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Application of VR 360 Video in the Introduction of Engineering Survey Equipment

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Abstract

Virtual Reality (VR) is a new technology used in the teaching and learning process in Malaysia. VR is a fully enclosed digital environment that replaces real surroundings. In response to the policy "Redesigning Higher Education 2017" and Industry Revolution 4.0 (IR 4.0), with the initiative of the lecturers from the Department of Civil Engineering, Politeknik Sultan Azlan Shah (PSAS), 'Interactive VR 360 Video in Introduction of Engineering Survey Equipment' was developed. In the development of the VR 360 video, the researchers attempted to match the content of Engineering Surveying syllabus, which involved Levelling and Traverse equipment operation and simulation video of practical fieldwork. The development of 360 videos was conducted to help students to learn the operation of survey equipment by using technology and as a tool to encourage independent learning among students. Indirectly it can overcome the lack of practical skills during the fieldwork. Therefore, this study aimed to evaluate the suitability of Video 360 as a new method in the process of teaching and learning for the engineering surveying course. In order to achieve the aim of this study two (2) objectives were designed, 1) to identify the content of interactive VR 360 video for Engineering Surveying that corresponds with the content of the syllabus and 2) to explore the perception of students towards the application. Data collection has been done through an online questionnaire (i.e. Google form) to gather opinions from different respondents. Based on the findings, video 360 content was developed according to the syllabus and is suitable as a teaching aid to students. Besides, the study found that students' perceptions of the use of video 360 application were positive based on the high average mean score.

Key-word: - Engineering Surveying, survey equipment, video 360, polytechnic students

1. Introduction

The advancement of Information Technology is very influential and provides tremendous benefits to the field of education. As we know, the information technology has an important role in modernizing the structure of education, from conventional to digital technology-based learning process. Technology integration is defined in terms of how teachers use technology to perform familiar activities more effectively and how this usage can re-shape these activities (Pourhossein Gilakjani, 2017). This shows that the integration of technology has facilitated learners' and educators' ways in obtaining and delivering knowledge as well as information respectively.

Robotic, cloud, Internet of Things (IoT) analysis, and many other technologies are explored and used by industry in this era of revolution 4.0. Thus, educational institutions in Malaysia do not miss the opportunity to provide various recent technologies for teaching and learning purposes. Higher education must prepare skilled graduates to meet the challenges of the Industrial Revolution 4.0. Accordingly, higher learning institutions need to plan to move in line with the Malaysian Education Development Plan (Higher Education) 2015-2025. PSAS is also not left behind to face the challenges of the 4.0 industrial revolution, most high-tech equipment and software facilities have been provided such as AR, VR and Adobe, and others to assist lecturers in the teaching process.

Not so long ago, virtual reality was a kind of science fiction material and now this is how engineering students use it to learn their craft. Virtual reality (VR) equipment consists of a VR auditorium and a head display (HMD). This VR set will teach novice engineers to study complex problems and develop creative solutions. The combination of VR and HMD auditoriums aims to help users understand the use of VR in various fields of engineering including mechanical, electrical and chemical. VR as an extension tool is able to provide students with direct experience and a more realistic view of how complex concepts behave in difficult scenarios using other geometric visualization methods.

Lecturers at PSAS take the initiative of VR technology existence at the polytechnic by developing a Survey Engineering Workshop via Virtual Reality that can help students improve their knowledge and understanding of the equipment in the Engineering Survey workshop and its practical procedures as shown in Figure 1.0. Virtual Reality is a simulation video innovation that allows one to interact with an object in 3-dimensional visualization (Dayana Farzeeha Binti Ali, 2009). It can attract students who are now more comfortable with the latest technology.

Figure 1.0: VR 360 Video

This VR 360 video content is divided into several main topics which is Virtual Surveying, Compass Surveying Video, Theodolite Surveying Video and JUPEM Website. The use of a 360º camera allows students to feel the atmosphere in the workshop without entering the equipment storage space and the use of 3D Vista software provides an interactive experience in Virtual Reality (VR). Figure 2.0 shows that students were entertained using HMD to experience the 360 video during the class activities.

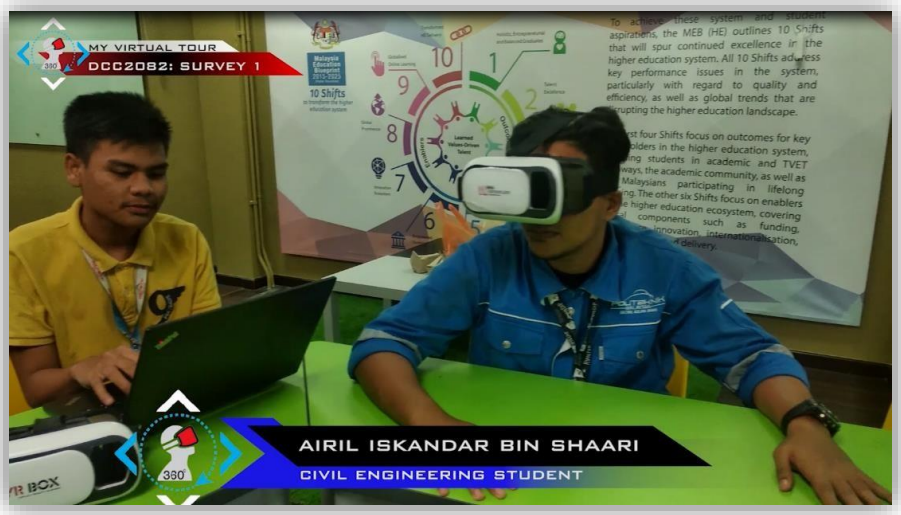

Figure 2.0: 360 Video Exploration

2. Problem Statement

An engineering program at a higher level has been introduced in major education systems since early 1996 (Megat Mohd Noor, 2002). Civil Engineering diploma program requires its students to register engineering surveying course in a particular semester. Engineering surveying is the course that combined theoretical coursework with hands-on practical field work with experience focuses on the application of engineering principles. The students have almost 56 hours of practical fieldwork during the course to equip them with the necessary skill by applying and adapting engineering practice. These courses are graded through their cognitive skills, affective skills and psychomotor skills. The total of 15 weeks of continuous practical work and lab reporting may become a burden for both students and lecturers. In addition to that, Engineering Technology Accreditation Council (ETAC) requires each student to be graded individually causing limited time for lecturers to brief the guidelines and explain practical procedures to each student as lecturers must also focus their attention to grade students according to the generic skill attributes. Therefore, the VR application can help students improve their knowledge and understanding of engineering survey course focusing on the equipment in terms of cognitive, psychomotor and effective aspects.

As mentioned earlier, in this engineering course, students need to perform practical work throughout the semester by using the lab and survey equipment. Practical work, especially based on the use of specialized equipment, must be done under supervision; therefore, students are unable to self-configure laboratory equipment, experience emergencies or the effects of misconfiguration that can cause equipment damage (Kamińska, 2019). Moreover, there is no possibility to practice and catch up beyond the practical class schedule. Therefore, in order to have the access, students must get the permission from the lecturers in charge. Due to this situation, many problems arise. Students are not allowed to access equipment session without the supervision of the lecturers and when this happens, students need a lot of time to identify the appropriate equipment for their practical tasks. Besides, students can use the equipment within the practical time period only. With a large number of students in one class, they have to share in order to learn and use the survey equipment. This situation may cause the students lack of practical skills during the field work. To address this issue, a number of lecturers developed this VR 360 video application 'Survey Engineering Workshop via Virtual Reality'. After being used throughout the semester, it needs to be reviewed whether this application is suitable or not as a new method in the process of teaching and learning for this course. This is because, nowadays, VR or AR tools open new possibilities for training technologist development.

3. Aim and Objectives of the Study

The aim of this study is to evaluate suitability Video 360 as a new method in the process of teaching and learning for the engineering surveying course. In order to achieve the aim, the objectives of the study developed are as follows:

i. To identify the content of interactive VR 360 video for Engineering Surveying that corresponds with the content of the syllabus.
ii. To explore the perception of students towards the application.

4. Scope of the Study

The development of this 360 Video is research or applied research. The study was done to solve teaching and learning process problems related to handling survey equipment and practical skills for survey engineering course. This Video 360 can solve critical problems that require immediate action, bring changes and new discoveries to the educational development. Video 360 developed in accordance with the engineering survey syllabus that focuses on the introduction of survey equipment, how to use and simulation videos of practical lab with are suitable for students doing engineering survey course to study and understand.

5. Significant of the Study

360 Videos produced can improve student achievement in terms of knowledge because students can understand the needs and functions of each space in the workshop without having to enter the workshop. In fact, the process of borrowing and returning equipment runs more easily and interestingly due to the initial exposure related to the operation and work procedures of borrowing and returning equipment. With this, students are indirectly able to make an analysis of equipment management control skills through each layout and space available in the engineering survey workshop. 360 Videos produced also can improve student achievement in terms of skills, such as students can understand the importance of choosing the right equipment to ensure the accuracy of measurement and meet the needs of the measurement. Students can be exposed to the procedure of preparing the actual equipment before starting the practice through video available with VR. As a result, students are able to plan in advance the equipment that will be used and the practical procedures that will be carried out. In addition, students can learn new things, namely applications and how to use the latest learning technology equipment that uses Virtual Reality technology.

6. Methodology

This study is a descriptive study using quantitative methods. Descriptive is writing to describe a situation systematically and factually accurately (Abdul Ghafar, 1999). The respondents of this study are 149 consists of 113 students and 36 lecturers. There are two samples in this study. The first sample was selected among lecturers at random in five (5) polytechnics that offer engineering survey courses from PSAS, PUO, PSA, PTSB, POLISAS, and PKB. While the second sample is students taken from two programs in the Department of Civil Engineering, Diploma in Civil Engineering and Diploma in Quantity Surveying. The respondents were consists of semester 2 and 3 students. The sufficient sample size was given as adapted from Krejcie and Morgan (1970) and Bartlett, et al., (2001).

The instrument of this study consists of a set of questionnaires. This set of questionnaires is divided into two different sets. The lecturer answered a set of questionnaires consisting of part A (demographics) and part B (syllabus requirements in video 360) while students also had part A (demographics) and part B (perceptions of video 360). Each of the questionnaire items was evaluated using 5- points Likert scales from 1 indicates "strongly disagree" and 5 indicates "strongly agree". Data were analyzed using SPSS Version 16.0. The descriptive statistics and reliability test was conducted in this phase.

7. Result and Discussion

Objectives 1: To identify the content of interactive VR 360 video for Engineering Surveying that corresponds with the content of the syllabus.

Objective 1 was established to get the view from respondents which is among lecturers to identify the content of interactive VR 360 video for Engineering Surveying that corresponds with the content of the syllabus. There are 8 items listed in the questionnaire. The alpha coefficient for the 8 items in the questionnaire for objective 1 is .727, suggesting that the items have relatively high internal consistency. (Note that a reliability coefficient of .70 and above indicate that the items are reliable and the measures are free from error). Table 1.0 shows the mean index of the data and the level of agreement in term of percentage for the content of interactive VR 360 video for Engineering Surveying that corresponds with the content of the syllabus.

Table 1.0: Mean Index of Objectives 1

	ID	N	Mean	Std. Deviation	Strongly Agree %	Agree %	Neutral %	Disagree %	Strongly Disagree %
Video 360 content is relevant to the Engineering Survey Syllabus	KS1	36	4.06	0.41	11.1	83.3	5.6	0	0
Video Content 360 meets the Engineering Survey syllabus	KS2	36	3.78	0.422	0	77.8	22.2	0	0
The content of the topic presented in order	KS3	36	4.33	0.586	38.9	55.6	5.6	0	0
The content of the topics presented facilitates the teaching and learning process	KS4	36	3.83	0.609	11.1	61.1	27.8	0	0
The content of the topics provided is easy to understand	KS5	36	3.72	0.454	0	72.2	27.8	0	0
The information provided in the video is clear and concise	KS6	36	4.03	0.609	19.4	63.9	16.7	0	0
The information presented through video is sufficient syllabus requirements	KS7	36	3.69	0.624	8.3	52.8	38.9	0	0
Video content fits the target group	KS8	36	4.19	0.401	19.4	80.6	0	0	0

From the descriptive studies, Table 1.0 shows that KS3, the content of the topic were presented in order has the highest mean score which is 4.33, followed by KS8, video content fits the target group 4.19, and the lowest was KS7 the information presented through video is sufficient syllabus requirements which is 3.69 mean score. But, KS7 has highest standard deviation 0.62. The findings of the study showed that the mean score of each question item exceeded 3.67, indicating that each question item was at a high mean score. The average mean score was 3.95 indicating that the respondents agreed that the information in this 360 video met the syllabus and learning objectives for this course.

Objectives 2: To explore the perception of students towards the application.

Objective 2 was established to get the view from respondents which is among students about their perceptions related to video 360 application in Engineering Surveying course. There are 10 items listed in the questionnaire. The alpha coefficient for the 10 items in the questionnaire for objective 2 is .896, suggesting that the items have relatively high internal consistency. (Note that a reliability coefficient of .70 and above indicate that the items are reliable and the measures are free from error). Table 2.0 shows the mean index of the data and the level of agreement in term of percentage for the content of interactive VR 360 video for Engineering Surveying that corresponds with the content of the syllabus.

Table 2.0: Mean Index of Objectives 2

	ID	N	Mean	Strongly Agree %	Agree %	Neutral %	Disagree %	Strongly Disagree %
VR 360 video was fun to use in Engineering Survey focus on introduction of level and traverse observation equipment.	IV1	113	4.27	38.9	50.4	9.7	0.0	0.9
VR 360 video appropriate to use in Engineering Survey focus on introduction of level and traverse observation equipment.	IV2	113	4.27	42.5	43.4	13.3	0.9	0.0
VR 360 video encourage independence learning.	IV3	113	4.29	39.8	49.6	10.6	0	0.0
VR 360 video encourage active and creative learning.	IV4	113	4.44	51.3	42.5	5.3	0.9	0.0
VR 360 video develops critical thinking.	IV5	113	4.07	34.5	43.4	16.8	5.3	0.0
VR 360 video support student centered learning.	IV6	113	4.24	40.7	45.1	11.5	2.7	0.0
Easy to access the VR 360 video and did not need any assistance when operating the survey equipment.	IV7	113	4.14	35.4	45.1	17.7	1.8	0.0
VR 360 video increased levels of understanding in the using of survey equipment.	IV8	113	4.3	41.6	46.9	11.5	0.0	0.0
The information in this course was well laid out and easy to understand using the VR 360 video.	IV9	113	4.27	44.2	13.3	0.9	0.0	0.0
Interested in using VR in every course of study in Polytechnics.	IV10	113	4.49	54.9	39.8	4.4	0.9	0.0

The findings of the objectives 2 showed that the mean score of each question item exceeded 3.67, indicating that each question item was at a high mean level. The average mean score was 4.28 indicating respondents have a positive response which they agreed that VR helps students to gain better experience in handling survey equipment and practical tasks.

8. Conclusion

The VR 360 Video produced successfully impacted changes in attitudes and social skills in line with 21st century skills emphasizing on 4C skills; Critical Thinking, Creativity, Collaboration and Communication. Students can think critically because they are able to change the views and perceptions related to engineering survey practice based on new evidences which have been browsed through the VR applications provided. Students have become more prepared and organized based on the information found in the VR applications they browsed. Students work more closely with each other in creating assignments after learning through VR. Students appear to be more flexible in completing assignments involving the use of VR. Creativity can be enhanced because students feel more fun and interested in delving into this subject after this application is introduced to them. Diversity in the learning process makes students think more creatively about something. When students can think creatively, it is easier for students to communicate when doing assignments using VR applications than conventional learning. Students also think that lecturers help students get along in understanding teaching and learning process through VR.

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