Adult and Higher Education (2025)
Clausius Scientific Press, Canada

DOI: 10.23977/aduhe.2025.070318
ISSN 2523-5826 Vol. 7 Num. 3

The Impact of Virtual Reality Technology on Students' Performance in Higher Vocational Education

Ji Qi

Shunde Polytechnic University, Foshan, Guangdong, China

Keywords: Virtual Reality Technology, Students' Performance, Vocational Education

Abstract: The application scenarios of Virtual reality (VR) in higher vocational education are becoming increasingly diverse. This study combined VR technology to investigate 30 engineering students from a vocational education university in Guangdong, China. After receiving VR technology for course implementation, their academic performance has greatly improved. This study not only contributes to the theory of academic improvement in higher vocational education, but also provides empirical evidence and operational teaching models for the reform of higher vocational education teaching.

1. Introduction

Higher vocational education serves as an important component of the national education system and human resource development in China. Currently, vocational education in China prioritizes a practice-oriented learning model, employing diverse approaches such as school-enterprise collaboration and work-integrated education to cultivate talent. However, the teaching process still faces significant challenges that cannot be fully resolved through traditional pedagogical approaches. These challenges include the need for large-scale comprehensive training in high-cost, high-risk, or extreme environments. Such complexity demands innovative solutions that transcend conventional practices, requiring a reimagining of how skills are developed and applied in vocational education.

On June 16, 2020, the Ministry of Education issued that "With the help of various information technologies, build virtual simulation training resources and simulation training environment to solve practical problems faced in the teaching of experimental training". Virtual reality (VR) technology can create a digital environment mirroring the actual training scene repeatable training in virtual reality. This provides an effective solution for high-cost, high-consumption, irreversible operations or large-scale comprehensive training in high-risk and extreme environments [1].

Virtual reality technology creates sensory experiences that break through physical limitations for users by constructing interactive 3D digital environments. Modern mainstream VR systems use six degrees of freedom(6of) tracking technology, combined with spatial audio algorithms, to achieve multidimensional perception fusion of vision, hearing, and even touch in head mounted displays(HMD) systems. The industrialization process in this field is showing exponential growth, forming a complete ecological chain in scenarios such as digital entertainment, immersive games, vocational training, and remote collaboration.

In the last ten years, the application cases include surgical simulation systems in the medical field, virtual laboratory construction in the education industry, and 3D visualization preview of architectural design. In virtual reality technology, the learning and teaching activities of embodied learning and other new technologies have become an educational letter, New Requirements for Educational Development in the Era of Informatization 2.0. Leveraging VR technology in vocational education emerges as an inevitable and potent strategy for China to nurture top-tier skilled professionals and expedite the digitization of vocational education[2].

Some studies have proven the success of VR in vocational education, where the integration of cultural literacy and technical expertise is crucial for cultivating well-rounded professionals in higher vocational education. This study aims to investigate the application efficacy of virtual reality (VR) technology in vocational education through an experimental framework, with a specific focus on enhancing academic performance among electronic engineering students at a higher vocational college in Guangdong Province. Employing a controlled experimental approach, the research will conduct multidimensional analyses by integrating demographic variables such as gender, family income, and so on. The primary objective is to elucidate how VR technology differentially impacts diverse student cohorts. The findings aim to furnish vocational institutions with evidence-based strategies for optimizing resource allocation, designing tailored pedagogical interventions, and advancing the synergistic development of digital transformation initiatives and educational equity in vocational education systems.

2. Related Studies

Virtual reality (VR) was first described in 1963 when Hall and Miller outlined the HMD and its applications in virtual reality systems [3]. Since then, the virtual world created by VR technology has been widely applied, especially in the area of education.

Through the search and analysis of the keywords "virtual reality" and "course" in the database, it can be seen that foreign research places more emphasis on professional fields such as medicine and intelligent driving, with a significant proportion of basic interactive design; Data collection mainly relies on questionnaire surveys and behavioural video methods. The current research methods are mainly quantitative research and mixed research, and will be expanded in two directions in the future: one is to conduct exploratory experiments on real scene transfer, and the other is to conduct iterative optimization experiments based on design research paradigms.

Horne and Hamza [4] explored the integration of virtual reality technology into building environment courses in a study. The School of Architecture and Environment at Northumbria University designed a four-year modular course in 2003 and introduced VR technology to help students gain a deeper understanding of architectural design principles and techniques. Detyna and Kadiri applied virtual reality technology to geography higher education courses in 2019. They created a highly immersive learning environment through a six degree of freedom helmet, helping students improve their understanding of geography knowledge [5]. Stone applied VR to welding training [6], while Conges (2020) found that VR training would not damage expensive tools and machinery [7].

Although the application of virtual reality in courses in China started later than that in North America, virtual reality has appeared in the teaching reform of various majors in higher education. The teaching application and teaching reform of virtual reality in China are relatively evenly distributed in terms of majors, and the theory and practice coexist. Quantitative research and hybrid research are both used at present; the teaching application of virtual reality in higher vocational teaching is more reference for us. In recent years, research in China has placed greater emphasis on the application of virtual reality in the teaching process

Li (2018) conducted experimental teaching using VR technology with 176 third-year nursing undergraduates to investigate whether scenario simulation methods could enhance teaching quality and effectiveness in nursing education. As VR technology advanced, the researcher achieved significant results by implementing improved scenario simulation approaches in this field [8]. Also, in order to find out the limitations in traditional education models, Gao (2019) specifically targeted three challenges in animal science experimental teaching: insufficient pedagogical depth, unskilled experimental operations, and limited internship opportunities. By developing a virtual breeding farm through VR technology, Gao provided an innovative solution for practice-oriented instruction. In recent years, there has been an increasing exploration of VR in vocational education, with Ping (2021) examining its implementation in chemical engineering training and Jing Yang (2021) exploring reform strategies for undergraduate industrial design education using this technology. Wang (2022) further advanced this research by conducting an in-depth case study on VR implementation in engineering training courses, focusing on the "VR Virtual Assembly Comprehensive Training Course" at Northwestern Polytechnical University in China [9].

3. Methodology

3.1. Objectives

This study aimed to determine the impact of virtual reality technology on students' performance in higher vocational education in China. It mainly aimed to determine if significant differences would exist between the pretest and post-test score of students when using the VR technology.

3.2. Participants

This study selected 30students from a selected higher vocational college in Guangdong province in China. The stratified random sampling method was used to select the participants with the following categories: sex, average monthly family income, and computer usage time.

3.3. Research Instruments

The VR work plan was designed by the researcher to help the experiment proceed.

A Virtual Reality Lesson Plan or a Work Plan indicates an Outline of the Lesson for 4 weeks that included the following: Objectives of the Lesson, Lesson Content, Teaching and Learning Strategies showing varied activities using Virtual Reality technology, Assessment Activities, and Time Allotment

3.4. Data Analysis

The gathered data were coded in the computer used the SPSS software, for the statistical treatment of data.

Descriptive and inferential statistics were used in analysing the data. Descriptive statistics used included percentage, mean, and standard deviations.

Inferential statistics employed included the t-test for independent samples, the t-test for correlated samples, and One-Way Analysis of Variance.

3.5. Result and Discussion

The t-test results for differences in pretest performance among the students classified according to sex in table 1 show that there is no statistically significant gender difference existed in pre-test

scores (t=0.246, P = 0.807). The ANOVA results for differences in pretest performance among the students classified according to average family monthly income, and computer usage time indicated there was no statistically significant difference in pre-test scores based on family income (F=0.571, p = 0.572) and computer usage time (F=0.036, p = 0.965).

Table 1 The pretest result

Variable	Group	M	T-Value/F	Sig	Df
A Sex	Male	48.545	-0.246	0.807	29
	Female	47.579			
B Family Income	Less Than 5000	52.200	0.571	0.572	29
	5000 To 10000	46.333			
	More Than 10000	47.769			
C Computer Usage Time	Less Than 5	47.750	0.036	0.965	29
	5 -10	47.600			
	More Than 10	48.857			

Table 2 The post-test result

Variable	Group	M	T-Value/F	Sig	Df
A Sex	Male	80.158	-0.188	0.852	29
	Female	80.818			
B Family Income	Less Than 5000	83.000	0.46	0.636	29
	5000 To 10000	78.583			
	More Than 10000	81.077			
C Computer Usage Time	Less Than 5	80.250	0.168	0.847	29
	5 -10	79.667			
	More Than 10	82.143			

The study found no statistically significant difference in performance between male and female students (p > .05) and The ANOVA results in table 2 indicated that there was no statistically significant difference in post-test scores based on family monthly income (F=0.46, p=0.636).

Table 3 The t-test results for differences between the pretest and post-test

Groups Compare	M	T-Value	Sig	Df
Pretest	47.933	-32.037	0.000**	29
Posttest	80.400			

Data in the table3 showed that there was a significant difference at the 0.01level between the pre-test total score and post-test total score (t=32.037, P = 0.000)), and the specific comparison showed that the average pre-test total score (47.93) was significantly lower than the average post-test total score (80.40). From the results, it could be concluded that VR technology significantly improved students' performance (K.K. Bhagat, 2016) [10].

4. Conclusions

The data analysis of the study indicated that the application of VR technology in higher vocational education is very successful which may due to the correlation between academic performance and hands-on ability in vocational education, especially for our students who were major in engineering, the immersion of VR can help them better understand academic knowledge. The VR technology used in the vocational education has changed students' enthusiasm for learning and increased their initiative. Virtual reality technology provides students with vivid and realistic learning experiences through three-dimensional vision, dynamic sound, and interactive functions. This innovative educational method has attracted students' interest, encouraged them to actively participate, and ultimately improved their learning efficiency.

References

[1] Ping, L. (2021). Research on the application of virtual reality technology in chemical engineering training teaching. Educational Watch, 3, 124-128.
[2] Jing, Y. (2021) Teaching reform strategy of undergraduate industrial design in colleges and universities based on virtual reality technology. Vocational Education in China, 7, 63-67.
[3] Hall, M. R., and J. W. Miller. (1963). "Head-mounted Electroocular Display: A New Display Concept for Specialized Environment." Aerospace Medicine, 34(4), 316–318.
[4] Horne, M., Hamza, N. (2005) Integration of virtual reality within the built environment curriculum. International Council for Research and Innovation in Building and Construction, 11, 311-324.
[5] Detyna, M., Kadiri, M. Virtual reality in the HE classroom: feasibility, and the potential to embed in the curriculum. Journal of Geography in Higher Education, 44, 474-485.
[6] Stone, R. T., McLaurin, E., Zhong, P., & Watts, K. P. (2013). Full virtual reality vs. integrated virtual reality training in welding. Welding Journal, 92(6), 167-173.
[7] Conges, A., Evain, A., Benaben, F., Chabiron, O., & Rebiere, S. (2020). Crisis management exercises in virtual reality. In 2020 IEEE Conference on Virtual Reality and 3D User Interfaces Abstracts and Workshops (VRW), 87–92.
[8] Li wei. (2018) Application and improvement of situational simulation teaching method in nursing teaching under background of virtual reality technology. nursing research, 9, 32-16.
[9] LL. Wang, L.H. Qi, Jun Luo, Bing Lv, J.J. Jiang. (2022) Exploring the Application of VR Technology in Engineering Training Courses. Modern Educational Technology, 7, 85-92.
[10] K.K. Bhagat, W.K. Liou, and C.Y. Chang. (2016) A cost-effective interactive 3D virtual reality system applied to military live firing training. Virtual Real, 6, 127–140.