Developing and Evaluating a Game-Based Project Management Learning Platform

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Abstract—**Educators need to know how to motivate information-management (IM) students (i.e., future business practitioners) to learn and use project management, which can provide the practical skills necessary for IM professionals to analyze data and make decisions. This case designed a platform of game-based learning for IM students' studying based on course of project management. Using a sample of 54 sophomores in Taiwan, a modified TAM model, self-efficacy and flow experience in playfulness were examined using experimental design and causal analysis for learner's attitude and behavior. A knowledge test is conducted to inspect the learning performance with platform support. Test results present higher performance in posttest than in pretest. The empirical results show that self-efficacy has significant, positive effects on perceived usefulness; but not significance on perceived usefulness. Perceived ease of use is positive influence on perceived usefulness on flow experience. In addition, it was found that perceived usefulness and perceived ease of use, positively influence IM students' attitude to use game-based learning platform, and flow experience not significantly effect on attitude to use game-based learning platform, whereas attitude toward game-based learning platform has a significant, positive impact on behavioral intentions, and the behavioral intentions has positively significant impact on actual platform use based on course of project management. Both theoretical and practical implications are discussed in this paper.**

Keywords-game-based learning; project management; perceived usefulness; perceived ease of use; self-efficacy; flow experience

I. INTRODUCTION

One of the challenges of designing game for increasing the study interest is that of engaging IM students. Hosting a course should not just be about the individual teaching but also facilitating IM students' learning interest and experiences. Unfortunately, it seems that the individual teaching is used mainly as the information distribution channel that neglects the needs of IM students. To achieve IM students' attention, new ways to utilize game-based learning based on project program must be found. The use of technology alone does not motivate students that have lived in the midst of technology. Thus, learning situations and methods that engage learners must be created. One approach is to design the game-based learning platform based on project management in education. Computer games may create a new learning culture that corresponds better with undergraduate students' habits and interests.

Traditionally, games are equated with having fun. However, the fun factor is not the magic bullet in educational game design. The promise of educational games is to engage and motivate players through direct experiences with the game world. Games should provide possibilities for reflectively exploring phenomena, testing hypotheses and constructing objects. Games have been used in education primarily as tools for supporting the practice of factual information. The nature of action-based drill and practice games may lead to behavior, where players tend to try actions with no reflection on outcomes. In such games players may simply keep on experimenting with actions until the scores improve.

This paper emphasizes the need for integration of flow experience and self-efficacy, and modification of technology acceptance model (TAM) to be able to design meaningful and engaging educational games. These theories show that the self-efficacy, perceived usefulness, and perceived ease of use, flow experience, attitude, and behavior intention can predict students' behavior. The main purpose of this paper is to examine what perceived factors contribute to the game-based learning intention in order to generate an optimal learning experience for students maximize the impact of educational games.

II. LITERATURE REVIEW

Hasan [1] discussed extensions to previous research on computer self-efficacy (CSE) and systems acceptance by examining the impact of multilevel CSE on IS acceptance. Hus and Lu [2] applied the technology acceptance model (TAM) that incorporates social influences and flow experience as belief-related constructs to predict users' acceptance of on-line games. The results reveal that social norms, attitude, and flow experience explain about 80% of game playing. Kim [3] investigated the factors influencing the usage and acceptance of the mobile game in Korea, based on the extended version of TAM. Hasan [1] examined the effects of general and system-specific CSE on perceived ease of use, perceived usefulness, and behavioral intention to use a system based on TAM. Ha et al. [4] extended TAM to include an emotion variable and measured the moderating effects of gender, age, and prior experience on game adoption. Teo et al. [5] extends

TAM framework, with subjective norm and facilitating conditions acting as external variables and showed that perceived usefulness, perceived ease of use and subjective norm were significant determinants of pre-service computer attitudes. Hsu et al. [6] provided the practical skills necessary for giving the students' study motivation. The empirical results showed that both computer attitude and statistical software self-efficacy have significant, positive effects on perceived usefulness. Moreover, Liu et al. [7] integrated framework: TAM, flow theory, and media richness theory on e-learning. This study revealed that perceived ease of use was a predictor of perceived usefulness; both the perceived usefulness and the attitude of the user were predictors of intention to use.

TAM is an adaptation of the theory of reasoned action (TRA) from psychology specifically tailored to model user acceptance of information technology. To provide an explanation and prediction of the determinants of IT usage, Davis [8] used the cost-benefit paradigm and self-efficacy theory to propose two influential beliefs: perceived usefulness and perceived ease of use. Perceived usefulness is defined as ''the degree to which a person believes that using a particular system would enhance his or her job performance'', and perceived ease of use as ''the degree to which a person believes that using a particular system would be free of effort''. According to TAM, the system usage is determined by individuals' attitudes toward using the system and perceived usefulness. Meanwhile, attitude toward using the system is jointly determined by perceived usefulness, perceived ease of use, self-efficacy, and flow experience. Hence, the hypotheses are stated as follows:

H1a: Self-efficacy will have a positive effect on perceived ease-of-use of a game-based project management learning platform.

H1b: Self-efficacy will have a positive effect on perceived usefulness of a game-based project management learning platform.

H2: Perceived usefulness will have a positive effect on attitude to use game-based project management learning platform.

H3: Perceived ease-of-use will have a positive effect on perceived usefulness of a game-based project management learning platform.

H4: Perceived ease-of-use will have a positive effect on behavioral intention to use game-based project management learning platform.

H5: Perceived ease-of-use is positively related to flow experience of game-based project management learning platform.

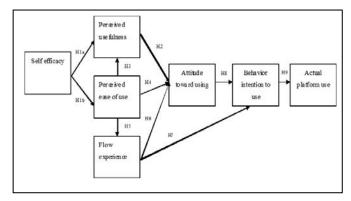H6. Flow experience is positively related to attitude toward game-based project management learning platform.

H7. Flow is positively related to intention to use game-based project management learning platform.

H8: Attitude has a positive effect on the intention to use game-based project management learning platform.

H9: An individual's intention to use game-based project management learning platform will have a positive effect on that actual usage behavior.

Among the latter is a study of learner acceptance of game-based project management learning platform among students. We thus reviewed the definition of existing theoretical determinants, presented new constructs affecting the TAM, and hypothesized. Based on the theoretical review, an amended technology acceptance model as shown in figure 1

will be tested.

Figure 1. The Research Model of Game-based Project Management Learning Platform

III. RESEARCH METHODS

A. Course of Project Management

Project management based on challenging questions or problems is a complex task, through the student's design, problem solving, decision-making or action of research to give students a period of time engaged in self-related work, and the completion of a real product or report [9. 10]. Students in the project management can acquire new knowledge and skills through process of design, training courses and outcomes of products. As the number of aforementioned complex phases in project management, this study focuses the task of decision-making in project management as a lesson unit for teaching experiment.

B. Game-Based Project Management Learning Platform

In this study, game-based project management learning platform is to assist learners learning project management through the computer network game. The operational flow in the platform is divided into practice phase and exam phase. There are two game features were designed in two phases, including the reward / incentive mechanisms of practice phase and peer progress prompt of exam phase. In the practice phase, the more bonus points that learners earned from platform according to the earlier completion of their problem solving. Platform also popup message of encouragement to increase learner's confidence while they reply a wrong answer. In the exam phase, the platform announces the answer progress of each learner on other learner's screen to form a context to increase competitive play among learners. To contrast with the game-based project management learning platform, e-learning platform is usually not usually to emphasis on providing the functions like peer progress prompt, only to provide web-based materials learning.

C. Subjects

This study selected undergraduate students who initially to take the course of project management as the subjects. They all possess prior-knowledge of calculus and production

management. They also attend the courses relating to the preliminary cost estimates, Calculus and Operation Management courses. In the teaching experiment, both pretest and posttest are conducted to verify the difference from learning platform use.

D. Procedure

It is a semester experiment. Subjects are first to take a pretest for getting attainment benchmark of learners in a classroom. An assistant then take the subjects into a laboratory for teaching experiment. Assistant first spends ten minutes to explain the purpose of lesson unit and practice way to the subjects. Next, they take forty minutes to practice exercises. During the practice, subjects are to use game-based project management learning platform to practice exercises. Finally, they take forty minutes to complete a knowledge test as posttest, and an attitude scaling are done for testing platform use.
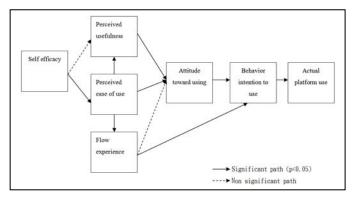
E. Measurement

Measurement for self-efficacy was developed from the study of Compeau and Higgins [11] and Agarwal and Karahanna [12]. Measurements for perceived usefulness and perceived ease of use were adopted from the study of Hong et al. [13], with modifications of fit the game-based project management learning platform. Measurement for flow experience was built from the study of Novak et al [14]. Measurements for attitude and behavioral intention were adopted from Davis et al.'s study [15], and then measurement for actual system use was developed from the study of Venkatesh et al. [16]. The scales were slightly modified to suit the course of game-based project management. All items were measured using a 7-point-type scale with anchors from 'very strongly disagree' to 'very strongly agree'.

IV. RESULTS

In regard to the knowledge test, the posttest showed that subjects prevalently have a higher score than pretest. To test structural relationships, the hypothesized causal paths were estimated. The results of causal paths by structural modeling analysis are shown in the figure 2. Eight hypotheses were supported and two were rejected. The overall fit of the model is acceptable, since the goodness-of-fit statistics are satisfactory and acceptable. The results generally support the proposed model, illustrating the new roles of self-efficacy and flow experience in game-based project management learning platform. The specified relationship between perceived usefulness and perceived ease of use and self-efficacy was supported by the data, as indicated by a significant CR (critical ratio). The CR is a t-value obtained by dividing the estimate of the covariance by its standard error. According to Arbuckle [17], CR values larger than 1.96 and 2.32 are statistically significant at 0.05 and 0.01, respectively. Ease of use of game-based project management learning platform may be conducive to reaching a higher level of positive flow experience and user attitude. Flow experience was the most important determinant of user attitude and user intention for game-based project management learning platform. This reflects the significant effect of attitude on user intention. On the other hand, the effects of self-efficacy on perceived usefulness and flow experience on attitude were not supported

by the results. There is a significant positive relationship between attitude and intention to use, and strong support for a positive relationship between intention to use and actual use behavior. The results imply that perceived usefulness/ease of use may influence attitude, which, in term, affects learners' use intention.

The model indicates that the variance in game-based project management learning platform explained, which is fairly high, given that numerous factors may affect acceptance of, and intention to use the game-based learning platform. The results show that the variance in individual intentions toward accepting the game-based project management learning platform can be explained by the experiment of self-efficacy, perceived ease of use, and flow experience, along with a

relatively small control.

Figure 2. Results of structural modeling analysis

V. DISCUSSION AND CONCLUSION

The main purpose of this paper was to examine what factors would determine the learner acceptance of a game-based project management learning platform, an emerging innovative information system use the near future. We use the TAM to evaluate game-based learning usage based on project management. As prior research demonstrates, we find that self-efficacy is significant in using online game. The higher a person's self-efficacy, the less anxiety that person has in using a project management platform. As Compeau and Higgins [11] found, high self-efficacy can both relieve anxiety and increase positive influence in using a computer. Agarwal et al. [18] found that self-efficacy is more related to perceived ease of use than to perceived usefulness. Moreover, perceived ease of use on game-based project management learning platform, then, is now viewed as another determinant of flow experience, which in turn affects attitude and behavior intention to actual system use based on the course of project management [2].

The teachers who use this game-based project management learning platform should be aware of the importance of self-efficacy and flow experience applied on TAM. Interpersonal interaction among students creates a community in which education value can be created by improving learning interest and efficiency. When students use the game-based learning platform intensely, the interaction with other students will cause more to join in. Therefore, teachers should strive to attract opinion leaders or community builders to affect others to

play this games-based project management learning platform through a normative effect. Moreover, through word-of-mouth communication or mass advertisements, teachers can accelerate network effects to achieve a perception of critical mass. The more students in this game-based learning, the more students-generated experience it is likely to exchange and thus the more users it will attract. This idea, called the dynamic loop, was found by Hagel and Armstrong [19] to yield increasing returns in a virtual community.

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