User Acceptance of Educational Games: A Revised Unified Theory of Acceptance and Use of Technology (UTAUT)

Roslina Ibrahim, Azizah Jaafar

Abstract—Educational games (EG) seem to have lots of potential due to digital games popularity and preferences of our younger generations of learners. However, most studies focus on game design and its effectiveness while little has been known about the factors that can affect users to accept or to reject EG for their learning. User acceptance research try to understand the determinants of information systems (IS) adoption among users by investigating both systems factors and users factors. Upon the lack of knowledge on acceptance factors for educational games, we seek to understand the issue. This study proposed a model of acceptance factors based on Unified Theory of Acceptance and Use of Technology (UTAUT). We use original model (performance expectancy, effort expectancy and social influence) together with two new determinants (learning opportunities and enjoyment). We will also investigate the effect of gender and gaming experience that moderate the proposed factors.

Keywords—educational games, games acceptance, user acceptance model, UTAUT

I. INTRODUCTION

THE prospect of computer games as a learning tool has been widely discussed in various literatures due to its engaging and fun characteristics, in contrast with straight forward teacher-centered way of education approach. It seems as a promising teaching and learning tools for 21st century as reported by Federal of American Scientists [1]. Contemporary students or so called "digital natives" are also found to be attached to computer games technology like never before [2]. Games are said to be able to teach 21st century skills such as problem solving, critical thinking, team working and collaboration as suggested by Gee [3].

Due to that potential, it has attracted researchers from various fields to investigate how games help students learn and how to integrate subject matter into games in the right

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ways. Among the trickiest part is integration of content into games that as of now, there are still no proven formula established, probably due to difficulty of blending these two different natures of entertainment and education into one technology. However, the promised of educational games in terms of motivating students to learn, high of retention, fun, engagement and popularity of games among younger generations seems to be a field worth of large-scale investigations. Federal of American Scientists (FAS) recommends that educational institutions need to transform organizational systems and instructional practices to take greater advantage of new technology such educational games.

Games definition can be vary. Computer games fall under digital games that defined as technology that provided visual information to one or more players, accepted input from player(s), use a set already programmed rules together with sensory interface and story that provide emotional appeal [4]. Educational game is a branch of games that is designed purposely for teaching and learning. FAS defined educational games as the knowledge of pedagogy that is integrated with the features of games that are motivating, engaging and rewarding to users. Thus, educational games can be defined as games technology for teaching or learning that integrates educational content of specific subject designed to meet desired learning outcomes for specific students. It is primarily designed to infuse more motivation for students to learn. Game has several delivery platforms such as computer – online and offline, console – Sony Playstation, Microsoft Xbox and Nintendo Wii, handheld – Sony PSP, Nintendo Game Boy and arcade based games. Digital games also have different genre such as board games, card games, strategy games, shooting games, sports games, role-playing games, action games, adventures games and multiplayer online games. Games genres keep expanding with the advancement of hardware, software and new technology.

EG believes to be able to teach various learning domain [5], [6]. Garris et al have found that EG are able to help student learning of various domain such as cognitive, affective as well as psychomotor skills [7]. Among the most widely discuss findings of EG is its ability to increase student motivation to learn [8], [9], [10], [11]. Study by Garzotto [12] revealed that multiplayer online games provide learning benefits on affective level as well as knowledge domain. Other studies also acknowledged the benefits of using games for learning such as [13], [14], [15] and [16]. According to these

studies, game motivates learning, offer immediate feedback, support skills, and influences changes in behavior and attitudes.

In Malaysia, research in EG are still very new. However, literature collections shown that this research field is expanding fast. Studies found that the younger generations are adapting rather fast into games technology [17], [18]. Study by Rubijesmin [19] indicates that most Malaysian students are familiar with many genres of computer games, an she believes games playing encourages social skills among the students. It is stated that more than 90% of male and female primary and secondary students have played some kind of computer games. In higher institution, study by Roslina et al [17] found that all of the students in the sample are playing computer games, in fact, about 35% of them play games almost every day. Most students also agree with the idea of using games as their learning approach (89%). Another study stated that 92% of secondary school students have experienced playing digital games and about 35% of the students spend more than 3 hours per week playing digital games [20]. These studies provided some insights that our teenage students have shown interest in using games for learning.

EG is already being tested in several studies such as Civilization III to teach history and geography, SimCity as a city planning games and Roller Coaster Tycoon to teach physics [1]. However, with many attempts to integrate games into education systems and rapid research growth in educational games field, less is being known about the factors that might affect student acceptance of educational games technology. Students are important elements but often overlooked in the e-learning adoption process [21]. Understanding factors that might affect student acceptance is important as suggested by literatures [22], [23], and [24]. It is useful for instructional game designers to take the factors into account during the design requirement process, thus increase the chances for EG success [25]. In addition, it could help instructors to integrate technology into a classroom in enhancing and improving the learning process [25].

Generally, factors that contribute to IS acceptance are varies according to people background or demographic, and other factors such as usefulness, ease of use, social influences, self efficacy and attitude are among the contributing factors for people to accept or reject any systems. User acceptance study is seeking those factors among an intended group of users to better leverage the use of the invented system. It is also extended beyond usability study by seeking to understand the reasons that might affect user decision to accept or reject an information system. Tremendous development of new systems in this century also needed better and deeper understanding of user factors to enhance it potential and usage.

Educational games, being the new buzz word in education and games research lately, is still very much lacking of understanding on the user factors [26]. Lack of user acceptance can be a significant impediment to the success of new information systems, in fact users are often unwilling to use IS which can result an impressive gains if used [27]. Davis [28] has viewed user acceptance as the pivotal factors in determining the success or failure of any IS project. Therefore,

we seek to investigate the acceptance factors of educational games among undergraduates' students in Malaysia.

This paper is organized as follows. Section two discusses on the theoretical background of user acceptance. Section three discusses about research model and hypotheses and finally section 4 is on the conclusion and future works.

II. THEORETICAL BACKGROUND

This section discusses theories and models related to adoption of new information systems and review of literatures on the user acceptance of educational games.

User acceptance is defined as demonstrable willingness within a user group to utilize information systems for the tasks or purposes that are intended to support [27]. It is also suggested that user acceptance of any information systems for intended purposes can be modeled and predicted.

Acceptance theory seeks to extend the existing model of user-centered design embedded in usability engineering approaches from issues of interface design towards predictions of likely usage. Among the most widely used technology acceptance model are Technology Acceptance Model (TAM) by Davis [28] and Unified Theory of Acceptance and Use of Technology by Venkatesh (UTAUT) [29].

Dillon and Morris [27] have suggested that principal of theoretical perspectives on technology acceptance is perhaps the diffusion of innovation (DOI) theory by Rogers [30]. It has been applied to both individual and organizational levels.

DOI contains five characteristics of innovations that affect their diffusion which are relative advantage (to extent which a technology offers improvements over currently available tools), compatibility (its consistency with social practices and norms among its users), complexity (its ease of use or learning), trialability (the opportunity to try an innovation before committing to use it, and observability (the extent to which the technology's output and its gain are clear to see). Diffusion studies have demonstrated that innovations affording advantages, complexity, potential trialibility, and observability, will be more extensively and rapidly diffused than innovations with the opposites characteristics [31].

A. Technology acceptance model (TAM)

User acceptance is growing research field originated in information systems (IS) research. The most common theory is Technology Acceptance Model TAM [28]. TAM explained the user behavioural intention to use a technological innovation. It becomes one of the most widely used model in IS due to its simplicity and easy to implement. A key purpose of TAM is to provide a basis for tracing the impact of external variables on internal beliefs, attitudes and intentions.

TAM proposes that perceived ease of use (PEOU) and perceived usefulness (PU) are the two most important factors in explaining system use (Figure 1). Perceived usefulness is the degree to which a person believes that using a specified system would enhance his or her job performance. Perceived ease of use stands for "the degree to which a person believes that using a particular system would be free of effort". It has one dependent variable – behavioural intention, which means the degree to which a person has formulated conscious plan to perform or not perform some specified future behaviour. TAM

is originated from Theory of Reasoned Action (TRA) by Ajzen and Fishbein [28] which discussed how attitude impacted behaviour. TAM is generally regarded as the momentous theory due to increasing volumes of relevant researches in recent years. It is also being applied into many different fields.
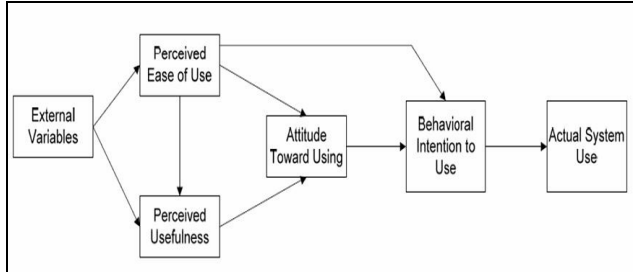

Fig. 1 Technology Acceptance Model (TAM) Davis 1989

B. Unified Theory of User Acceptance and Use of Technology (UTAUT)

Another popular and more recent model in IS study is Unified Theory of Acceptance and Use of Technology (UTAUT). The model was formulated by Venkatesh [29] through extensive review as well as empirically compared eight acceptance models which are theory of reasoned action (TRA), technology acceptance model (TAM), motivational model (MM), theory of planned behaviour (TPB), model of PC utilization (MPCU), innovation diffusion theory (IDT), combined TAM and TPB (C TAM-TPB) and social cognitive theory (SCT). This rigorous combination and comparison of acceptance models resulted in the formulation of the UTAUT model that combined almost every aspect of IS acceptance from system's characteristics (how system will help user in doing their tasks and how easy it is to use the system) and users' characteristics (attitude, social influence, anxiety and facilitating conditions) in predicting user acceptance. UTAUT has the capability to explain about 70% of variance, thus provides useful tool for managers to assess the likelihood of success for the new technology introductions. Venkatesh et al further encouraged others to continue validating and testing their model using different technology and context, also identifying new constructs that can add to the prediction of IS intention [29].

UTAUT has four direct determinants of behaviour intention and use behaviour: performance expectancy, effort expectancy, social influence and facilitating conditions. UTAUT also has four moderators that are found to mediate the effects of the four key determinants on usage intention and behaviour (Figure 2).
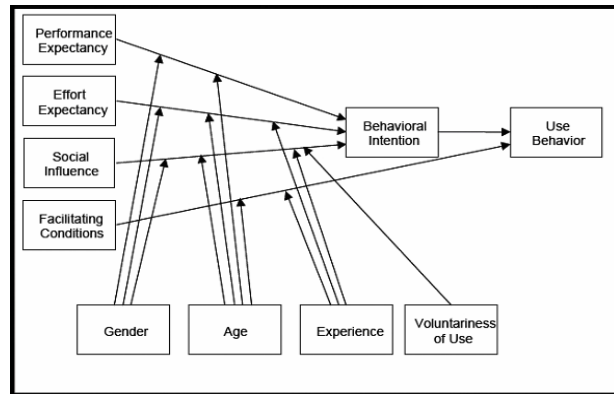

Fig. 2 Unified Theory of Acceptance and Use of Technology (UTAUT)

The lack of user understanding in educational games research and novelty of UTAUT in user acceptance research has initiated this study to investigate user factors regarding acceptance of educational online games.

UTAUT studies were originated from the use of information systems in organization to improve work performance. Its popularity has extended into other contexts of studies including mobile services [32], [33], e-government [34], [35], internet banking [36], [37], and medical [38], [39]. However, literature on usage of UTAUT in educational games context is relatively nonexistent. Although several studies have been done on game acceptance factors, those studies used TAM or other theories/models and was done on entertainment games [40], [41], [42] and [43]. There are few studies done on EG acceptance but with different focus and model such as i) Bourgonjon et al [22] used extended TAM model to investigate preferences of school students in using EG and Kebritchi [44] used Diffusion of Innovation (DOI) to investigate factors affecting teachers' adoption of modern educational computer games.

This paper has reviewed several studies related to games acceptance including both EG and entertainment games. Table 1 shows the literatures' summary of game acceptance studies.

III. RESEARCH MODEL AND HYPOTHESES

UTAUT model is based on job environment, whereby users use the information systems to assist their working process. However, since educational games in some ways differ from the traditional IT context, the UTAUT constructs do not fully reflect the educational games context factors that may influence user acceptance. Thus, some modifications need to be done to the original model to assist the nature of new technology. Besides, traditional acceptance model can be modified to suits the needs of other technology [45]. After considering the context of educational games and user factors, we propose two new constructs into UTAUT in order to account for online educational game acceptance: perceived learning opportunities and perceived enjoyment.

TABLE 1
LITERATURES SUMMARY OF GAMES ACCEPTANCE STUDIES

Author, Year, Model	Sample/ Technology/ system	Findings
Bourgonjon et al et al, (2010), Extended TAM	858 Flemish school students/ Educational games/ No system were used	Usefulness, ease of use, learning opportunities and personal experience with games have direct effect on preference with gender effect found to be mediated by experience and ease of use.
Kebritchi, (2010), Diffusion of innovation	3 school teachers/ Educational games/ Dimenxian	Relative advantage, compatibility, complexity, trialability and observability
Fang and Zhao (2010), extended	173 US universities student/ Several games genre	Enjoyment and perceived ease of use. Two personality traits (sensation seeking and self-forgetfulness) have positive impact on enjoyment
Fetscherin and Lattemann, (2008), Extended TAM	N=249 second life users/ Virtual worlds/ Second Life	Community, attitude, social norms have direct effect on perceived usefulness while anxiety does not, ease of use effect usefulness and intention.
Wang and Wang, (2008), Extended TAM	281 responses/ Online games/ World of Warcraft, Lineage and Maple Story	Perceived playfulness on intention based on gender. Self-efficacy, perceived playfulness and BI were all higher in men while computer anxiety was higher in women. No gender differences on system characteristics (speed, feedback and challenge)
Ha, Yoon and Choi, (2007), Extended TAM	1169 broadband gamers/ Mobile video games/ Not stated	Perceived enjoyment is better predictor than usefulness. Age and gender are also key moderators of game acceptance.
Hsu and Lu, (2004), Extended TAM	223 web based gamers/ Several Games on different websites	Social norm, attitude and flow experience explain about 80% of game playing, key determinants is ease of use.

Educational game is considered recent technology especially in Malaysian higher education systems and none of the systems is under implementation, we therefore used behavioural intention as a dependant variable in the early stages of online educational game acceptance. Therefore, two original constructs from UTAUT were omitted; facilitating conditions and use behaviour. Additionally, we will investigate the acceptance of online educational games in totally voluntary usage context and the students are from the same age group, so we have omitted the voluntariness of use and age moderators. The model proposed is presented in Figure 3.
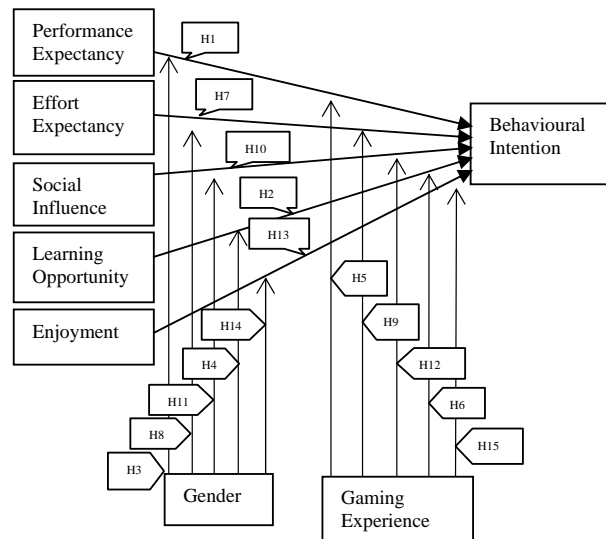

Fig. 3 Proposed educational games acceptance model

The proposed educational games model has six latent variables and two moderators. Altogether, we generated 15 hypotheses as discussed in the following paragraph.

A. Performance Expectancy and Learning Opportunities

In UTAUT, performance expectancy is the key determinant of predicting user behavioural intentions as suggested by Venkatesh [29]. Performance expectancy defined as "the extent to which an individual believes that using an information system will help him or her to attain benefits in job performance". Detail inspection of items measuring performance expectancy shows that it is focused on results of performing the activities on user performance. From the educational point of view, it might be argued that this is rather restrictive for the learning context because it is narrowly focused on results while it is generally agreed that education goes beyond the mere outcomes. Consequently, the learning process has to be taken into account as well. Thus, we add the construct learning opportunities in order to account for the process of learning. Study of educational game acceptance by Bourgonjon et al [22] also suggested that there are separate measures between performance expectancy and learning opportunities considering the distinction between process and product of the two constructs. Perceived learning opportunities (LO) defined as "the extent which a person believes that using an online educational game can offer him or her opportunities for learning". Venkatesh et al (2003) proposed that gender and experience will moderated the relationships of performance expectancy on behavioural intention. In this regards, gender effect are found to be stronger for men than the women [46]. Bourgonjon et al [22] found both gender and experience will moderated the relationship between usefulness and preference to use, therefore, we proposed that the relationship between performance expectancy and learning opportunities towards behavioural intention will also be moderated by gender and

experience. From these constructs, we offer the following hypotheses:

H1: *Performance expectancy has a significant relationship with behavioural intention in using online educational games.*
H2: *Learning opportunities have a significant relationship with behavioural intention in using online educational games.*
H3: *Performance expectancy influences behavioural intention to use online educational games more strongly for men than for women.*
H4: *Learning opportunities influences behavioural intention to use online educational games more strongly for men than women.*
H5: *Performance expectancy influences behavioural intention to use online educational games more strongly for experienced gamers than for novices.*
H6: *Learning opportunities influences behavioural intention to use online educational games more strongly for experienced gamers than for novices.*

B. Effort Expectancy

Effort expectancy is defined as "the degree of ease associated with the use of systems". This construct is similar with ease of use construct in TAM. Venkatesh et al (2003) formulated this construct from three previous models: TAM, MPCU and IDT. Prior studies suggest that construct related to ease of use will have greater effect on women and user with more experience have better acceptance of technology [29]. Since an online educational game is in its infancy, it is believed that effort expectancy will be an important determinant of behavioural intention to use the games.

Also, influence of effort expectancy on behavioural intention will be moderated by gender and game experience. Bourgonjon et al [22] found that gender and experience do affect user intention. Venkatesh et al [29] also found that gander and experience does moderate the effect of effort expectancy on behaviour intention, with such effects are stronger for women and those with limited experience. Therefore, we propose the following hypotheses:

H7: *Effort expectancy has a significant relationship with behavioural intention in using online educational games.*
H8: *Effort expectancy influences behavioural intention to use online educational games more strongly for women than men.*
H9: *Effort expectancy influences behavioural intention to use online educational games more strongly for novices than experienced user.*

C. Social Influence

Venkatesh et al defined social influence as "the extent to which a person perceives that important others to believe he or she should use a new information system". Social influences originated from three constructs of previous 8 model: subjective norms (TRA, TAM2, TPB and C-TAM-TPB, social factors (MPCU) and image (IDT) [29]. This study combined together social influences to the research model in order to explore the moderating effect of gender and games experience on the relationship between social influence and behavioural intention. We expected that social influences will be the significant determinants of behavioural intentions to use

learning games, and that the effect of social influences on behavioural intention will be moderated by gender and gaming experience [29], page 468 suggested that the social influences affect will be stronger for women than men and people with limited experiences.

H10: *Social influences has a significant positive relationship on behavioural intention in using online educational games.*
H11: *Social influences will affect behavioural intention to use online educational games more strongly for women than men.*
H12: *Social influences will affect behavioural intention to use online educational games more strongly for novices than experienced user.*

D. Enjoyment

Enjoyment refers to the extent which the activity of using the computer system is perceived to be personally enjoyable in its own right [47]. Davis et al proposed that enjoyment have positive influence on behavioural intention to use a system and classified enjoyment as a type of intrinsic motivation and perceived usefulness as extrinsic motivation. Educational games are supposed to combine both intrinsic and extrinsic motivation in order to be an effective learning tool.

Games must provide user with enjoyment considering its own nature. This lead to the type of such system as dual, combination of both hedonic and utilitarian as suggested by Chesney [48] and Heijden [49]. Researchers have suggested that perceived playfulness or perceived enjoyment has a significant influence on the behavioural intention to use hedonic systems [42] and as suggested by Bourgonjon et al [26]. Thus an acceptance model for game systems should incorporate enjoyment in it for better prediction of users factors [50]. Ha, Yoon and Choi also (2007) also found that perceived enjoyment is the variable with the greatest effect on intention to play games. Therefore, we propose that enjoyment is a determinant for user intention to use information systems, and it is moderated by gender and games experience, the effect will be stronger for men [42] and for user with more experience.

H13: *Enjoyment has a significant relationship on behavioural intentione in using online educational games.*
H14: *Enjoyment influences behavioural intention to use online educational games more strongly for men than women.*
H15: *Enjoyment influences behavioural intention to use online educational games more strongly for experience user than the novices.*

All of the above latent variables and moderators are presented in table II together with their definitions and sources.

TABLE II
LATENT VARIABLES AND MODERATORS IN THE PROPOSED
MODEL

Variables	Definition	Sources
Performance Expectancy	the extent to which an individual believes that using an information system will help him or her to attain benefits in job performance.	Venkatesh et al [29]
Effort Expectancy	the degree of ease associated with the use of systems	Venkatesh et al [29]
Social Influence	the extent to which a person perceives that important others to believe he or she should use a new information system	Venkatesh et al [29], Ajzen [51], Venkatesh and Davis [52]
Learning Opportunity	the extent which a person believes that using an online educational game can offer him or her opportunities for learning.	Bourgonjon et al [22], Fu et al [53]
Enjoyment	the extent which the activity of using the computer system is perceived to be personally enjoyable in its own right	Bourgonjon et al [22], Chesney[54], Heijden [49], Wang and Wang [42]
Gender	The effect of performance expectancy, effort expectancy, social influence, learning opportunity and enjoyment will be moderated by gender	Venkatesh [29], Vnekatesh and Morris [46] Bourgonjon et al [22]
Gaming Experience	The effect of performance expectancy, effort expectancy, social influence, learning opportunity and enjoyment will be moderated by gaming experience	Venkatesh [29], Bourgonjon et al [22]

IV. CONCLUSION AND FUTURE WORKS

Educational games research and developments experienced a rapid growth especially in this century due to rapid hardware and software development as well as preferences among millennial generations. This is due to promising factors offered by games such as fun, engaging and highly motivated. Many attempts have been made to implement such technology into education, formally or off-school time. However, most studies focus on games design and its effectiveness, but little attention has been given in understanding the wider aspects of games that might influence student's acceptance. While usability research focus to quantify the user experiences with the systems and helps to maximize the systems ease of use or user friendliness, user acceptance focus on understanding both ease of use and other factors that might affect user decision to use an information system.

It examined factors (such as benefits, easy to operate, and other social factors) that influence users to adopt any IS. User acceptance also incorporated usability issues in its model together with the user social factors and condition that facilitate users in adopting the systems. Besides, system with good usability not necessarily will be adopted by the user because they might not have specific use with the system. However, system with poor usability might be useful for user to perform specific tasks, hence make them struggle to learn on how to use the system. Thus, user acceptance of information technology combined these two constructs as the main determinants of information systems acceptance. Therefore, it examines both the systems perspective as well as individuals' perspectives in determining the factors that affect user to accept or reject any new information system.

Even though user acceptance is widely studied by researchers, most contexts used are in job organization and less is being done in education sector, it is even relatively unknown in educational games. As a result, we use UTAUT-the recent user acceptance model by Venkatesh et al [29] to predict factors that affect student acceptance of learning games. We use the readily available constructs such as performance expectancy, effort expectancy, social influence and behavioural intentions to use educational games and add two new variables: learning opportunities and enjoyment with two moderators, gender and game experience to explain educational games acceptance factors.

Our future work is to test our proposed model by using educational games among the undergraduate students from several higher institutions in Malaysia. This is a work in progress seeks to find the determinants of educational games acceptance as well the differences between gender, and different types of student (gamers and non-gamers) in accepting the technology. The knowledge will be useful both for decision making process as well as the instructional game designer in understanding what user want and why they want it. Those findings will be useful to better leverage the process of educational games design and development in producing educational games that are preferred by the students.

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