

THE INFLUENCE OF INTERACTIVE CONTENT DELIVERY USING AUGMENTED REALITY IN ENHANCING SATISFACTION OF LEARNING PROJECT COURSE AMONG POLYTECHNIC STUDENTS: EYE-CATCHING PROJECT HANDBOOK

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ABSTRACT

The purpose of this research is to explore the influence of eye-catching project handbook as interactive content delivery in promoting satisfaction of learning project course among polytechnic students. The eye-catching project handbook is a creative and innovative ALL-IN-ONE handbook that developed using augmented reality application. Through this handbook, students can digitally interact with objects that overlaying in real-time at the camera view of smartphones. Therefore, a research conducted to indicate how extent the interactive content delivery influences the students. A quantitative method has been used in this research. The elements of the questionnaire consist of four factors include usefulness, ease of use, ease of learning and satisfaction in learning. Based on findings, the usefulness of using the handbook is at high level with a mean of 3.53 and standard deviation of 0.6. The ease of use of using the handbook is at high level with a mean of 3.62 and standard deviation of 0.526. Furthermore, the ease of learning of this handbook at high level with a mean of 3.02 and standard deviation of 0.583. Accordingly, students' satisfaction in learning at high level with a mean of 3.52 and standard deviation of 0.549. As conclusion, the research proved that there is a positive relationship between the handbook as an interactive educational resource and its impact on providing satisfaction of learning among students. As a result, this handbook demonstrates the success of using augmented reality with enrich of basic project guidelines in order to improve learning experiences towards 4.0 education.

Keywords: handbook, augmented reality, satisfaction

1. INTRODUCTION

The evolution of education method has involved technology to increase the teaching and learning throughput. Most studies promote the use of digital learning tools in real-life scenarios (Sharples, Milrad, Arnedillo-Sánchez, & Vavoula, 2009; Ogata & Yano, 2004; Wong & Looi, 2011). The interaction between digital learning tools and the actual environment is very important in order to enhance students' personal knowledge (Wu, Lee, Chang, & Liang, 2013). The interaction can obtain through mobile learning aid such as smart phones which capable to increase students' learning experiences. Such a learning support technology is achievable through the use of augmented reality application. Augmented reality is a growing phenomenon on mobile devices, associated with the increase in mobile computing in recent years and the international ubiquity of internet access. Augmented reality presents a particularly powerful user interface (UI) to context-aware computing environments. It combines human senses with virtual objects to facilitate real-world environment interactions for users to achieve an authentic perception of the environment (Azuma, 1997). Accordingly, an all-in-one eye-catching project handbook created by using augmented reality application in a creative and innovative way. The designed handbook represents

digital information with physical world settings in a variety of multimedia elements such as text, images, audio, video and animation. This allow computer generated virtual imagery to exactly overlay physical objects in real time and students able to experience and explore it interactively through the camera of their mobile devices. Besides that, the integration of web tools in learning activities marked an important turning point. Indeed, earlier studies proved that students' experience in learning is enhanced by the usage of web technologies (Annetta, Minogue, Holmes, & Cheng, 2009; Bolliger, Supanakorn, & Boggs, 2010; Rovai, Ponton, Wighting, & Baker, 2007).

2. LITERATURE REVIEW

Towards the era of advanced technologies, there is a higher demand in perceiving technology in education setting (Olson and Riordan, 2012). Earlier studies showed that technology-based learning environments induced positive attitudes and higher satisfaction among learners toward instruction (Kulik, 1994; Schacter, 1999; Sivin-Kachala, 1998). This technology-based learning environments combine the use of computers, multimedia materials, whiteboards, internet, Web 2.0 authoring tools, simulations, games, mobile phones and immersive technologies such as augmented reality (Dror, 2008). In recent years, technology-based learning environment has increasingly focused on immersive technologies such as augmented reality and mobile learning in order to improve the satisfaction and experiences of the users in enriched multimodal learning environments (Johnson, Adams Becker, Estrada, & Freeman, 2015).

Generally, augmented reality is a technology that layers computer-generated enhancements on top of real world in order to make it more meaningful through the ability to interact with it (Augment, 2015). Researchers have documented the potential of augmented reality technology in employing such facilities to assist students in learning in real-world environments in comparisons with traditional instructions (Andujar, Mejias, & Marquez, 2011; Chen, Chi, Hung, & Kang, 2011; Kamarainen, Metcalf, Grotzer, Browne, Mazzuca, Tutwiler, & Dede, 2013; Platonov, Heibel, Meier, & Grollmann, 2006). Based on previous researches, the advanced visualization application of augmented reality has been used for educational purposes in construction training and sustainable design (Messner and Horman, 2003; Vassigh, 2008). Also, the high potential of using this technology capable to enhance the instructional methods in engineering and science as well (Shirazi and Behzadan, 2013). The effective use of augmented reality in more interactive environments of education setting capable to better define the feeling of presence in a virtual environment (Hendrix, C., & Barfield, W., 1996). Researches showed that education with augmented reality has proven to be extremely useful in increasing the students' satisfaction in learning process (T. Y. Liu & Chu, 2010; Jara, Candelas, Puente, & Torres, 2011; Di Serio, Ibáñez, & Kloos, 2013; Bujak et al., 2013; Chang et al., 2014). This clearly revealed that augmented reality technology contributed to improve academic achievement compared to traditional teaching methods as this technology enriching the real world with digital information and media.

3. PROBLEM STATEMENT

The development in the educational setting has involved high technology to enhance teaching and learning environment. Due to the unattractiveness of the existing teaching and learning method, students tend to lost attention in learning and they found it very difficult to understand. DEE5081-PROJECT1 and DEE6092-PROJECT 2 are compulsory courses to be taken by all the final year students of electrical department in Polytechnic Malaysia. The courses required knowledge of electronic components, tools and

techniques in preparing circuits in order to develop a complete project. Students are tending to face problem in finding the notes and sources to start the project. They are uncertainty of the sources they find on the internet. Thus, students hard to relate the theoretical knowledge to implement it practically. Moreover, there are no interactive learning material for the course of project to attract the students. The use of augmented reality in education, and particularly in mobile learning, is still in its infancy and it remains to be seen how useful it will be in creating effective learning experiences. In order to deliver teaching and learning materials in creative and innovative approach, this handbook designed to facilitate students in understanding the basic concept of augmented reality. Throughout this handbook, the augmented reality application will be fully utilized.

4. CONCEPTUAL FRAMEWORK

In this study, researchers have adapted the conceptual framework as illustrated in Figure 1 below.

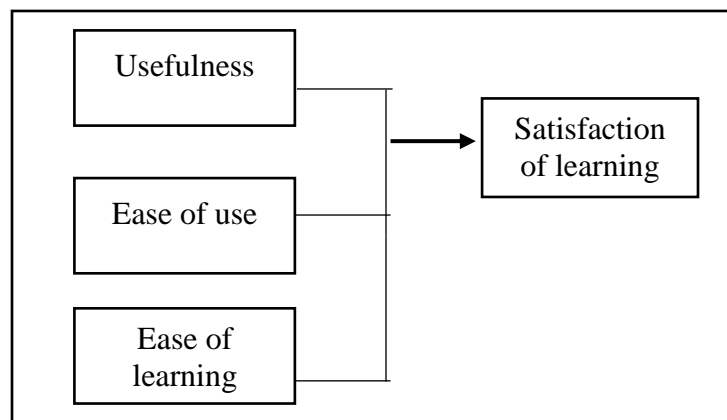


Figure 1: Research conceptual framework
[adapted from (Noraini, 2008)]

An Eye-Catching Project Handbook developed to provide an extensive overview about the Project 1 and Project 2 courses to all the final year students of electrical department in Polytechnic Malaysia. There are variety of information provided to analyse about the electronic components and tools that will be used for project development using element of multimedia. The usefulness, ease of use and ease of learning of the interactive eye-catching project handbook are independent variables for this study which are influence students' satisfaction of learning project course. Thus, students excitedly interact with objects that overlaying in real-time at the camera view of smartphones. This allow the students to satisfy with the interactive content. The results of this study will be able to show the relationship between the independent variables with the students' satisfaction of learning.

5. OBJECTIVES

The objectives of this study were:

- a. To analyse the level of usefulness in using handbook as interactive content delivery using augmented reality.
- b. To analyse the level of ease of use in using handbook as interactive content delivery using augmented reality.

- c. To analyse the level of ease of learning in using handbook as interactive content delivery using augmented reality.
- d. To analyse the level of satisfaction in using handbook as interactive content delivery using augmented reality.
- e. To analyse relationship between the handbook as an interactive educational resource and its impact on providing satisfaction of learning among students.

6. RESEARCH QUESTIONS

Through this study, researchers sought to find answers to the following:

- a. How is the level of usefulness in using handbook as interactive content delivery using augmented reality?
- b. How is the level of ease of use in using handbook as interactive content delivery using augmented reality?
- c. How is the level of ease of learning in using handbook as interactive content delivery using augmented reality?
- d. How is the level of satisfaction in using handbook as interactive content delivery using augmented reality?
- e. How is the relationship between the handbook as an interactive educational resource and its impact on providing satisfaction of learning among students?

7. METHODOLOGY

Methodology is an important aspect in ensuring the objectives can be achieved as planned. This research is a quantitative survey. Quantitative method focuses on aspects of data collection and analysis of data in the form of numbers.

7.1 Participants

The research was conducted at Electrical Engineering Department of Sultan Azlan Shah Polytechnic. A total of 40 respondents were chosen randomly from fourth and fifth semesters that undertaking DEE5081-PROJECT1 and DEE6092-PROJECT 2 courses.

7.2 Procedure

Eye-catching project handbook developed to provide an extensive overview about the project course. This handbook aims to detail each of the project development process. Appropriate images used as markers to identify the object to be displayed on the scene such as graphic, videos, audio, text and animation. This allows the students to visualize the processes in interactive way. Apart from analyzing the basic concepts of project, examples that provided throughout the handbook help the students to achieve a more exciting experience, as well as outline the techniques used most commonly. Moreover, Students are enabled to actively build their own circuits and simulated it virtually. The handbooks were printed and distributed to the students that undertaking DEE5081-PROJECT1 and DEE6092-PROJECT 2 courses. The students were asked to give their judgment about the interactive handbook.

7.3 Instrument

A questionnaire was designed by using online google docs that consists of 30 items. The questionnaire was carried out at the end of semester. There are five parts in the questionnaire; Part A: Biographical information; Part B: Usefulness; Part C: Ease of use; Part D: Ease of learning and Part E: Satisfaction of learning. The four-point Likert Scale used to measure the responses by the respondents for each item in the questionnaire that ranged from 1 (strongly disagree) to 4 (strongly agree).

Table 1: Likert Scale

Score	Range
4	Strongly Agree
3	Agree
2	Disagree
1	Very Disagree

**Adapted from Mohd Najib(2003)*

Statistical Package for Social Sciences (SPSS) version 25 used to analyse all quantitative data gained through the questionnaire. Each part in the questionnaire interpreted according to the achievement of mean score which can be categorized into low, moderate and high as shown in Table 2.

Table 2: The interpretation of score mean

Mean Score	Level
0 – 1.33	Low
1.34 – 2.66	Moderate
2.67 – 4.00	High

**Adapted from Nunally (1978)*

8. RESULT AND DISCUSSION

The data collected analysed based on the result of Cronbach's Alpha through reliability test and descriptive analysis of mean and standard deviation for each factor that influence to the students' satisfaction of learning project course using eye-catching project handbook.

8.1. Reliability test

The data collected analysed based on the result of Cronbach's Alpha through reliability test. The result of the reliability test has shown that the value of Cronbach's Alpha is 0.811. This indicated that the research has good reliability as the value obtained greater than 0.7. Table 3 shows the alpha value for each item constructed in the questionnaire.

Table 3: Cronbach's Alpha score

Elements of Questionnaire	Score
Usefulness	0.749
Ease of Use	0.705
Ease of Learning	0.716
Satisfaction	0.709

8.2. Part B: Usefulness

Table 4 shows that the highest mean is for item B1- "It helps me be more effective" with mean of 3.68 and standard deviation 0.526. Based on the findings, the students realised the eye-catching project handbook is effective to use as it helps students find relevant information much easier by scanning each trigger images rather than having to separately finding for it in other resources. The lowest mean is for item B8 - "It does everything I would expect it to do" with mean of 3.40 and standard deviation 0.632.

Table 4. Part B-Usefulness

NO	ITEM	MEAN	STD.DEVIATION	LEVEL
B1	It helps me be more effective.	3.68	0.526	High
B2	It helps me be more productive.	3.43	0.594	High
B3	It is useful.	3.43	0.675	High
B4	It gives me more control over the activities in my life..	3.53	0.640	High
B5	It makes the things I want to accomplish easier to get done.	3.58	0.594	High
B6	It saves me time when I use it.	3.58	0.549	High
B7	It meets my needs.	3.60	0.591	High
B8	It does everything I would expect it to do.	3.40	0.632	High
Average		3.53	0.6	

8.3 Part C: Ease of Use

According to the result of Part C in Table 5, all items are at high level. This indicates that the use of this handbook with augmented reality applications was easy and enjoyable to the students.

Table 5. Part C-Ease of Use

NO	ITEM	MEAN	STD.DEVIATION	LEVEL
C1	It is easy to use.	3.58	0.594	High
C2	It is simple to use.	3.60	0.545	High
C3	It is user friendly.	3.65	0.483	High

C4	It requires the fewest steps possible to accomplish what I want to do with it.	3.68	0.526	High
C5	It is flexible.	3.70	0.564	High
C6	Using it is effortless.	3.63	0.490	High
C7	I can use it without written instructions	3.48	0.599	High
C8	I don't notice any inconsistencies as I use it	3.63	0.490	High
C9	Both occasional and regular users would like it.	3.55	0.504	High
C10	I can recover from mistakes quickly and easily.	3.75	0.439	High
C11	I can use it successfully every time.	3.53	0.554	High
Average		3.62	0.526	

8.4 Part D: Ease of Learning

The average mean score for Part D is 3.02. Students absolutely agreed that the interactive handbook is suitable to use for the purpose of learning with the highest mean score of 3.08 for item D4 - "I quickly became skilful with it". This results revealed that introducing students to a new instructional technology (Augmented Reality) stimulated their interest and increased their involvement in learning.

Table 6. Part D-Ease of Learning

NO	ITEM	MEAN	STD.DEVIATION	LEVEL
D1	I learned to use it quickly.	3.03	0.480	High
D2	I easily remember how to use it.	2.95	0.639	High
D3	It is easy to learn to use it.	3.00	0.641	High
D4	I quickly became skilful with it.	3.08	0.572	High
Average		3.02	0.583	

8.5 Part E: Satisfaction of Learning

Based on the result of Table 7, the highest mean score is for item E7 – "It is pleasant to use" with mean of 3.63 and standard deviation 0.490. The lowest mean score is for item E3 – "It is fun to use" with mean of 3.43 and standard deviation 0.549. The findings prove that use of this interactive handbook brought satisfactory among students.

Table 7. Part E-Satisfaction of Learning

NO	ITEM	MEAN	STD.DEVIATION	LEVEL
E1	I am satisfied with it.	3.50	0.599	High
E2	I would recommend it to a friend.	3.50	0.599	High
E3	It is fun to use.	3.43	0.549	High
E4	It works the way I want it to work.	3.53	0.554	High
E5	It is wonderful.	3.48	0.506	High
E6	I feel I need to have it.	3.58	0.549	High
E7	It is pleasant to use.	3.63	0.490	High
Average		3.52	0.549	

9. CONCLUSION

The interactive content delivery using augmented reality is convenient and students can navigate easily by scanning the printed images. It is also an effective and attractive method due to the capability of saving time and energy in assessing the relevant information in other resources. Since this is an interactive method, students can digitally interact with objects that overlaying in real-time at the camera view of smartphones using Blippar reader. Correspondingly, students get motivated, excited and engaged in order to use the augmented reality as Web 2.0 technology. Besides that, the usage of augmented reality in the handbook enriching the teaching and learning experience in 21st century education. This method responds indirectly to the higher education plan in 9th shift by transforming the 21st century education to technology-based learning. Therefore, this innovative method can be widely used in most of education institute especially related to computer engineering courses.

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