity and (2) virtual reality technology helps students better understand space and design space more conveniently.

In addition, there are some points worth noting. First, due to the faster and faster software updates, some web pages have simplified and beautified some functions of pan2vr software (such as 720 Cloud). This allows students to get started faster and simplifies the content of the software teaching part. However, there are also problems such as a lack of professionalism. Perhaps future research can study the impact of software type.

Secondly, the emergence of many current technologies has a great impact on the study and work of environmental design students. Based on the research results, this researcher believes that for students majoring in environmental design, the advantages of many current technologies outweigh the disadvantages. In addition to the virtual reality technology (VR) in this study, there are also augmented reality (AR), mixed reality (MR), extended reality (XR), etc. These are technologies related to space creation and have a certain impact on the environmental design major. However, in comparison, the ability of augmented reality (AR) to provide an immersive experience is relatively limited compared to virtual reality (VR). Mixed reality (MR) provides a deeper sense of immersion, but not as much as virtual reality (VR). Extended reality (XR) can be understood as the final destination expected by humans in the metaverse, but the technology still needs further development. For students majoring in environmental design, perhaps the impact of virtual reality technology will be greater and easier to learn and accept. This is also the reason why this experiment initially chose to study the integration of this technology into the environmental design classroom. However after experimental research, perhaps the effective combination of multiple technologies can produce more significant results. However, the diversity of technology also raises the question of whether students can accept and effectively use it. This researcher believes that subsequent research will answer these questions one by one.

Third, in addition to the three variables of creativity, logic, and expressiveness studied in this experiment, some variables may be affected by virtual reality technology. Variables such as cognitive

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ability, divergent thinking ability, evaluation ability, judgment ability, inductive ability, and observation ability will also be affected (Liu, 2022). Similarly, many factors affect the experimental results, such as the length of time, gender, age (OBEID, 2019), and virtual reality environment (Marileena Koskela et al., 2005). In addition, differences in research subjects and experimental courses will also affect the experimental results. For example, this experiment is aimed at junior students majoring in environmental design. Is virtual reality technology suitable for freshmen and sophomores studying basic courses? These are all issues that need to be studied and verified.

Conclusion

This study uses quantitative methods to study the impact of virtual reality technology on the academic performance of students majoring in environmental design. Through experiments, the researchers concluded that virtual reality technology is effective in improving the abilities of students majoring in environmental design in all aspects and is more effective than traditional teaching methods.

First, based on theory and practice, the research process and research methods of applying virtual reality technology to environmental design courses are obtained. Students are taught to use virtual reality technology to improve the creativity, logic, and expressiveness of their works through pan2vr software.

Secondly, the test standards and scoring standards of the spatial browsing course of Sichuan Communication University for many years are used to test students' performance in all aspects.

Finally, based on data analysis, the research conclusions are drawn. Through descriptive statistics and paired sample t-tests before and after the test of the experimental group, it is concluded that there are significant differences between the experimental group and the pre-test, that is, virtual reality technology effectively improves the creativity, logic, expressiveness, and overall performance of students majoring in environmental design. Through descriptive statistics and independent sample t-tests on the improvement values of the experimental group and the control group, it is concluded that there are significant differences in the average scores of the two groups, that is, students using virtual reality technology have higher improvements in creativity, logic, expressiveness, and overall performance than students using traditional teaching methods.

These findings are consistent with the results of the relevant literature mentioned above. For example, the results of OBEID (2019) are that the immersive virtual design environment contributes to the creativity of the participants in the design process, which is consistent with the results of this experimental study. Another example is the teaching technology mentioned in the paper by Raschidow (2023), which helps to cultivate students' logical thinking abilities. Another example is the VR interactive painting proposed in the paper by Eroglu et al. (2020), which will improve the painting performance of the creator. These documents are consistent with the results of this study and are also supporting literature for this study.

In addition, this chapter also draws some other findings based on the experimental data. The selection of virtual reality technology software and hardware, the integration of VR, AR, MR, XR, and other technologies, as well as gender, age, region, time, and other factors may affect the experimental results. Subsequent studies can consider these factors and seek more appropriate ways to apply virtual reality technology to environmental design classes, which may achieve more significant results.

The above is the summary and discussion of this study. This study hopes to provide some reference and inspiration for researchers in related fields in the future.

Recommendation

Provide recommendations for future research on the same or similar topic. The question that needs to be answered in this section is if the researcher is going to conduct the research again in the future, what can be done to make this more complete? The researcher can also look at the section “Limitation” in Ch. 1 as a base for recommendations for future research.

In general, the results of this experiment show that virtual reality technology has a positive impact on the creativity, logic, performance, and overall score of environmental design students, and the improvement is more significant than traditional teaching methods. Although this experiment has drawn relevant conclusions, there are also some problems as follows.

First, there is the issue of virtual reality technology software and hardware selection. The software selected to assist virtual reality technology in this experiment is pan2vr, which is a professional virtual reality technology software in the field of environmental design. However, due to its professional nature, it will be relatively difficult to learn. 720 Cloud is a web software that simplifies and beautifies some functions

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of the pan2vr software. Students may get started more quickly and simplifies the teaching part of the teacher software. However, there are also problems such as not being professional enough, having fewer functions, and having poor stability. In the future, virtual reality technology software that is more suitable for environmental design professional teaching may appear, and further research will make it more complete.

Second, the integration of multiple technologies. Based on the results of this experimental study, this researcher believes that in addition to virtual reality technology, other related technologies may also have a positive impact on the performance of students majoring in environmental design. For example, Augmented Reality (AR), Mixed Reality (MR), Extended Reality (XR), etc. are all technologies related to space creation and may have a certain impact on the environmental design profession. Future experiments can be conducted in the direction of effectively combining multiple technologies to jointly assist environmental design teaching.

Third, other influencing factors. In terms of control variables, there are many factors to consider. The first is gender differences. Men and women may perceive space differently, and the gender of the participants may affect the results. The second is geographical restrictions. Most of the subjects in this experiment came from Sichuan. The different settings and teaching environments of environmental design courses in different regions will also affect the experimental results. The last is the number of experiments. To make the research results more accurate, multiple experiments need to be conducted for verification. In addition to the three dependent variables of creativity, logic, and performance in this experimental study, some variables may be affected by virtual reality technology. Variables such as cognitive ability, Divergent thinking ability, Evaluation ability, Judgment ability, Inductive ability, Observation ability, etc. will also be affected (Liu, 2022).

Based on the above problems and possibilities, to further study the application of virtual reality technology in environmental design professional teaching, the following suggestions are put forward based on the research results.

1. Future research can add several experimental groups to avoid chance. Increase the comparison between the experimental group and the control group, and the experimental group and the experimental group to ensure the accuracy of the experiment and also discover other possibilities.

2. Future research can be conducted in multiple universities to compare whether the experimental results of each experimental group are different. You can compare the grading standards of various colleges and universities to look for other factors that may be affected.

3. Future research can conduct separate experiments on gender to study whether gender affects the effectiveness of virtual reality technology in environmental design teaching.

4. If there are new developments in technology in the future, we can look for virtual reality technology software and hardware that are more suitable for environmental design teaching.

5. In the future, the effect of integrating multiple technologies can be studied to find more effective technologies for environmental design teaching.

References

Alizadehsalehi, S., Hadavi, A., & Huang, J. C. (2019). Virtual reality for design and construction education environment. *AEI 2019*. https://doi.org/10.1061/9780784482261.023

Biocca, F. (1992). Virtual reality technology: A tutorial. *Journal of Communication*, *42*(4), 23-72. https://doi.org/10.1111/j.1460-2466.1992.tb00811.x

Chen, F. (2021). Teaching research on integrating virtual reality technology into environmental design professional courses. *Journal of Physics: Conference Series*, *1744*(4), 042220. https://doi.org/10.1088/1742-6596/1744/4/042220

Erdfelder, E., Faul, F., & Buchner, A. (1996). POWER: A general power analysis program. *Behavior Research Methods, Instruments & Computers, 28*(1), 1–11. https://doi.org/10.3758/BF03203630

Eroglu, S., Schmitz, P., Martinez, C., Rusch, J., Kobbelt, L., & Kuhlen, T. (2020). Rilievo: Artistic Scene Authoring via Interactive Height Map Extrusion in VR. Leonardo. 53 (4), 438-441. Doi: 10.1162/leon_a_01933.

Fontana, A., & Frey, J. H. (2000). The interview: From structured questions to negotiated text. In N. K. Denzin, & Y. S. Lincoln (Eds.), Handbook of qualitative research (2nd ed., pp. 645-672). Thousand Oaks, CA: Sage.

Citation
Chen, Y., & Zhu, L. (2025). The Research on using Virtual Reality Technology to Improve the grades of Environmental Design Students. International Journal of Sociologies and Anthropologies Science Reviews, 5 (1), 193-206; DOI: https://doi.org/10.60027/ijsasr.2025.4818

Freina, L., & Ott, M. (2015). A literature review on immersive virtual reality in education: State of the art and perspectives. *11th International Conference eLearning and Software for Education*. https://doi.org/10.12753/2066-026x-15-020

Gebken, R., Bruce, R., & Strong, S. (2010). Impact of the Leadership in Energy and Environmental Design Accredited Professional Credential on Design Professionals. *Journal of Professional Issues in Engineering Education and Practice. 136* (3), 132-138. 10.1061/(ASCE)EI.1943-5541.0000016.

He, Z. (2022). Study on the application of traditional Chinese auspicious images in environmental art design based on VR senses. *Computational Intelligence and Neuroscience*, *2022*, 1-12. https://doi.org/10.1155/2022/1189613

Hospers, J. (1971). *Libertarianism: a Political Philosophy for Tomorrow.* University of Michigan.

Hubbard, T. L., & Ruppel, S. E. (2023). Subjective Lateralization within Auditory Imagery: Valence and Verbality. *Imagination, Cognition and Personality*, *42*(3), 281-310. https://doi.org/10.1177/02762366221120220

Koskela, M., Kiltti, P., Vilpola, I., & Tervonen, J. (2005). Suitability of a Virtual Learning Environment for Higher Education. Electronic Journal of e-Learning. 3 (1), 23-32.

Lansdown, J., & Schofield, S. (1995). Expressive rendering: A review of nonphotorealistic techniques. *IEEE Computer Graphics and Applications*, *15*(3), 29-37. https://doi.org/10.1109/38.376610

LaValle, S. M. (2023). *Virtual reality*. https://doi.org/10.1017/9781108182874

Lei, Y. (2011). Reform and innovation on a curriculum of environmental art design major using computer technology. *2011 International Conference on Business Management and Electronic Information*. https://doi.org/10.1109/icbmei.2011.5916903

Li, W. (2021). Application analysis of VR virtual technology in environmental art design teaching. *Journal of Physics: Conference Series*, *1744*(4), 042222. https://doi.org/10.1088/1742-6596/1744/4/042222

Liu, P., & Phongsatha, S. (2022). Application research on enhancing the cognitive ability of art appreciation of senior high school students in Chengdu through virtual reality technology. *International Journal of Innovative Research and Scientific Studies*, *5*(3), 236-248. https://doi.org/10.53894/ijirss.v5i3.676

Liu, X. (2023). Digital transformation of environmental design education and application of virtual reality. *Journal of Education and Educational Research*, *5*(3), 53-56. https://doi.org/10.54097/jeer.v5i3.13303

McGovern, E., Moreira, G., & Luna-Nevarez, C. (2019). An application of virtual reality in education: Can this technology enhance the quality of students' learning experience? *Journal of Education for Business*, *95*(7), 490-496. https://doi.org/10.1080/08832323.2019.1703096

Meinhold, R. M. A. (2020). *Virtual reality*. In *Salem Press Encyclopedia of Science*.

Mitias, M. H. (1992). Dewey's theory of expression. *Journal of Aesthetic Education*, *26*(3), 41. https://doi.org/10.2307/3333012.

Obeid, S. (2019). The impact of immersive virtual design environments on creativity in the design process. *International Journal of Design Creativity and Innovation, 7*(3), 210-225. https://doi.org/10.1080/21650349.2019.1591540

Page, T., Gyuha, J., & Thorsteinsson, G. (2007). Technology-enhanced learning in design education through the use of virtual reality learning environments. *Journal of Korea Design Knowledge*, *null*. 4, 213-224. https://doi.org/10.17246/jkdk.2007..4.023

Raschidow, A. S. (2023). Enhancing logical thinking abilities through advanced teaching technologies. *Journal of Educational Technology and Society, 26*(1), 45-58. https://doi.org/10.2307/educational_tech_soci.2023

Raschidow, A. S. (2023). Enhancing logical thinking abilities through advanced teaching technologies. *Journal of Educational Technology and Society, 26*(1), 45-58. https://doi.org/10.2307/educational_tech_soci.2023

Stansfield, S., Shawver, D., Sobel, A., Prasad, M., & Tapia, L. (2000). Design and implementation of a virtual reality system and its application to training medical first responders. *Presence: Teleoperators and Virtual Environments*, *9*(6), 524-556. https://doi.org/10.1162/105474600300040376

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