Student Acceptance Model of Educational Games in University Class

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ABSTRACT

This study aims to explore students' motivations for playing educational games. The structural equation modeling (SEM) of data from 591 students in university history classes revealed that perceived enjoyment and satisfaction are significantly associated with students' acceptance and behavioral intention to play educational games, consistent with the predictions of the Technology Acceptance Model. Based on the results, both implications and future studies are addressed.

CCS CONCEPTS

• **Human-centered computing** → **Empirical studies in interaction design**; • **Applied computing** → *Computer games*;

KEYWORDS

educational game, Technology Acceptance Model, perceived enjoyment, perceived satisfaction

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1 INTRODUCTION

Digital games have become efficient tools in education. Digital games provide opportunities to learn specific information in mediated environments by actively inter-acting with educational contents and agents within games [12, 13]. Training through information technology services (e.g., the Internet, game, computer, smartphone) is an important issue not only for high school or university education, but also for effective human resource management in various industries. There have been numerous attempts to deliver educational contents via simulated games [9, 18, 19, 22]. For example, a study conducted by Squire utilized a sophisticated video game named the Civilization series to enhance attitudes as well as learning effects [19]. The study argued that the game not only delivered educational contents to its players, but also provided a chance to develop and improve creative problem-solving capabilities [19].

Despite these potential educational benefits of digital games, much of the design attention has focused on the commercial and entertainment aspects of games [22], with only a few studies examining the effects of games in the field of education [18]. It is unclear whether educational games will continue to sustain interest after the initial novelty of using the gamification strategy in a learning context. Therefore, the present study aims to investigate students' attitudes toward educational digital games and their continual intention to play the games, by utilizing the theoretical framework offered by the Technology Acceptance Model (TAM).

2 LITERATURE REVIEW

2.1 Technology Acceptance Model

TAM, developed by Davis and his colleagues, has been extensively used to predict user acceptance of and attitude towards new technologies and services [7, 8]. TAM consists of four key constructs, perceived usefulness, perceived ease of use, attitudes, and intention to use, which are considered the critical determinants of how users respond to, and adopt new technologies.

A large number of studies has demonstrated that user acceptance of digital devices and technologies is predicted by perceived usefulness and ease of use, which are theorized by TAM as affecting users' attitudes toward the technologies, which in turn can significantly predict intention to use the technologies [6–8, 14]. Therefore, the present study extends TAM to the domain of educational games, and proposes the following hypotheses.

- H1: Perceived ease of playing has positive effects on perceived usefulness.
- H2: Perceived ease of playing has positive effects on attitude.
- H3: Perceived usefulness has positive effects on attitude.
- H4: Perceived usefulness has positive effects on with intention to play.
- H5: Attitude has positive effects on intention to play.

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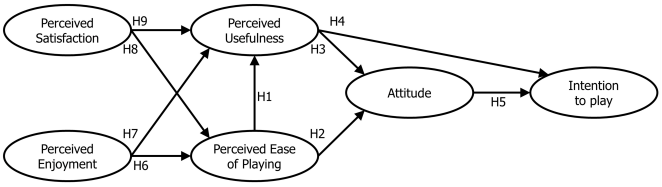

Figure 1: The proposed research model.

2.2 Perceived Enjoyment and Satisfaction

Prior research has found that enjoyment is a critical factor affecting users' psychological states [15]. Users with greater pleasure and enjoyment are more likely to use the technology more consistently and frequently [20, 21]. Therefore, we hypothesize that:

- H6: Perceived enjoyment has positive effects on perceived ease of playing.
- H7: Perceived enjoyment has positive effects on perceived usefulness.

Perceived satisfaction with a specific service and technology is known to positively affect users' behavioral intention to continue use the service and technology. For instance, satisfaction with the Internet is positively related to intention to use [4, 5, 14, 16]. In addition, this relationship was confirmed by a large number of previous TAM studies. Therefore, we hypothesize the followings:

- H8: Perceived satisfaction has positive effects on perceived ease of playing.
- H9: Perceived satisfaction has positive effects on perceived usefulness.

2.3 Research Model

The proposed research model is shown in Figure 1.

3 STUDY METHOD

3.1 Participants

Data for this study came from 591 undergraduate students (449 males, 142 females) in Seoul, Korea, who had a four-week gaming experience in historical educational games (e.g., Civilization series, History of Three States, The Age of Exploration, Total War).

3.2 Procedure and Measures

An online survey was posted on three websites of student communities to examine the proposed relationships in the research model. Students responded to the survey questionnaire items by marking on a 7-point Likert scale (ranging from 1="strongly agree", to 7="strongly disagree").

All questionnaire items included validated items from prior research. Perceived satisfaction (Cronbach's a=0.90) was measured by three items (e.g., Overall, I am satisfied with playing these games) previously used by Park and his colleagues [14]. Perceived enjoyment (a=0.84) was measured with an index of three (e.g., I enjoyed playing these games) items used by Roca and colleagues [16]. Questionnaire items for perceived usefulness (three items; a=0.89; e.g., Playing these games enhances my job or school productivity), perceived ease of playing (three items; a=0.81; e.g., These games are easy to play), attitude towards playing the educational games (three items; a=0.85; e.g., I think playing these games are beneficial), and intention to play the games (three items; a=0.87; e.g., I am likely to continue to play the games) were adopted from the original TAM studies [6–8, 14].

4 RESULTS

4.1 Analysis Method

Structural equation modeling (SEM) and Confirmatory Factor Analysis (CFA) method were employed to test the hypotheses and evaluate the measurement model with a package of LISREL 8.70. Tests of validity and reliability were examined by using the maximum likelihood method.

4.2 The Measurement Model

The measurement model indicated an acceptable fit between the measurement model and the collected data; chi-square/d.f.=4.81, GFI=0.92, AGFI=0.93, NFI=0.91, NNFI=0.92, SRMR=0.041, RMSEA=0.044. In addition, the results of the data passed reliability tests (i.e., Cronbach's alpha, composite reliability, and discriminant validity) [1–3, 10, 11, 17].

4.3 Hypotheses Testing

As summarized in Table 1 and Figure 2, all hypotheses were supported. The SEM showed good-fit indices between the research model and the data; Chi-square2/d.f.=4.94, GFI=0.91, AGFI=0.92, NFI=0.95, NNFI=0.94, SRMR=0.047, RMSEA=0.047 [1–3, 10, 11, 17].

H1, H2, H3, H4, and H5 were supported. Consistent with prior TAM studies, perceived ease of playing was positively related to perceived usefulness (H1, $beta$=0.31, p<0.001) and attitude (H2, $beta$=0.29, p<0.001). Perceived usefulness had significant positive effects on attitude (H3, $beta$=0.54, p<0.001) and behavioral intention to play (H4, $beta$=0.49, p<0.001). Attitude influenced behavioral intention to play (H5, $beta$=0.46, p<0.001). 66.5% of the variance of behavioral intention to play was explained by perceived usefulness and attitude, while 51.1% of the variance of attitude was explained by perceived usefulness and ease of playing.

The relationship between the two external variables and the two constructs of the TAM were explained by H6, H7, H8, and H9. Perceived enjoyment had a significant positive effect on perceived usefulness (H7, $beta$=0.64, p<0.001), while perceived satisfaction positively affected perceived usefulness (H9, $beta$=0.24, p<0.001). Perceived satisfaction had a significant effect on perceived ease of playing (H8, $beta$=0.27, p<0.001), and perceived enjoyment had a moderate effect on perceived ease of playing (H6, $beta$=0.11, p<0.01).

5 CONCLUSION

By examining the two external variables and the four original constructs of TAM, the present study demonstrated that perceived enjoyment and satisfaction were influential factors in designing and implementing educational games in class. Consistent with findings from previous TAM research, our SEM results showed that perceived enjoyment and satisfaction significantly affected user acceptance of and intention to play the games. Games are inherently fun and enjoyable, and enjoyment derived from having this fun is

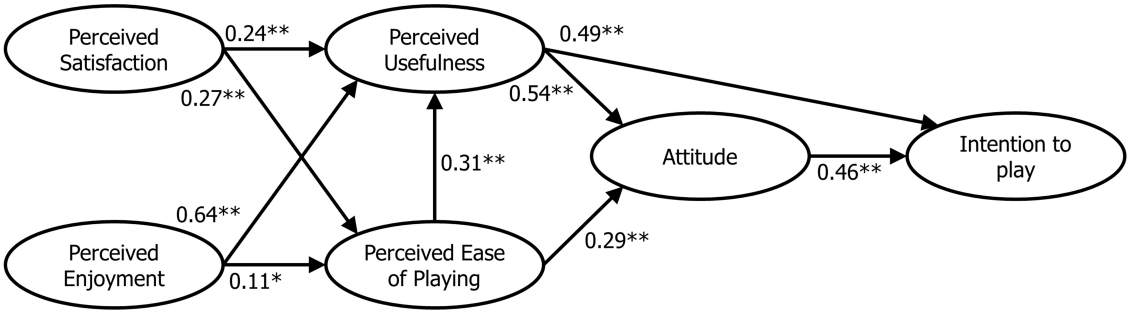

Figure 2: Results of hypotheses testing (p<0.001, *p<0.01).**

Table 1: Summary of Hypotheses Testing (*p<.01, **p<.001, PEP: Perceived Ease of Playing, PU: Perceived Usefulness, AT: Attitude, IP: Intention to Play, PE: Perceived Enjoyment, PS: Perceived Satisfaction)

Hypothesis	*beta*	SE	CR	Outcome
H1. PEP > PU	0.31**	.028	12.55	Supported
H2. PEP > AT	0.29**	.044	12.32	Supported
H3. PU > AT	0.54**	.029	15.60	Supported
H4. PU > IP	0.49**	.021	15.17	Supported
H5. AT > IP	0.46**	.032	14.99	Supported
H6. PE > PEP	0.11*	.019	2.84	Supported
H7. PE > PU	0.64**	.034	25.11	Supported
H8. PS > PEP	0.27**	.026	8.91	Supported
H9. PS > PU	0.24**	.027	8.79	Supported

likely to lead to greater perceived ease of playing and perceived usefulness. In addition, this study revealed that perceived usefulness and attitude (H4 and H5) determined the behavioral intention to play the game.

The present study confirmed the successful application of TAM to the field of educational simulation games. This suggests the key factors in MIS (Management Information System) design can be also applied to designing of educational games. A larger implication is that games should be developed and played not only for entertainment purposes, but also for educational purposes with enjoyment and satisfaction as strong motivational factors. Future studies may confirm and extend our findings by examining individual differences such as gender and age as well as other external, cognitive, and psychological factors in determining users' behavioral intention to play.

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