

THE DEVELOPMENT AND PERCEPTION OF THE USE OF VIRTUAL REALITY LEARNING KITS FOR ELECTROMAGNETIC INDUCTION

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ABSTRACT

This study aims were to develop a virtual reality learning kit for teaching and learning in Electromagnetic Induction and to determine the perception of the use of the VR video from the perspective of undergraduate Physics students. This research implements development research design by utilizing the ADDIE model which involves five phases which are analysis, design, development, implementation, and evaluation. Convenient sampling techniques were used in this study. A total of 35 undergraduate Physics students in their fifth and sixth semesters of study from one of the public universities in Malaysia were selected. Research instruments used are the expert validity forms and the usability questionnaires. Collected data were then analysed using Statistical Package for Social Science (SPSS) software for validity, reliability, and usability analysis. The findings of the study show that the usability instrument has high reliability with a Cronbach's Alpha value of 0.898. On the other hand, the developed virtual reality learning kits have high validity with 97.0% of the agreement for face validity and 95.1% for content validity respectively while the usability of this virtual reality learning kit is at a high level of agreement with a mean score of 3.37. This virtual reality learning kit helps students in reviewing their lessons on mobile with flexible time. Hence, this will indirectly increase students' motivation to learn the topic of electromagnetic induction in an interesting and fun environment.

Keywords : Virtual reality video, usability, electromagnetic induction, ADDIE.



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I. INTRODUCTION

In the 21st century, teaching aids are very important and should be used in the teaching and facilitation process to ensure the learning process more effective. The use of a suitable teaching aid will effectively increase the student's interest and performance in their learning [1]. The use of teaching aids can help teachers convey information and info related to the topics taught more effectively. The use of virtual reality (VR) as a teaching aid is in line with the constructivism theory which stated that knowledge is constructed based on the learning process that they experience. This is because VR is an example of teaching aids that use the Mobile Learning method (M-Learning). A study was conducted to examine the effect of using VR on the achievement of students with different levels of spatial ability. The research found that the achievement of students with low levels of spatial ability is almost the same as students with high levels of spatial ability [2].

Many students consider that Science is a difficult subject because many terms need to be understood as well as involve complicated calculations. Some students were unable to distinguish between electromagnetic forces with potential differences [3]. It is undeniable that this topic requires deep understanding and mastery of concepts. Therefore, the selection of appropriate learning methods and teaching aids used by teachers is very important to help teachers to convey information accurately. The use of PowerPoint application alone cannot give maximum effect to help students in mastering a concept completely due to the limited function of the PowerPoint itself which limits the ability of students to learn beyond boundary or imagination. Plus, the poor quality of the PowerPoint slides could affect the learning experience and satisfaction [4].

II. METHOD

A. Research Design

The research design serves as a guide to assist researchers in the process of collecting, analysing, and evaluating the results. The research design used by researchers is the development research which implements along with survey studies. A set of the instrument was used in this study to collect data from the selected research sample and then the data were analysed to answer the research questions. This study has used the ADDIE model for the process of the VR learning kit development. ADDIE model is a well-known model that is commonly used for designing effective teaching and learning activities [5]. The five phases in the ADDIE model are Analysis, Design, Development, Implementation, and Evaluation [6]

B. Sample

Two experts were chosen to validate both the newly developed VR learning kits and the research instruments used in this study. A pilot test was carried out to measure the reliability of instruments through Cronbach's alpha value. A convenient sampling technique was utilized in this research. A total of 35 undergraduate Physics students in their fifth and sixth semester of study from one of the public universities in Malaysia were selected as the research sample in order to determine the usability of the Virtual Reality Learning Kits in the teaching and learning of Electromagnetic Induction. Data was collected from the usability instrument that was adapted from a standardized usability instrument [6] and was subsequently validated for its face, content, and reliability.

C. Instrument

Validity forms and usability instruments are used in this research to collect research data. The usability instrument consists of four parts, namely Part A, B, C, and D. Part A is the demographics of the respondents which aims to find out the information of the respondents. Sections B, C, and D have three dimensions namely usability of VR, ease-to-use, and levels of user satisfaction. The questionnaire question set used a five-point Likert scale as the respondents' answer choices. These questionnaires were distributed using Google Form to the research sample together with a link to the VR video.

D. Data Analysis

The data collected were analyzed using Statistical Package for Social Science (SPSS). Data were analyzed using descriptive statistics of percentage. Researchers used the consent percentage method to study the validity of virtual reality videos. The Cronbach's alpha number was used to indicate the reliability data of the research instrument. Finally, researchers used descriptive analysis methods to obtain mean score values to analyze the usability of the VR video.

III. RESULTS AND DISCUSSION

A. Reliability of the Usability Instrument

Table 1 represents the reliability values (Cronbach's Alpha) for every dimension measured in the instrument obtained from the pilot study.

Table 1. Reliability Values (Cronbach's Alpha) for Every Dimension

Construct	No of Item	Value of Cronbach's Alpha
Usability of VR	4	0.842
Easy-to-Use	4	0.814
Satisfying Level	4	0.922
Average Value	12	0.898

This average value of reliability shows that the instruments used have a good level of internal consistency and reliable to be used to obtain the required data.

B. Expert Validity

Table 2 shows the percentage of expert agreement for Electromagnet Induction virtual reality learning kit. Results show that the average percentage of the expert agreement has high validity with 97.0% of the agreement for face validity and 95.1% for content validity, respectively [7].

Table 2. The Percentage of Agreement of Experts

Expert	Percentage of Expert Agreement (%)			
	Face Validity		Content Validity	
	VR Learning Kit	Instrument	VR Learning Kit	Instrument
Expert A	100.0	88.0	92.0	88.3
Expert B	100.0	100.0	100.0	100.0
Average Score	100	94.0	96.0	94.2

C. The perception of the use of Virtual Reality Learning Kit

Table 3 shows the respondents' analysis of the perception of the use of the Electromagnetic Induction VR learning kit.

Table 3. The perception of the use of the Electromagnetic Induction VR learning kit.

Construct	Mean	Standard Deviation
Usability of VR	4.37	0.754
Easy to use	4.38	0.749
Satisfying Level	4.37	0.763
Average	4.37	0.755

The total mean and standard deviation for these three constructs were 4.37 and 0.755, respectively. Overall, the mean score was at a high level and the standard deviation showed a small data distribution. Thus, the results of this analysis indicate that respondents agree on the perception of the use of the developed VR learning kit for teaching and learning electromagnetic induction. This positive perception is in agreement with experts' evaluation. Experts agree that the VR video has high potential to increase the fun of learning as well as promote active learning.

Besides, this VR learning kit also provides convenience to students due to its flexibility to be accessed. This VR learning kit can bridge the gap between educators and students. Distance learning tools such as these VR videos can connect teachers and students in the same space with a digital representation of themselves. Thus, teachers can teleport to the world of VR and guide students through their experiences while using VR video. Effective learning occurs when students can experience for themselves what they are learning. By VR, they are not limited to word descriptions or book illustrations, in fact, they are able to explore topics and see how things come together. Students are inspired to find information related to the topics studied on their own. As such, students could learn by doing rather than passive reading.

IV. CONCLUSION

A validated virtual reality learning kit for the topic of electromagnetic induction was successfully developed. Its perception of use from the perspective of the Bachelor of Physics Education at UPSI had been successfully determined. This virtual reality learning kit had a high percentage of expert agreement. The level of perception of the use of this developed virtual reality learning is also at a very good level.

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