Enhancing Learning Performance of Engineering Students in Virtual Reality Environment

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Abstract

Virtual reality (VR) is used in entertainment universally, such as in movies and games. However, rarely is it used in education, particularly in Engineering Science. Therefore, the paper tried to apply virtual reality to education by teaching students the basics and practical applications of the Raspberry Pi in a realistic-looking world, and thus discussed whether immersive virtual reality could improve students' learning performance. In the end, the research showed that virtual reality could significantly improve students' learning performance, and most students said that they are more willing to learn in virtual reality.

Keywords: Virtual reality, Learning performance, Engineering education

1. Introduction

Virtual reality, a technology that allows users to feel like they are in it through immersive virtual scenes, is applied to all aspects of life [1]. For example, viewers are allowed to enter the world of movies by wearing head-mounted devices in movie theaters; consumers could browse the rooms in the catalog "in person" in the furniture store. However, virtual reality is rarely used in education, especially in the field of Engineering Science.

It is believed that virtual reality would bring a prospective future to education if it were introduced into education [2]. For instance, when learning embedded systems, not only could virtual reality save the cost of purchasing electronic equipment such as signal generators, oscilloscopes, and electronic components, but it also enables students to use electronic devices safely without worrying about breaking components or getting injured due to improper operation. Therefore, the paper focuses on building an immersive environment in virtual reality to explore students' learning performance.

2. Materials and Methods

The research obtained the experimental results by the following steps. First, we built an educational situation in virtual reality by using a virtual reality editor, Magic VR. In other words, Students in the realistic-looking environment could practice manipulating the Raspberry Pi to learn its basic knowledge and applications. After learning, they were required to fill out the post-test questionnaire to let us know their learning performance. Furthermore, a short interview about their feelings of learning experience through virtual reality was also applied for the research to figure out if virtual reality is helpful for learning.
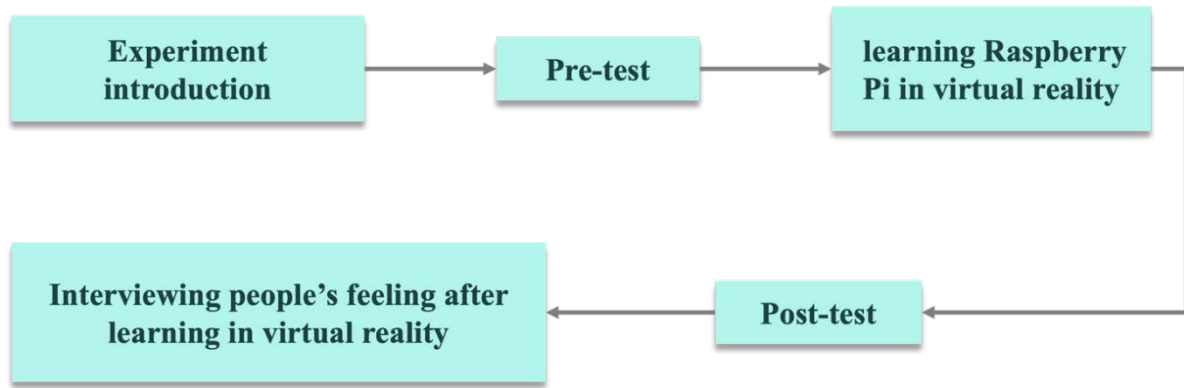
Figure 1. The experimental process.

3. Results and discussion

The study used a dependent sample t-test to analyze differences in learning performance between the pre-test and post-test. Table 1 shows the result of the dependent sample t-test. The mean of the pre-test was 39.39 with a standard deviation of 19.75; the mean of the post-test was 86.36 with a standard deviation of 9.33. The t value was -11.064 ($p < 0.001$). This result reached a significant difference. This means that when students use virtual reality to learn, their learning performance can be significantly improved. After analyzing the experimental data, the students using virtual reality can significantly improve their learning performance.

Table 1. The result of the dependent sample t-test.

	Mean	SD	t	p
Pre-test	39.39	19.75	-11.064***	0.000
Post-test	86.36	9.33		

*Note: ***p < 0.001*

Most students said they liked learning in immersive virtual reality since it allowed them to do hands-on training, which left them with a strong impression of the basic concept and application of Raspberry Pi. In addition, the students also said that virtual reality enabled them to engage in the course and increase their learning performance as it could add numerous unbelievably and imaginatively interesting interactions and games to their learning, which is different from the limitations of traditional teaching.

4. Conclusion

In conclusion, the experiment confirms that learning in virtual reality could significantly improve students' learning performance. Therefore, the application of virtual reality in education could be imperative in the future.

Reference

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