A Review on Mobile Game Learning Applications Trends

Fatin Aliah Yahya[1], Ibrahim Ahmad[2], Farah Farhana Roszali[3], Norziah Sarudin[4]

[1,2.3]*Faculty of Information and Communication Technology, Universiti Teknikal Malaysia Melaka, 76100 Durian Tunggal, Malacca, Malaysia.*

[4]*School of Medicine, International Medical University, Kuala Lumpur*

ABSTRACT

Technology has become the most priority in everyday life for everybody. It has been used for variety of uses such as for military, manufacturing, medical and education. Nowadays, young generation or youth has been exposed drastically with the latest technology and most of them are very high-tech students. Besides that, mobile technology has been grown rapidly and from this experiencing of mobile technology, the prices for mobile devices has been dropped or reduced which make the most people become capable to own a mobile device. As we known, the mobile device has provided various function and application. One of them is a games application that allows the user to have a learning experience. The game application has been used for learning purposes in education which included in various types of games and different learning content. This paper aim to systematically review in this topic of mobile game application for learning. A total of 42 papers were identified and 10 papers were included for this review. The review will be focusing on the acceptance of the mobile game application for learning. The reviewed papers have been selected using different search engines and the papers have been filtered to meet the objective of this paper. Most of the reviewed paper show positive effect on the usage of the game application for learning and improve their learning process. Mobile game application which has been used for learning is not a new field as the paper reviewed from this study is from 2012 until 2019. It will keep continue as mobile technology has become necessity in everyday life.

Keywords: *Mobile Learning, Mobile Game, Acceptance.*

I. INTRODUCTION

According to Oxford Dictionaries, game is defined as: "An activity that one engages in for amusement or for fun". While the basic definition of the game is to play or to compete between two or more players with the rules set to achieve the objectives of the game. The game consists of various types or genres for example sports, simulation, adventure, escape and so on. This concept related to activities involving a sense of entertainment and excitement. In the field of research, mobile game application had a wide interest to be focused on. There are many researchers discussed about game application as game can be used in different types of industries such as medical, training, entertainment and so on.

However, the game not only focuses on people to play but provides an activity in the learning process as well. Subsequent paragraphs, however, are indented. Few researchers have done their research related to mobile game application which has been used for learning purposed.

Educational games have been introduced to learn some learning content or specific skills. It consists of board games, video games, card games and computer games. Today, computer games have been developed and available on the market as some of the educational games can be found on the noble prize-winning website which has developed various educational games for learning basic science concepts. The transformation from traditional or conventional learning process, now the students learn through the latest technology that can attract the interest apart from a wide material access by the students. The opportunity to implement learning in a natural environment and to provide motivational effects has been offered by the mobile technologies [1], [2].

Furthermore, it has been proved that mobile learning applications can help the user to improve their learning as well as helping to motivate the user [3]. 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) [4]. M-Learning defined as any educational provision where the sole or dominant technologies are handled or palmtop devices. It has encouraged the effectiveness of learning, the sharing and transferring the knowledge as well as learners' confidence and interest alike [5]. This learning transformation support 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 [6].

The implementation of learning and teaching process by using the technology is helped in interactive and interesting to convey the information and knowledge. The 21st century education system is a very challenging system of impact rather than the development of national liberalization and globalization in line with the rapid development of technology and ICT [7]. This paper provides a systematic review in the field of mobile game application which has been used as a learning tool by the students. The review that will be discussed might be useful for the researchers who are studying in the same field of mobile game application for learning.

This research aims at investigating the contribution of the mobile game for learning, by studying the effect and acceptance of the user toward the usage of the mobile game learning.

II. METHOD

Our initial strategy was based on the search strategy of the most recent review on game design for students. They have created search strings within the bounds of three categories: 'm-Learning', 'games' and 'educational' and used the search engines such as Google Scholar, IEEE, Scopus and Science Direct.

For the purpose of the current review, we continue this existing search strategy on three level by year range, the search keywords and the search engines. First, our extended year range includes articles published from 2012 to 2019. Second, the search strings were continued in the categories 'm-Learning' (by adding new words such as, 'system', 'technology', 'development') and 'games'(e.g., 'games design', 'brainstorm', 'platforms') and 'educational'(e.g., 'application', 'engagement', 'acceptance'). Third, in other databases for example Web of Science and ACM Digital Library, the search also performed to expand the review to the field of design and HCI to study the acceptance and perception of the target user toward the mobile game learning application. The research and analysis of the papers identified in the first search was carried out independently by the researcher. After that, the data were organized in tables that containing of author, year, objective, sample and result.

III. RESULT

50 papers related to the study have been identified. However, around ten duplicated paper have been removed, around 22 papers have been excluded as they are not conforming with the objective of this paper. The final sample for analysis was composed of 17 papers in total. Fig.1 show the selection of the review process.

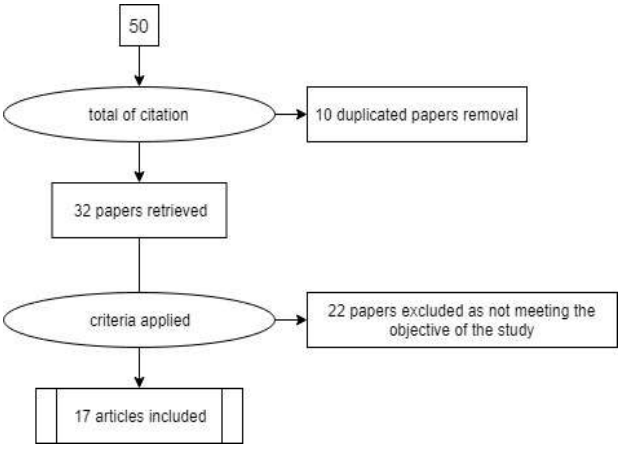

Fig. 1. Selection of Review Process

Four articles has been published in 2017 [8]–[11], two papers published in 2019 [12], [13], two papers in 2018 [14], [15] and one published in 2016 and 2013 respectively [16], [17]. The studies had been conducted in different country such as Malaysia [8], [12], [14], Croatia [9], Indonesia [10], Taiwan [11], [16], Hong Kong [17], England [15] and Iran [13].

Since this paper reviewed about the usage of the game learning, the content of the game for each of the papers have been identified. There are different subjects for the learning content that has been used in their research such as science computer [13], programming [8], Mathematics [9], [16], English [11], [12], Science [15], [17], Jawi [14], and Chemistry [10].

The result in the tables shows that most of the user give a positive feedback regarding on their performance in learning as well as their engagement in playing the games. Different types of user has been conducted previously such as primary students [9], [11], [14], [16], preschool students [15], undergraduate [8], secondary school [10], [12], [13], [17]. Although there are differently categorized, the result gain from those researchers are still positive.

The acceptance model that has been selected to be reviewed in this study is UTAUT model, the result of the paper reviewed related to the usage of UTAUT model have been discussed in the table for paper 11 until 17. All the paper showed a positive result for the acceptance of user toward the usage of mobile game application for learning. The study has been conducted in different places such as Coimbra [7], Namibia [18], Macau, Mainland China[19], Malaysia [20], Beijing[21] and Iraq [22].

Table 1. Synthesis of Paper Reviewed from 2012-2018 in the Field of Mobile Game Application for Learning

Author /year	Objectives	Sample	Result
Paper 1 [8]	To determine the significant different between the traditional teaching and traditional teaching with game-based learning approach	20 undergraduate Year 1 degree student	Result showed that post-test is higher than pre-test mark. The 10 interviewed students said they enjoyed and agreed with the use of game for learning.
Paper 2 [9]	To introduce gamification to digital lessons for students' mathematics learning in lower primary school.	59 primary students	Gamification allows students to sustain more interest compared to the non-gamified approach to learning with digital resources.
Paper 3 [12]	To investigate whether the developed mobile game can motivate students learning the English language to achieve better performance.	64 students	Students who used mobile game learning improved their motivation level as well as their scores in post-test.
Paper 4 [14]	To investigate how the elements of the game in the mobile app impacted students' Jawi spelling skills.	20 primary school students	Positive results as the post test score is higher than the pre-test. The mobile game enhanced student's understanding of Jawi subjects compared to the traditional learning methods.
Paper 5 [10]	To develop and understand the effect of a mobile game-based learning (M-GBL) implementation on student learning outcomes associated with student learning independence.	40 students	The result is positive on the effectiveness of using mobile game as learning tool based on the students' chemical learning outcomes when
Paper 6 [15]	To investigate the learning effects of touch screen mobile game applications by capturing and analyzing the interactions of 4 and 5 years old with the game Angry Birds and report on their impact on science learning and development.	32 preschool students	Older children benefited more from playing the game as evidenced in their improved understanding of how projectile motion works.
Paper 7 [16]	To investigate the effectiveness of the digital game learning application used for learning Math	64 5th-grade students	The average score for the post-test of the students positively increase. Most of the students can accept the game learning and they believe such learning method can help to increase their interest in learning Math.
Paper 8 [11]	To evaluate the speaking ability of the learners y using a digital game-based English learning.	105 elementary students	Game not only enhanced the students' English speaking but also helped them develop a more positive attitude about English learning

Paper 9 [17]	To motivate students to study mathematics using a serious game to utilize that gaming addiction to help students instead	85 students	Playing the game has increased their motivation to study more to beat the game.
Paper 10 [13]	To motivate the audience to use an interactive and entertaining environment due to the difficult time-consuming issues that exist in the learning of computer science, resulting in a loss of motivation.	20 computer science students	Game-based learning can help a lot to engage the audience to learn. Most of them figured that game-based learning was a decent way to educate better learning.
Paper 11 [7]	To investigate the different factors and drivers that could influence students' behavior into the usage of mobile technologies for learning.	160 participants who are medical students from University of Coimbra	Medical students perceive mobile learning and the use of apps moderately positive.
Paper 12 [18]	To understand and measure students' perceptions towards the adoption of mobile learning in Namibian high schools	90 high school learners in the region of Namibia drawn from three high schools.	Students have positive perceptions on the adoption of mobile learning. Most learners can access the internet through mobile phones
Paper 13 [19]	To investigate learners' continuance intention toward using smartphones apps to study by applying an acceptance model	250 samples Macau, Mainland China and overseas	Performance expectancy (PE), social influence (SI) and facilitating conditions (FC) are tested to have a positive influence on learners' behavioral intention toward using smartphone education applications
Paper 15 [20]	To examine how a group of Malaysian pre-services teachers utilised mobile technology for their learning using UTAUT	100 respondents were taken from the population using a stratified random sampling technique	Performance expectancy, effort expectancy, social influence, attitude toward technology and self efficiently are all significant determinants of behavioral intentions to use mobile devices for learning
Paper 16 [21]	To investigate main determinants of mobile learning acceptance in higher education in China.	186 participants at Beijing Normal University	Achievement value, effort expectancy, social influence and performance expectancy have significant influence on the behavioral intention to use mobile learning.
Paper 17 [22]	To identify the factors that influence the acceptance of M learning by students and lecturers in higher education in Iraq.	370 respondents. 159 respondents have participated voluntarily	The constructs of the UTAUT effect positively to the behavioral intention and the use behavior. The Behavioral intention influences positively the use behavior.

IV. DISCUSSION

Technology development has created a new learning concept, m-learning. M-learning is a learning method that uses a smartphone or mobile gadget to enable

someone to learn anytime and anywhere. Students can easily access learning materials. It can provide motivation and enthusiasm for learning [23]. M-learning can also be defined as a learning method using mobile devices to meet the learning needs in a short time and be able to communicate with others without relying on time or place [23]–[25].

The improvement of teaching and learning style should be done in conjunction with modern technology because the learning environment of young generation is not same as the previous generation where the bombarded of technology is not existing yet. As we known, the previous generation lived in the absence of advanced technology while new generation they are witnessing the escalate of technology sophistication. Games also have features that pertain to effective learning environments like elements of urgency, complexity, learning by trial-and- error, and scoring points [26], [27]. Education mobile game application is very suitable to be used in learning process as it can give a lot of benefit for both the teachers and the students. This technology can provide advantages in the form of time use because m-Learning devices can reduce the time and space limitations [28]. Nevertheless, the development of learning from young teachers is needed to improve the new strategies, methods, techniques and approaches in line with the government aspirations towards revolution 4.0.

The literature review about the usage of mobile learning without including the game application have been conducted and it can be wrapped up that most of the user accepted the usage of the mobile for their learning purposes especially in high school as all the result pertain with this field of study show a positive result for each of the papers [18]–[22], [29], [30]. A few papers have been listed in the table of synthesis regarding to the acceptance model used by the previous researcher [7], [18]–[22]. To evaluate the acceptance of the user toward the mobile learning application, the UTAUT model has been used and most of the researchers got a positive result on the behavioral intention to use mobile learning[22], [31]. The performance of the user who use mobile learning for their own usage show a positive effect as well as their acceptance and perception toward the use of mobile learning.

M-learning has recently arisen as a new type of learning model which allows the user to achieve learning materials easily without any barrier while using mobile technologies and the internet[32], [33]. It becomes more popular and famous as there are many studies had done about the game technology for learning process [34]–[37]. There are a lot of subjects that used this game technology medium to teach and learn. Regardless of the type of subjects, educational mobile game application should be provided as in this era our life is surrounded by sophisticated technology. Game-based learning helped learners practice frequently through the context and challenging missions and enhance their interests and motivations [36]–[38].

Literature review which specifically done in the field of game technology was included in this study. The results have been included in the table in result section. The study has been carried out to evaluate the effect of using mobile game learning from user performance. As we can see from the result, all of the users from different studies shown their positive responses towards the usage of mobile game application. Mobile game application able to increase learner performance in learning as it is more interesting to use as a learning tool. Therefore, mobile game application able to motivate learner to learn more passionately as well as helping in engaging the user to the application itself. It is presumed that this increased motivation implicated students in learning tasks and led to a positive learning outcome. [11], [13], [39].

Interface design is one of the significant factors of games that would attract the interest and increase the level of excitement of students while playing the games [40], [41]. Besides that, a good design of user interface can make the communication more effective, easily and less mistaking guidance for users [42]. This factor can help and improve the understanding of learners regarding the topics discussed in the application. Furthermore, simple interface and instructions drive the user to reduce the time taken for studying the application. Hence, interface design of the educational game application should be considered because it gives a lot of advantages in developing of games technology.

V. CONCLUSION

Mobile application has been widely used in educational and the result shows that it has been accepted by most of the user for their learning process. From the review of this study, mobile game application has given the positive effect for the user especially in the performance in learning. Most od the researchers gain a positive effect in learning ability. Most of the user for the mobile game application has positively accepted. They agreed to used game for their learning purposes. This review started from the mobile learning application and has been narrowed into mobile game learning. the review of this paper has been focused on the mobile game learning application which has been done from previous researchers in various learning content and different types of games applications. However, more result and review need to be done specifically on the acceptance of the mobile game technology in educational area. The further study related to this area should be carried out as the game designer should take seriously in designing a product specifically for student to use for their learning.

This conclusion underlines the need to conduct research that seeks to further evaluate the acceptance of mobile game technology implemented with m-learning element in educational area.

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