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A Study on Virtual Reality Based Instruction in Teaching to Improve the Performance of Students

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Abstract

Virtual reality technology-based instruction educational institutional environments plays vital role in teaching-learning process. Virtual Reality (VR) technique is incorporated in teaching-learning processes to measure the various parameters such as depth understanding of the concept, quick learning, and deep knowledge by learners. In this research work, evaluations were conducted Multiple Choice Questions (MCQ) before and after the VR technique is applied in delivering lecture. A statistical method paired samples t-test is used to test the significant of Virtual Reality in learning process. The research findings emphasize how virtual reality-based training to improve the performance of students.

Keywords: *virtual reality, paired samples t-test, teaching-learning, null hypothesis, alternative hypothesis*

1. Introduction

Learning in a VR-based simulation environment could be implemented via desktop/laptop PCs which allowed students to explore complex subjects in a way that traditional teaching methods cannot make it possible [4]. Virtual Reality (VR) is a tool that many language educators have considered for use in their classrooms. However, since VR is a continually evolving technology with quickly changing features, applications, and educational affordances, it is difficult for teachers to understand exactly what the technology is and what it can bring to their classrooms [5].

The rapid increase in the processing power of the computer led to the deployment of desktop-based virtual reality technology in the learning and higher education. The drastic reduction in the cost of technology and availability of high-speed Internet connection further increased the use of this less immersive form of virtual reality technology [6]. The cost of virtual reality technology was just one of many factors keeping schools from implementing it. Mass adoption of this technology was unfeasible due to the high cost of purchasing and maintaining the numerous complex devices needed to create an immersive environment. Users of virtual reality environments have reported a number of psychological and bodily discomforts. The entertainment business saw the emergence of highly immersive virtual reality technology in the 1960s with Morton Heiling's creation of Sensorama, a console meant for a single user and intended to capture the attention of viewers. Virtual reality (VR) has developed in step with technology. According to some researchers, gamification falls under the category of virtual reality, which includes desktop, non-immersive, immersive, wearable, and conventional virtual reality [5]. Virtual reality encompasses various forms, each with its own conceptual differences and confusing definitions, but ultimately, it all entails interacting with simulated surroundings. When compared to other instructional approaches, virtual reality (VR)-based simulation learning has been demonstrated to be effective at engaging students [7]. The future of VR learning is bright, as several major players in the technology and social network services sectors, including Facebook, Microsoft, and Tencent, have recently announced their plans to develop the metaverse a virtual reality environment where people can work, learn, and socialize.

2. Virtual Reality In Training

Virtual Reality (VR) is a technology that allows users to immerse themselves in an artificial computer-generated environment and interact with it in real-time. At present, there are three main categories of VR simulations used namely non-immersive, semi-immersive, and fully immersive simulations. Applications of VR include education, business, health care, logistics and entertainment. VR allows individuals to repeatedly practice in a specially simulated environment for a specific purpose. This technology helps instructors to train learners in an effective way. Many industries are using VR technique to train their employees to improve efficiency. Educational institutions are also engaging VR educational content for students of all ages. Virtual Reality modeling Language (VRML) is used for creating a three-dimensional digital content.

Field trips are a great way for learners to interact with curriculum material outside of the usual classroom setting, and educators hope to encourage students' interest in what they are studying. Pupils can engage in interactive environment exploration to gain a more profound comprehension of the subject matter. Field visits are frequently used by educators to give students exposure to material that will not yet be taught formally. As a result of experiencing the material in a real-world setting, field visits enable students to internalize the concepts and form meaningful connections with the material.

Evidence supporting the effectiveness of VR-based simulation learning in engaging students is cited [7]. This finding suggests that VR technology holds promise as an instructional tool capable of enhancing student learning outcomes. Virtual Reality is to examine overall effect as well as the impact of selected instructional design principles in the context of virtual reality technology-based instructions [3].

3. Methodology

3.1 Statistical Methods

A numerous statistical methods are available for analysis and interpretation of the data. The selection of an appropriate statistical method depends on objective of the problem, types of data, and nature of observations such as paired and unpaired.[1] Two main statistical methods are used in data analysis namely descriptive statistics and inferential statistics. Descriptive statistics summarizes data using indexes such as mean, median, standard deviation. Inferential statistics draws conclusions from data using statistical tests such as F-test, student's t-test, ANOVA test, etc. [2]. Inferential statistical methods are categorized as parametric or nonparametric. Hence, Paired t-test is an appropriate method to test the significant of VR based training to improve the performance of students.

3.2 Formulation of Hypotheses

Performance of employee is evaluated using Virtual Reality (VR) method and to know whether VR method increases performance of students with respect to depth understanding of the subject. The 15 students performance scores are measured both before and after VR method is applied. A statistical method “paired samples t-test” is applied to test VR method improves performance of students with respect to depth understanding of the subject.

The Null Hypothesis (H_0) is stated as “There is no statistically significance difference between before and after VR method based on depth understanding of the subject”. The Alternative Hypothesis (H_1) is stated as “There is statistically significance difference between before and after VR method based on depth understanding of the subject”.

3.3 Data Set

Multiple Choice Question (MCQ) based tests are conducted for a group of 15 students of Under Graduate programme to know the depth understanding of subject before and after VR technique is applied. The Table 1 shows the performance scores of students before and after VR.

Table 1: Scores of Students Before VR and After VR

Student id	Score (Max. 10)	
	Before VR	After VR
001	4	6
002	4	6
003	6	6
004	4	6
005	4	6
006	4	6
007	6	6
008	2	8
009	6	6
010	4	6
011	4	6
012	4	6
013	4	6
014	6	6
015	2	8

4. Result And Discussion

Graphical representation (Figure 1) shows effectiveness of VR method to improve performance of students with respect to depth understanding of subject.

However, it is necessary to statistically test whether null hypothesis is accepted or not using Paired samples t-test method. The representative sample has been statistically tested using the Statistical Package for Social Science (SPSS) package. SPSS package provides insights into the problem, helps to develop ideas or hypotheses

for potential quantitative research.

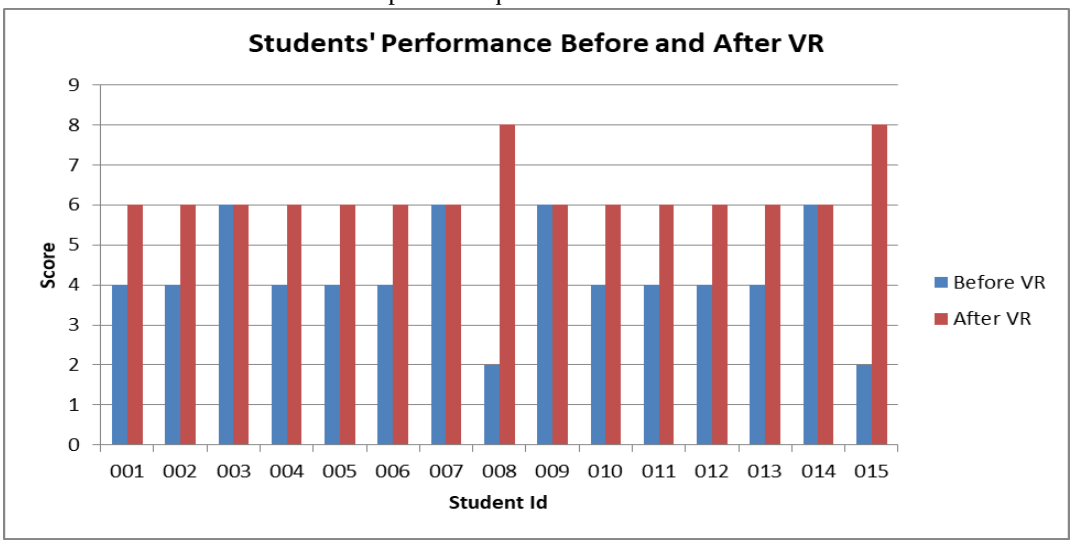

Figure 1: Students' Performance Before and After Virtual Reality

Output of SPSS package is given below:

Paired Samples Statistics

		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	Before_VR	2.07	15	.458	.118
	After_VR	3.13	15	.516	.133

Paired Samples Test

		Paired Differences					t	df	Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
					Lower	Upper			
Pair 1	Before_VR After_VR	-1.067	.258	.067	-1.210	-.924	-16.000	14	.0001

From Paired Samples Test table, The Sig. (2-Tailed) value in our example is 0.0001. This value is less than 0.05. So, we reject the Null hypothesis. That is, we can conclude that there is a statistically significant difference between before and after VR method based on Depth of understanding the subject.

From Paired Samples Statistics table we also observe that the mean Score of After VR (3.13) is greater than the Mean Score of Before VR (2.07). Finally conclude that performance of students is improved after VR method is applied.

5. Conclusion

This research article emphasizes the importance of Virtual Reality technique in training to improve performance of students with respect to depth understanding of subject. The study shows the performance of

students is improved by applying the VR in learning with statistical evidence. Further the research can be extended by considering other parameters such as creativity, research attitude and innovation.

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