Measuring Learnability through Virtual Reality Laboratory Application: A User Study

ABSTRACT

The cutting-edge technology of virtual reality has changed almost every aspect of life in e-commerce, engineering, medicine, and entertainment. This technology has also made its way to the field of education in the form of virtual laboratories. A lack of student engagement and interest towards STEM subjects is reported in the literature. Several studies have been conducted to evaluate virtual reality in education, but these studies are limited in terms of participants and subject coverage. This study aimed to assess the effectiveness of virtual laboratories to develop student's practical learning skills for secondary school physics. For this purpose, a desktop-based virtual laboratory application was developed based on the guidelines extracted from the literature. A user study was adopted as the main research method, and it was conducted with 184 students of 4 different schools. In each school, students were divided into two groups: experimental (used the virtual laboratory application) and control (used a physical laboratory). The data were collected through an academic quiz conducted at the end of the study. The mean score of the experimental group was 7.16, compared with 5.87 for the control group. The results revealed that the students' learning using the virtual laboratory application was better compared with the control group. Interestingly, there was no significant difference in the performance of boys and girls in both groups. The usability questionnaire was also completed by 92 students of the experimental group to assess the application interface. The mean score was 73.5 (above average) with an internal consistency of 0.76. The participants found the virtual laboratory application to be user-friendly, easy to use, and supportive in learning.