UNIVERSITI TEKNIKAL MALAYSIA MELAKA

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DESIGN AND EVALUATION OF MOBILE EDUCATIONAL GAME USING M-LEARNING APPROACH FOR SECONDARY SCHOOL STUDENTS

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DESIGN AND EVALUATION OF MOBILE EDUCATIONAL GAME USING M-LEARNING APPROACH FOR SECONDARY SCHOOL STUDENT

FATIN ALIAH BINTI YAHYA

A thesis submitted
in fulfillment of the requirements for the degree of Master of Science
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DECLARATION

I declare that this thesis entitled "Design and Evaluation of Mobile Educational Game using M-Learning Approach for Secondary School Student" is the result of my own research except as cited in the references. The thesis has not been accepted for any degree and is not concurrently submitted in candidature of any other degree.

Signature : ………………………...…………….

Name : Fatin Aliah binti Yahya

Date : ………………………...…………….

APPROVAL

I hereby declare that I have read this thesis and in my opinion this thesis is sufficient in terms of scope and quality for the award of Master of Science in Information and Communication Technology.

Signature   : …………………..………………..

Supervisor Name   : Ts. Dr. Ibrahim Bin Ahmad

Date   : …………………..………………..

DEDICATION

This research is dedicated to my family and friends who are never missed to give attention

and love throughout my research journey.

This research also dedicated to my supervisor, Ts. Dr. Ibrahim bin Ahmad who have

guided me with great attention and motivated me to set a higher goal to produce a better

research.
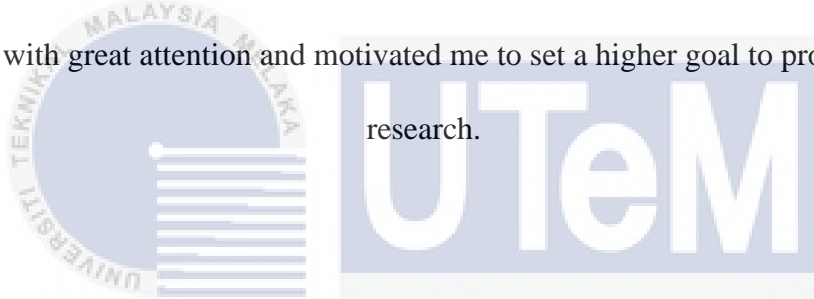
Finally, I dedicated this research to all UTeM lecturers, staffs and SMK Ubai teachers who

involved in giving cooperation for this study.

ABSTRACT

Game-based learning is one of the most widely used methods in education nowadays. Starting with Personal Computer platform games, it has now spread its wings to the mobile platform. However, the studies to evaluate the user acceptance on the required design for mobile-based gaming applications are still not as much. Therefore, this study aimed to identify user acceptance on the characteristics of the design interface that are integrated with M-Learning elements. The characteristics of game design that has been obtained from an initial requirement are based on three main constructs namely interface design, information design and interaction design which are then integrated with the elements of M-Learning that has been identified to develop a mobile educational game application. The action game genre is selected based on user opinions from the pilot study while the acceptance model used as the basis of the study is from the UTAUT-EG acceptance model. The methodology of this study was done by combining the quantitative and qualitative data, where pre-test and post-test were conducted on this mobile game application to evaluate its effectiveness. The process started with the analysis of the game design characteristic based on users' opinion. The sample of this study consist of 85 secondary school students in Form 5 who studied the topic of Novel Literature in the subject of Malay Language. The objective of this study are (i) to design the interface on mobile game-based learning by integrating M-Learning elements, (ii) to identify the user acceptance of the developed game application and (iii) to evaluate the design of the mobile game once it has been completed. Based on the user acceptance questionnaire that has been used, the study found that the mean value obtained from all factors of user acceptance is positive, overall exceeding 4.00 value. The user and expert ratings on the mobile game applications also showed positive appraisal for all rating constructs with the overall mean value is 4.25 for users and 4.36 for experts. t-tests that has been conducted shows that there are significant differences from user scores before and after using the game application. This study shows that the mobile games that have been developed have a positive impact on user acceptance upon the use of games in their learning. Furthermore, the integration of M-Learning elements was also noticed to have a valuable impact on this study. Thus, educational game designers need to pay close attention to the characteristics aspects that are appropriate before designing a mobile educational game interface that is accessible to the target users.

REKA BENTUK DAN PENILAIAN PERMAINAN PENDIDIKAN MUDAH ALIH MENGGUNAKAN PENDEKATAN M-PEMBELAJARAN UNTUK PELAJAR-PELAJAR SEKOLAH MENENGAH

ABSTRAK

Pembelajaran berasaskan permainan merupakan satu kaedah yang telah banyak digunakan di dalam bidang pendidikan masa kini. Bermula dengan platform komputer peribadi, ia telah mula melebarkan sayapnya ke platform mudah alih. Namun begitu, kajian untuk melihat penerimaan pengguna terhadap reka bentuk yang diperlukan untuk aplikasi permainan berasaskan mobile masih kurang dijalankan. Oleh yang demikian, kajian ini bertujuan untuk mengenalpasti penerimaan pengguna terhadap ciri-ciri reka bentuk antara muka permainan yang diintegrasikan bersama elemen-elemen M-Pembelajaran. Ciri-ciri reka bentuk permainan yang diperoleh dari kajian rintis adalah berdasarkan kepada tiga konstruk utama iaitu reka bentuk antara muka, reka bentuk informasi dan reka bentuk interaksi ini kemudiannya diintegrasikan bersama elemen-elemen M-Pembelajaran yang telah dikenalpasti untuk membangunkan sebuah aplikasi permainan pendidikan mobile. Genre permainan aksi dipilih berdasarkan pendapat pengguna daripada kajian rintis manakala model penerimaan yang digunakan sebagai asas kajian adalah dari model penerimaan UTAUT-EG. Metodologi kajian ini telah dilakukan dengan menggabungkan data kuantitatif dan kualitatif, di mana ujian pra dan pos dibuat terhadap aplikasi permainan mudah alih ini untuk melihat keberkesanannya. Proses bermula dengan analisis terhadap ciri-ciri reka bentuk permainan mudah alih berdasarkan pendapat pengguna. Sampel kajian ini adalah seramai 85 pelajar sekolah tingkatan 5 yang mempelajari topik Novel Komsas dalam subjek Bahasa Malaysia. Objektif kajian ini adalah (i) untuk mereka bentuk antara muka permainan mudah alih berdasarkan pendapat pengguna dengan mengintegrasikan elemen-elemen M-Pembelajaran, (ii) untuk mengenal pasti penerimaan pengguna terhadap aplikasi permainan yang dihasilkan dan (iii) menilai reka bentuk antara muka permainan mudah alih itu setelah ianya siap dihasilkan. Melalui soal selidik penerimaan yang digunakan, kajian mendapati nilai min yang diperoleh dari semua faktor penerimaan pengguna adalah positif, secara keseluruhannya melebihi nilai 4.00. Penilaian pengguna dan pakar terhadap aplikasi permainan mobile yang diperolehi juga menunjukkan nilai positif untuk kesemua konstruk penilaian dengan nilai min keseluruhan ialah 4.25 untuk pengguna dan 4.36 untuk pakar. Ujian-t yang telah dijalankan menunjukkan terdapat perbezaan yang signifikan dari markah pengguna sebelum dan selepas menggunakan aplikasi permainan tersebut. Kajian ini menunjukkan bahawa permainan mudah alih yang telah dihasilkan memberi kesan positif kepada penerimaan pengguna terhadap penggunaan permainan dalam pembelajaran mereka. Sebagai tambahan, pengintgrasian elemen-elemen M-Pembelajaran juga dilihat memberikan kesan yang bermakna di dalam kajian ini. Oleh yang demikian, para pereka bentuk permainan pendidikan perlu memberikan perhatian terhadap aspek ciri-ciri yang bersesuaian sebelum mereka bentuk antara muka permainan pendidikan mudah alih yang boleh diakses oleh pengguna sasaran.

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LIST OF ABBREVIATIONS

D-Learning   - Distance Learning

E-Learning   - Electronic learning

EGAM   - Educational Game Acceptance Model

HCI   - Human Computer Interaction

ICT   Information and Communication Technology

KOMSAS   - Komponen Sastera (Literature Component)

M-Learning   - Mobile Learning

MOE   - Ministry of Education

TAM   - Technology Acceptance Model

T-Learning   - TV-based learning

UTAUT   - Unified Theory of Acceptance and Use of Technology

UTAUT-EG   - Unified Theory of Acceptance and Use of Technology Educational

Game

LIST OF PUBLICATIONS

1. Yahya, F. A., Adullasim, N., and Ahmad, I., 2019. The Evaluation of Mobile Educational Game Design Using 3i Factors. *In 2019 IEEE 9th International Conference on System Engineering and Technology (ICSET)*, pp. 227-231. (scopus)

2. Yahya, F. A, Ahmad, I., Roszali, F.F, and Sarudin, N., 2019. A Review on Mobile Game Learning Applications Trends. *International Journal of Recent Technology and Engineering (IJRTE)* (presented)

3. Yahya, F. A., and Ahmad, I. B., 2018. Implementing M-Learning Elements into Mobile Game Technology. *Journal of Advance Research in Dynamical & Control Systems*, 10(11). (scopus)

CHAPTER 1

INTRODUCTION

1.1 Introduction

Technology has become one of the priorities to everybody in everyday life. It has been used for a variety of uses, such as for medical and education. Nowadays, youth are very much in touch with the latest technology, and most of them are very high-tech students (Teodorescu, 2015). Apart from that, mobile technology has been experiencing rapid development, and from this rapid growth of mobile technology, the prices for mobile devices has been lowered which make the majority of people capable of owning a mobile device (Ako-Nai et al., 2012; Sauri et al., 2014). There are many researches have been done for mobile application technology in various area and platform such as mobile application for medical area (Quarles, 2015; Soto et al., 2015; Correa et al., 2018; Elaklouk and Zin, 2018; Smith et al., 2018) and education area with different types of technology such as Augmented Reality technology (Taleb et al., 2015; Liu et al., 2016; Martí-Parreño et al., 2016; Hou and Lin, 2017; Lv et al., 2017) and Game Technology (Albayrak, 2015; Moreno et al., 2015; Yu et al., 2016; Shiue et al., 2017) . Mobile technologies offer the opportunity to embed learning in a natural environment and also provide motivational effects (Schwabe, 2005; Su and Cheng, 2015). In the context of e-Learning, the integration of such devices to the learning process gave birth to an independent type of learning known as mobile-Learning (M-Learning) (Giannakas et al., 2018). The opportunity to implement learning in a natural environment and to provide motivational effects has been offered by mobile technologies (Schwabe, 2005; Su and Cheng, 2015). Furthermore, it has been proved that mobile learning applications can help users to improve their learning as well as to help motivate the user (Shiue et al., 2017).

With the fast development of wireless technology, students exposed to a new educational and learning experience that is led to M-learning (Sarrab, 2015). According to Teodorescu (2015), mobile devices are quite famous among university students, where student have the right way to receive in mobile learning experience. They also proved in their study that traditional teaching and learning strategies corroborated with M-Learning practice have open the way to the successful improvement for their students' skills. They stated that M-learning encourages the effectiveness of learning, sharing, and transferring the knowledge as well as learners' confidence and interest alike. Some other researches which done to secondary school student by (Bourgonjon et al., 2010; Fojtik, 2014; Chung et al., 2015; Darren Pullen et al., 2015; Ozdamli and Uzunboylu, 2015), those researches also provides positive results of using mobile in learning. The learning transformation supports just-in-time and just-in-place learning capabilities, allowing learners (and instructors) to have instant access to learning content and collaborative activities anytime, and from arbitrary device types and platforms (Korucu and Alkan, 2011; Giannakas et al., 2018).

Apart from that, traditional game-based learning undergoes a rapid shift to mobile platforms with the aim not only to move learning outside the classroom and take advantage of them anywhere and anytime experience, but also to transform radical the learning experience (Giannakas et al., 2018). Realizing the interest and development of the game technology industry in the world today, there are many potentials that can be manipulated through its use, especially in education. Thus, the development of the education sector should always be emphasized that the progress of a civilization remains and harmonious. Both gaming and appropriate (learning) strategies, have significantly positive effects to both students' learning achievements and motivation. These learning strategies integrate digital resources with the aim to support and guide students in real-world scenarios. However, the same authors, Giannakas et al. (2018), indicated that without careful design, adding learning support to a game might

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have a negative influence on the enjoyment of students while engaged in the gaming process (Giannakas et al., 2018).

1.2 Problem background

People must adhere to the principle of early changes in the country, namely the Bahasa Malaysia will be the language of the country and the number one use should include all affairs in the country and widely implemented. This is because Bahasa Malaysia is the basis of identity, the foundation of thought and the view of life as a sovereign and dignified nation. The struggle should continue to ensure that the position and use of Bahasa Malaysia continue to be at the right level, not only its widespread use, but also used properly, sincerely and consciously. In its function, the Bahasa Malaysia has been set up as the medium of introductory science. On the basis of the Bahasa Malaysia as the language of instruction in schools, it is widely used.

According to Awang et al. (2016), the Federal Constitution has stated the Malay language as a National Language and is mandatory for use in government-assisted schools as provided under Article 152. Furthermore, Bahasa Malaysia subjects are considered important and have been promoted in line with the National Education Policy, as well as a tool to unite the multiracial population of the country. Bahasa Malaysia is the compulsory subject which need to be learn by all of the student in primary and secondary school in Malaysia and the success of Malay language in the country is closely related to the motivation of the users of the language itself. According to Chee and Vijayaletchumi (2017) in their study, they found that students who failed in Bahasa Malaysia test had a low level of motivation in learning Bahasa Malaysia subject in schools. Attitudes and exercises can shape behaviour. Therefore, it is not possible for this subject to be learnt without training. Lack of interest and the environment is also a constraint for pupils to master this subject. Therefore, parents and educators need to motivate poor students to Bahasa Malaysia. They suggest that the delivery of knowledge in Bahasa Malaysia should be more interactive to facilitate the mastery of pupils' skills, as well

as inculcate interest and provide a conducive environment for students to interact with teachers and other colleagues.

Motivation refers to a strong desire or a strong spirit in someone who encourages him to try or do something with the goal of achieving success. Motivation is a motivator involving the process of generating, retaining and controlling interest (Kamaruddin Hussin, 1993; Chee and Vijayaletchumi, 2017). Psycholinguistic aspect influences student learning when learning Bahasa Malaysia subject in the classroom. Students who are negative towards this subject do not agree to learn Bahasa Malaysia subject, thus less exposure to it (Zamri Mahamod, 2007; Chee and Vijayaletchumi, 2017). This statement can be reinforced by the research done by Awang et al. (2016) on the initial exploration of motivation of Bahasa Malaysia learning at a public university in Malaysia. They argue; students are slightly higher in integrative motivation to learn Bahasa Malaysia compared to instrumental motivation.

Up to now there has been no further research and development of mobile games education conducted to study the effectiveness of the use of mobile gaming in implementing the learning element for the Bahasa Malaysia subject at secondary school level. If the effect of using the educational mobile game application which have been implemented by learning elements can help students to understand their learning in reading, then this study can be used as a method of teaching and learning that can be used continuously.

1.3 Problem statement

Game technology is a technology that requires further research especially in education perspective as to produce a better technology which can assist student for their learning experience. Problems related to the mastery of the students on the subject of Bahasa Malaysia especially in motivation aspect are also discussed in many studies (Abu Bakar and Subramaniam, 2012; Muslim, 2012; Awang et al., 2016; Chee and Vijayaletchumi, 2017; Isam et al., 2017). The preliminary interview with teacher who are teaching Bahasa Malaysia subject

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in secondary school reveal the following problem statement with the currently used learning process. Traditional teaching method is mainly through lecture and rote learning and uses paper and pencil tests to assess whether learners memorize the declarative knowledge, which may be harder to increase learners' motivation (Yu et al., 2016).

(Kaliisa et al., 2019) revealed that the use of mobile technologies in higher education, especially in developing countries, is still at the early stage of development which is being used in an educationally limited way. The interests for including digital games learning in educational contexts is increasing in popularity and the student-centred learning (game-based), can better attract students than traditional teaching methods. (Shiue et al., 2017). Most of the student will have low attention or less motivation with the traditional lesson in the classroom. This can be proved by a complete study has been done by previous researcher Furió Ferri et al. (2015), where they presented the first complete study in which an educational mobile game with special features such as augmented reality (AR) was compared with a traditional classroom lesson. The study was clearly shown that there are the differences in the acquired knowledge before and after using both learning methods. The positive outcome goes to mobile learning compared to classroom lesson because the user of the mobile game learning remembered a lot of the knowledge transmitted in the game.

The monthly results of the students for the KOMSAS division were unsatisfactory because the teaching and learning techniques used were less encouraging. This situation is also due to the fact that teachers of this subject in the school, still using traditional "chalk & talk" teaching method which is more teacher-centred teaching (Rafiza, 2013). Rafiza had done a research for KOMSAS via multimedia project based. They stated that students were weak in this topic as there were lack of variation in teaching and learning techniques for KOMSAS. This statement can be reinforced by the preliminary study done for this research by gathering the data of student who sit examination for Bahasa Malaysia.

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