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What influences college students to continue using business simulation games? The Taiwan experience

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ABSTRACT

Previous studies have pointed out that computer games could improve students' motivation to learn, but these studies have mostly targeted teachers or students in elementary and secondary education and are without user adoption models. Because business and management institutions in higher education have been increasingly using educational simulation games in recent years, factors influencing the continuing use of business simulation games by higher-education students are worth probing into. This research adopted the technology acceptance model, expectation confirmation theory, and agency theory as its theoretical base. Moreover, learning motivation and classroom climate from the perspective of learning, as well as perceived attractiveness and perceived playfulness from the perspective of playfulness and attractiveness were also added to the final research model. A total of 185 valid student respondents in Taiwan's higher education who have used business simulation games in their classes participated in the survey. The results show that perceived playfulness and learning performance positively influence students' satisfaction, which further influence the intention to use computer simulation games. Furthermore, perceived ease of use and perceived attraction play a critical role in determining perceived playfulness. Perceived ease of use was also positively influenced by perceived attraction. The research results on the students' perspective provide a strong support for the teachers to adopt or continue using computer simulation games in classrooms. However, the agency theory failed to be sustained as a useful tool in motivating students' learning activities, which is worthy of further research.

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1. Introduction

Ever since technology was used on games, from the early electronic toys, TV video games, and computer software games up to the latest online game, players have been attracted to these electronic games (Mumtaz, 2001). In the existing literature, there is a close relation between educational simulation games and learning. Randel, Morris, Wetzel, and Whitehill (1992) discovered that educational simulation games can increase the motivation to learn. Terrell and Rendulic (1996) specifically indicated that games increase the students' internal motivation as well as their learning performances. Interestingly, Prensky (2003) pointed out that from the perspective of successful learning, motivation is an indispensable condition and that games just happen to provide such a condition. In their experiment, Schwabe and Göth (2005) applied games in their learning activities, which not only increase the motivation of the students but also increase the opportunity for them to interact with each other.

At present, most computer games emphasize the commercial benefits or leisure aspects, while only a few focus on the curriculum teachings of higher education and business management (Ebner & Holzinger, 2007; Virvou & Katsionis, 2008), the effect of learning on gaming environments, and the factors that influence the teaching designs (Garris, Ahlers, & Driskell, 2002; Leemkuil, de Jong, de Hoog, & Christoph, 2003).

Although the decision to use business simulation games is made by the teacher, the students' perception is equally important in promoting the inclusion of business simulation games in classrooms for three reasons. First, like other technology adoption in education, the teachers would normally like to know the students' response to the new technology. Most teachers interviewed in this study expressed such eagerness and even helped to administer the survey. Second, based on Prensky (2003) claim that games provide an indispensable motivational condition for students' learning, students may be more interested in choosing courses that incorporate business simulation

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games in the instructional activities. However, word-of-mouth from other experienced students may be more critical to their final decisions. Third, for the millennium generation born after 1981, using technology in their learning is but natural (Murphy & Smark, 2006) and games have become popular tools for informal learning (Kapp, 2006). It is therefore important to know how the millennium college students think the business simulation games are being promoted for their formal learning (Lim, 2008; Prensky, 2008). Based on these three reasons, students' responses to classes using simulation games is a critical indicator of the widespread use of simulation games in higher education, which is also why this study targets the students.

How do Taiwan's college students fare? Due to the rapid increase in number of higher educational institutes to over 160 during the last 15 years, Taiwan's college entrance rate has reached nearly 100% as of 2008. The elite- to popular-oriented education reform has bred the issue of decreasing student quality, such that 87% of the college students and 80% of the parents have agreed that the quality of college students is low, and 78% of college professors have agreed that the quality of college students is worse than that 10 year ago (Hsu, 2006). According to the national surveys, for the 2005 junior college students, 20.3% of them never or hardly participated in class activities; 29.9% often and sometimes avoided attending classes; and 49.7% often or sometimes did irrelevant things in class (Liu, 2006). These findings are supported by a 2003 national survey where 36% of college professors evaluated the students' learning attitude in class to be negative (Ru, 2007). Chiu (2007), whose findings were part of the same national survey database, attributed the cause to the fact that over 30% of students were busy with part-time jobs and other activities like online chatting instead of studying. Corollary to this, over 50% of the 2003 freshmen spent less than an hour per day on schoolwork, and this did not improve when they became juniors in 2005. This poses a big challenge for Taiwan's higher education institutes.

On the other hand, up to 40% of the 2005 college junior students were not satisfied with their college learning achievements (Liu, 2006). In addition, they admitted that teacher-student interactive learning, implementation of experiment or research, student group discussion and presentation, research report of self-selected topic, and problem-solving are the most desirable instruction methods for increasing their learning achievement (Fu, 2007). Therefore, some technology-enabled instructional tools such as business simulation games and Student Response Systems (Tao & Yeh, 2009) have become emergent trends in Taiwan over the last few years. These instructional tools assist the teachers in meeting the methods of instruction that students prefer for better student learning achievements. However, the perceived effects of these technology-enabled instructional tools have not been empirically tested especially on a national or regional scope.

To understand the intention of the challenged Taiwanese college students to continue using business simulation games, the main objective of this study is to construct an appropriate research model to empirically test experienced students' perceptions of Taiwan's status-quo business simulation games and their future intention to use these games. In general, many theories and models from different domains may contribute to the intention to continue using business simulation games. Thus, a secondary objective is to propose a research model that is sophisticated enough to represent the complexity of the research issues yet with a high feasibility for an adequate empirical testing according to the observations in literature and Taiwan's physical environment, as well as opinions from in-depth interviews with experienced teachers and students. In the remaining sections of this article, the background information for establishing a common ground of understanding before introducing the research methods is provided first; these are followed by the data analyses, discussions and conclusions.

2. Background theories and information

To set a cornerstone for a common understanding before constructing the research model, related background theories and information based on literature analysis and interview results are briefly summarized in this section to serve as a common ground. These are the Technology Acceptance Model (TAM), Expectation Confirmation Theory (ECT), Agency Theory (AT), educational theories of Constructivism and Motivation, and Taiwan's business simulation games.

2.1. Technology acceptance model

Davis, Bagozzi, and Warshaw (1989), citing the Theory of Reasoned Action (TRA) by Fishbein and Ajzen (1975), points out that TAM is mainly used to explain the degree of acceptance of information technology by a person, while perceived usefulness (PU) and perceived ease of use (PEU) explain the two most important factors affecting the behavior of using technology. TAM can explain the willingness of a user to accept a new technology, and at the same time it can also analyze the relevant factors that influence the degree of acceptance of a user. As shown in Fig. 1, when a person uses a certain technology, TAM can be used to discuss which external factors influence the user's internal beliefs, attitude, and intention, and thus, further influence the condition of the usage of technology.

Since its appearance, TAM has been revised or extended by many scholars to such forms as TAM 2 (Venkatesh & Davis, 2000) and the Unified Theory of Acceptance and Use of Technology (Venkatesh, Morris, Davis, & Davis, 2003). In addition, it has been cited more than 700 times (Davis, 2007). Recently, there have been some critiques and future suggestions for TAM studies in an issue of the Journal of Association for Information Systems (Bagozzi, 2007; Benbasat & Barki, 2007; Goodhue, 2007; Schwarz & Chin, 2007; Straub & Burton-Jones, 2007; Venkatesh, Davis, & Morris, 2007). Nevertheless, PEU and PU remain the two most robust components in several recent TAM meta-analyses (King & He, 2006; Ma & Liu, 2004; Schepers & Wetzels, 2007; Yousafzai, Foxall, & Pallister, 2007).

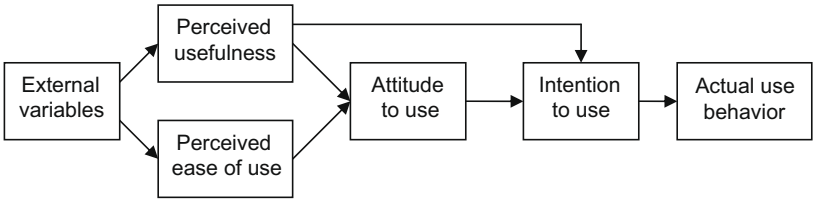

Fig. 1. Technology acceptance model (*Source*: Davis (1989)).

2.2. Expectation confirmation theory

Oliver (1980) proposed the ECT in the area of marketing as depicted in Fig. 2. ECT implies that the initial tendency to purchase the commodity will affect the consumer's behavior to purchase it the next time. If the level of satisfaction for a commodity or a service is high, it will increase the buyer's willingness to purchase again and vice versa (Churchill & Surprenant, 1982). Bhattacherjee (2001a) proposed an information system continuance model that relates satisfaction and perceived usefulness to the degree to which users' expectations about an information system are confirmed. Thus ECT is used to discuss and understand the continued use of information technology.

ECT has been studied more intensively recently in information-related domains. A significant portion of recent empirical studies has shown its integration with TAM for a more comprehensive research framework in such applications as online brokerage (Bhattacherjee, 2001b), e-learning (Chiu, Hsu, Sun, Lin, & Sun, 2005; Roca, Chiu, & Martínez, 2006), and mobile Internet services (Hong, Thong, & Tam, 2006). The importance of ECT is growing. It is even suggested by Davis (2007) as a prominent candidate theory to be considered together with TAM in future research directions.

2.3. Agency theory

The AT came into being during the period 1960–1970. An economist used the idea of risk sharing to discuss the relation among human beings and the relation between an individual and an organization. Afterwards, this idea was applied by Jensen and Meckling (1976) in the agency relation among human beings and thus AT was developed. They define agency relationship as the situation where a principal assigns a work to an agent, thereby granting the agent certain authorities; their agency relations normally exist based on a contract. Eisenhardt (1989) defines AT as the way to best organize relationships in which the principal determines the work, while the agent undertakes to complete it. AT in the past studies was used to discuss the use of incentives and control mechanisms to drive the staff (Bhattacherjee, 1998; Eisenhardt, 1989).

2.4. Constructivism and motivation theories

The constructivism theory and motivation theory are two educational theories most related to students' perception of business simulation games. Merrill (1991) claimed that teaching activities should not merely be designed for teaching but for learning as well. From the view of constructive learning, the roles of teachers and students have changed from the scenario of teachers playing the role of instructors in the past to a situation where assistants, directors, and coaches are now tasked with establishing a suitable learning environment for the learning content. However, the students who played passive roles just accepting information have now become active learners, who voluntarily build complete knowledge in a learning environment.

Shen (2008) pointed out that the education simulation games are designed for use in an environment that allows students to apply the knowledge they have acquired. The principle of constructivism is suitable for the environment of business simulation games because the users put the existing business management knowledge to use, in order to make use of the software to establish a new concept and emphasize on the importance of interaction between teachers and students.

"Motivation", on the other hand, means the cause of the learner's activity and the maintenance of the learner's activity through which the positive goal of the learner's internal motivation is addressed. It is one of the key factors of the influence of learning performances. However, the motivation of learners, their thoughts, and ideas might not completely be the same; thus these motivations can be further classified into the theory of behavior, humanism, and cognition.

First, the motivation theory of behavior implies that motivation comes from learning, and stresses the application of reinforcement to establish a link between stimulation and reaction to make the most of the reinforcement theory in promoting learning as well as the cause and maintenance of motivation (Chang, 2001). Next, humanism is regarded as a need in motivation and it proposes the need-hierarchy theory, which may be classified into five levels represented by Maslow (Li & Shan, 1997). This implies that the responsibility of a teacher is not only to impart knowledge but also to provide a suitable learning environment (Chang, 2001). Finally, the principle of cognition implies that human motivation includes a plan, a goal, an expectation, a reference and a not-so-simple decision as to whether or not an individual must be rewarded or punished (Stipek, 1993). In other words, our behavior is not only controlled by the instincts and the incentives we receive (Li & Shan, 1997), but also it is influenced by what we think, what we believe, and what we expect.

2.5. Taiwan's business simulation games

In Taiwan, the Top-Boss Corporation (http://www.top-boss.com.tw) is the major provider of business simulation games, offering products such as the Business Operations Simulation System (BOSS), Marketing Winners, Distribution Master, and Beer Games. Another business simulation game provider is Pitotech Corporation (http://www.pitotech.com.tw) which offers Virtual Business Management, Virtual Business Retail, and Virtual Business Sport games, but has a much smaller market share in Taiwan. The meaningful differences of these business simulation games and their educational values are as intuitive as their names. BOSS is a general business operation game, while

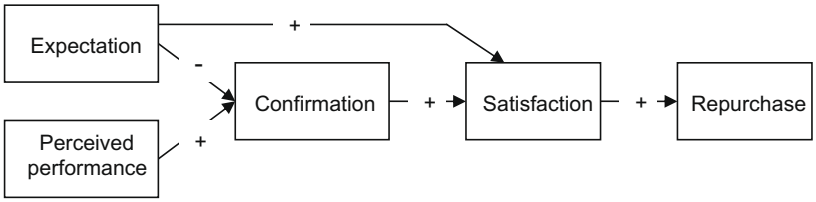

Fig. 2. Expectation confirmation theory (*Source*: Oliver (1980)).

Marketing Winners is a marketing game. Distribution Master is a logistic game, while Virtual Business Retail is a retail. Other related vendors such as APEX International Corporation (http://www.apex.com.tw) which offers the Virtual Stock Exchange game are not appropriate candidates for this study aiming at business management.

In recent years, Top-Boss Corporation has successfully promoted their products to higher education institutes through such means as free trials, workshops, training camps, and sponsorships of national business simulation game competitions. As a result, the earliest product of BOSS game has become the most popular business simulation game adopted in higher education institutes and in national competition games. Logically, Top-Boss Corporation is named after its flagship product the BOSS simulation game. Most of their games are cross-functional decision-making games. Take BOSS for example. It is a general operational game, which includes functional areas of production, sales, procurement, research and development, and finance. Consequently, with multiple expertise and four difficulty levels, the collaborative decision-making games are good training tools not just for business-major college students but also for corporate managers. As TOP-Boss has been able to set up the Chinese Web-based interface on all their business simulation games, it has been expanding their market to China's universities and business corporations in recent years.

As these business simulation games are team-based and competition-oriented, most of the teachers we interviewed or spoke to in the workshops incorporated BOSS or other games in their curriculum as group competition activities. These usually repeated several times in a row several days apart due to its round of game play nature. In addition, for those teachers who use these games throughout most of the semester, the rationale of the different expertise of business decision-makings in the games was used to illustrate the knowledge and applications of the targeted course subjects in class.

Due to the play-by-round mechanism of these business simulation games, each group of students competes with others in each round by entering the required parameters in many Web-based forms. To compensate the form-by-form game playing process, graphical reports or visual performance data are also available for the users to increase their usability and learning interest during the games.

3. Research methods

The primary objective of this study is to understand how students perceive business simulation games and consequently their intention to continue their use. Briefly speaking, the integrated research model considers the variables of adoption, incentive, emotion, and selected educational theories of constructivism and motivation based on the literature analysis and teacher interviews. As the focus is on the experienced students' intention to continue using business simulation games in future classes, ECT is the targeted base model. However Premkumar and Bhattacherjee (2008), imply that the idea of TAM and ECT in the intention to use information technology is complementary in nature. In other words, TAM can explain the acceptance behavior before the adoption, while ECT can explain the behavior of continuance of use. Although several studies have integrated TAM and ECT in their research models (Bhattacherjee, 2001b; Chiu et al., 2005; Hong et al., 2006; Roca et al., 2006), the process with which they were synthesized varied significantly. Therefore, model construction will be introduced from a high-level perspective first, followed by the summary of the hypotheses supported by references.

3.1. Research model derivation

King and He (2006) proposed a TAM component structure that dissects TAM into the core TAM and four other categories, namely, prior factors to the TAM component, factors suggested from other theories, contextual factors to the TAM component, and consequent factors such as attitude, perceptual usage and actual usage. According to King and He (2006) and other TAM meta analyses (Ma & Liu, 2004; Schepers & Wetzels, 2007; Yousafzai et al., 2007), it is not possible to comprehend the factors affecting TAM in this ECT-focused research. Nevertheless, it is important to learn from the TAM literature how it can be integrated with ECT to perfect the research object.

Two of the five suggestions concluded from Benbasat and Barki's (2007) TAM meta-analysis can be taken as guidelines in integrating the base research model. First, a number of studies emphasize the importance of perceived usefulness (PU), but only a few are devoted to the discussion of the factors that cause usefulness. Therefore, Benbasat and Barki (2007), suggested finding out the factors that influence the PU and perceived ease of use (PEU). Second, while TAM forecasts the degree of actual usage of software by a user, it only stresses on the frequency and the number of times of its usage. Thus, this simple way of explaining the degree of usage of a software is deficient (Delone & McLean, 2003; Doll & Torkzadeh, 1998), leading the TAM researchers to neglect other important behaviors of users (Nambisan, Agarwal, & Tanniru, 1999). Schwarz and Chin (2007) also had similar suggestions for the above point.

Based on the above suggestions, the integrated research model, as seen in Fig. 3, can be derived accordingly, which is explained step by step below.

First, how can TAM and ECT be logically integrated for the adoption and continuance of use of business simulation games? According to Benbasat and Barki's (2007) second point, this research substitutes the learning performance in place of the usage intentions and actual usage of TAM. Since the actual usage of business simulation games will produce performance, using learning performance to measure the actual usage will result in a much significant meaning in practice. Furthermore, the cognitive performance of ECT is compatible with the learning performance modified for TAM, thereby providing TAM and ECT a fine linking point between them. The rationalization is as follows: Traditional ECT must collect the three variables, namely, expectations, cognitive performance, and confirmation. In fact, each paired measurement items of expectation and cognitive performance only differ in how the same question is presented before and after the technology adoption. Meanwhile, each measurement item of confirmation repeats the same question of the paired measurement items of expectation and cognitive performance except for their difference (Premkumar & Bhattacherjee, 2008). Therefore, the level of expectation can be inferred through the difference between the counterpart of cognitive performance and confirmation. This is evidently supported by existing studies such as those by Bhattacherjee (2001b), Roca et al. (2006) and Thong, Hong, and Tam (2006), which only concentrate on the confirmation.

Second, how can incentive be added into the base model of TAM and ECT in order to encourage students to engage themselves more in class activities? In the learning environment of business simulation games, the teachers and students share a similar relation to that

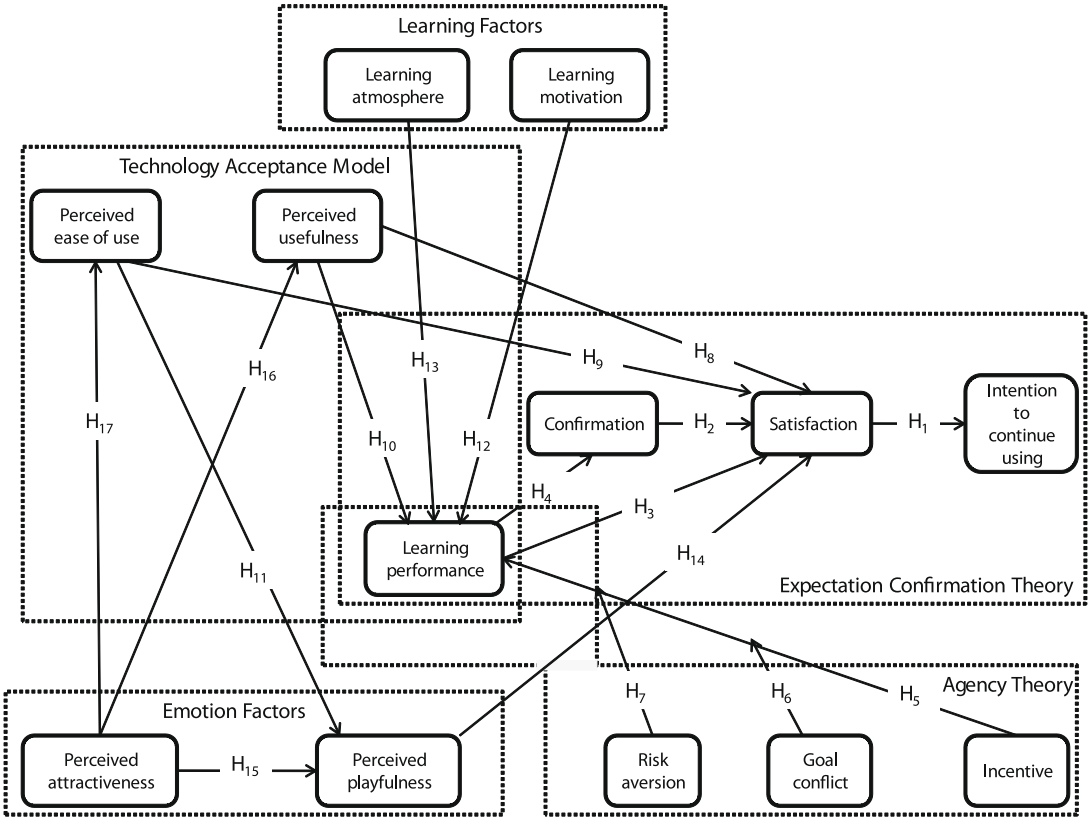

Fig. 3. Continuance use of educational simulation games model.

between managers and employees in business organizations like the AT that explores the use of incentives and control mechanisms to motivate staff in order to reduce the negative effects developed when a goal faces a conflict. In addition, the e-learning studies on user typology reveal that teachers (Tao, 2008) and students (Tao & Yeh, 2008) have very different cognitive types clustered from the same measurement items. Therefore, AT should be appropriately applied to this research to explore the insightfulness of teacher–student relationships. According to the AT, the teacher is regarded as the principal and the student is regarded as the agent. Incentives can encourage a student to learn using an business simulation game. Among the two incentive types (Bergen, Dutta, & Walker, 1992), only the impact of the result-oriented incentives in learning is considered inasmuch as this research is based on the performance of the actual incentive. Therefore, the two moderating variables, risk aversion and goal conflicts, in result-oriented incentives (Bhattacherjee, 1998) should also be included in the research model.

Third, because games bring fun and pleasure into formal learning settings, emotional factors are necessary to be brought into the research model to observe their impacts on the base model of TAM and ECT. According to Ha, Yoon, and Choi (2007), emotion-related factors include cognitive playfulness (Moon & Kim, 2001; Lin, wu, & Tsai, 2005), perceived enjoyment (Davis, Bagozzi, & Warshaw, 1992; Hsu & Lu, 2004), cognitive attraction (Heijden, 2003; Tractinsky, Katz, & Ikar, 2000), flow experience (Hsu & Lu, 2004) and perceived sacrifices. Moon and Kim (2001) agreed that in the view of TAM, it cannot be completely explained how playfulness affects the attitudes and actual behavior of a human being. However, Bagozzi (2007), particularly pointed out that emotions may affect human behavior. Emotional related factors are expected to be provided through the use of business simulation games, which is quite different from the objective of performance improvement from general information systems. However, the proposed integrated model cannot accommodate all the emotional factors unlike commercial online games. As such the pleasure and fun provided by business simulation games may not be that great in scope and depth. Therefore, based on the literature analysis and teacher interviews, this research includes two emotion-related factors, cognitive playfulness and cognitive attractions, in the research model. More importantly, these two emotional factors can be regarded as the cause for PU and PEU, which matches the first point of Benbasat and Barki (2007) as mentioned above. Note that these two emotional factors are the only prior factors affecting PU and PEU in this study. Other factors are redirected to address ECT starting from the performance factor downward.

Finally, the primary reason for using business simulation games is to motivate students to participate in class learning activities, as well as to construct their knowledge by playing the games with rationalized thinking. This is supported by the national survey of Taiwan's college students (Fu, 2007) which confirms that teacher-student interaction, collaborative learning, experiment or implementation, and problem-solving are helpful in their learning. Furthermore, the desire for learning achievement of Taiwan's college students matched the concept of the learning pyramid originally proposed by Dale Cone. This was later ranked by different scholars with proximate learner retention rates of 90% (teaching others), 75% (practicing what was learned), 50% (group discussion), 30% (seeing a demonstration), 20% (audio-visual), 10% (reading), and 5% (lecture) (Lalley & Miller, 2007). Hence, the theory of motivation and the theory of constructivism are appropriately added in this research. These two theories point out the factors of the importance of learning through appropriate motivation and teacher-student interactions. Moreover, classroom climate is a naturally formed atmosphere that occurs during the teaching and learning activities, where the teachers and the students interact with each other

and includes how the students interact with their classroom environments (Tsai, 1995; Walberg, 1979). Thus, we can see that teacher-student interactions and classroom climates are closely related and that it is important to include classroom climates in the research model.

There are more theories and models that may potentially relate to continuous usage of business simulation games. However, considering all of them can make the proposed research model in Fig. 3 more complicated and not feasible for empirical testing. Consequently, if only to serve as an initial investigation of college students' perception on continuous usage of business simulation games, the proposed research model is practically feasible while theoretically complicated enough to explore the research objectives, as well as to serves a base model for related future research.

3.2. Hypotheses and measurement

In Fig. 3, hypotheses H_1–H_{17} can also been seen, which are summarized in Table 1 by their originating theories with corresponding supporting references to avoid lengthy description of their derivation process. Accordingly, the measurement items for the factors in the hypotheses can be adopted and modified from the supported references as indicated in Table 2 for displaying the reliability analysis of the factors.

As this study targets college students who have taken courses using business simulation games in class activities, all universities in Taiwan region are considered. Due to the limitations of the regional based of student population, it is not easy or feasible to collect the objective educational gains of students from 160 potential Taiwanese universities. Therefore, the students' perceptions of the proposed research model are incorporated in this study. This has a precedent in the TAM meta-analysis of Yousafzai et al. (2007) where over half of the independent variables listed in the selected studies are categorized under the self-reported use or perception instead of the actual use of perception.

4. Data analysis

Descriptive analysis and Partial Least Square (PLS) were used in this study in conducting the data analyses as shown below.

4.1. Sample profile

This research put up the online survey for three weeks from 10 June 2008 to 2 July 2008. A total of 223 questionnaires were retrieved, but only 185 of them were considered valid responses.

A brief summary of the statistics analyzed is illustrated below: 34.1% of the students were male and 47.6% of the students had the habit of playing computer games. Majority of the students belonged to universities in southern Taiwan (58.4%), and majored in management (97.3%). Among the surveyed students, 76.2% have attended only one class that uses business simulation games and they mostly used BOSS (88.1%) and Distribution Master (34.1%), in their classes. The statistics indicates that 56.2% of students use the business simulation games for an hour or less after their classes. The three major factors that influence the students' use of business simulation games in their classes are: (i) the content of the game is interesting (63.2%), (ii) the games correspond with the basic requirements of the class (56.2%), and (iii) the games increase the level of participation within the class (56.2%).

Table 1
Hypotheses and supporting references.

Expectation confirmation theory related hypotheses	
H_1	The student's satisfaction on business simulation games has a noticeable impact on the intention of the user for continuous use. Bhattacherjee (2001a), Roca et al. (2006) and Chiu et al. (2005)
H_2	The confirmation degree of the students using the business simulation game has a noticeable impact on the level of satisfaction. Roca et al. (2006) and Thong et al. (2006)
H_3	The student's learning performance in business simulation games has a noticeable impact on the level of satisfaction Oliver and DeSarbo (1988) and Tse and Wilton (1988)
H_4	The student's learning performance in business simulation games has a noticeable impact on the level of confirmation. Churchill and Surprenant (1982) and Tse and Wilton (1988)
Agency theory related hypotheses	
H_5	Incentives for using a business simulation games have a significant impact on the learning performance. Bhattacherjee (2001b) and Eisenhardt (1989)
H_6	Incentives for using a business simulation games may receive the interference of goal conflicts because of the learning performance. Bhattacherjee (1998)
H_7	Incentives for using a business simulation games may receive the interference of risk-aversions because of the learning performance. Bhattacherjee (1998)
Technology acceptance model related hypotheses	
H_8	Perceived usefulness of business simulation games has a significant impact on the satisfaction level. Bhattacherjee (2001a, 2001b) and Devaraj et al. (2002)
H_9	Perceived ease of use of business simulation games has a significant impact on the satisfaction level. Devaraj et al. (2002), Roca et al. (2006) and Thong et al. (2006)
H_{10}	Perceived usefulness of business simulation games has a significant impact on the learning performance. DeLone and McLean (2003) and Doll and Torkzadeh (1998)
H_{11}	Perceived ease of use of business simulation games has a significant impact on the cognitive playfulness. Heijden (2003), Liao et al. (2007) and Venkatesh (2000)
Learning factors related hypotheses	
H_{12}	The learning motivation of a student on business simulation games has a significant impact on the student's learning performance Pintrich and De Groot (1990)
H_{13}	The classroom atmosphere when using business simulation games has a significant impact on the learning performance. Deng (1992) and Moos (1971)
Emotion factors related hypotheses	
H_{14}	Cognitive playfulness of business simulation games has a significant impact on the satisfaction level. Moon and Kim (2001) and Webster et al. (1993)
H_{15}	Perceived attractiveness of business simulation games has a significant impact on the perceived usefulness. Heijden (2003)
H_{16}	Perceived attractiveness of business simulation games has a significant impact on the perceived ease of use. Heijden (2003) and Tractinsky et al. (2000)
H_{17}	Perceived attractiveness of business simulation games has a significant impact on the cognitive playfulness. Heijden (2003)

Table 2
Related statistics and reliability analysis.

Aspects	Items	Mean	σ	Loading
Perceived usefulness: CR = 0.96 Davis (1989)				
PU1	Business simulation games allow me to complete my studies faster.	4.95	1.05	0.93
PU2	Business simulation games increase my learning efficiency.	5.04	1.09	0.95
PU3	Business simulation games improve my learning performance	4.99	1.08	0.94
Perceived ease of use: CR = 0.90 Davis (1989)				
PEU1	Business simulation games are easy to use	4.65	1.22	0.83
PEU2	Interacting with business simulation games is unambiguous and easy to understand.	4.68	1.10	0.89
PEU3	Using business simulation games to complete course related tasks are easy.	4.75	1.01	0.87
Perceived attractiveness: CR = 0.92 Heijden (2003)				
PA1	I am attracted by the general appearance of the business simulation games.	4.31	1.05	0.91
PA2	I am attracted by the combination of colors used in business simulation games.	4.34	1.07	0.89
PA3	I am attracted to the business simulation games as a whole.	4.82	1.03	0.88
Perceived playfulness: CR = 0.92 Moon and Kim (2001)				
PP1	Time flies when I use business simulation games.	5.00	1.17	0.84
PP2	It is interesting to use business simulation games.	5.09	1.09	0.93
PP3	I feel like exploring more information when I use business simulation games.	5.07	1.10	0.90
Learning motivation: CR = 0.83 Duncan and McKeachie (2005)				
LM1	I would rather opt a course that makes me curious even if it is more difficult.	4.88	1.09	0.63
LM2	I feel that the contents of the business simulation games are practical and are worth the effort to learn it.	5.15	0.96	0.81
LM3	I believe that I can learn all the concepts in a class which uses the business simulation games.	4.97	1.08	0.84
LM4	I feel that my performance is better than the others when I use business simulation games.	4.32	1.11	0.67
Classroom climate: CR = N/A Fraser and Treagust (1986)				
Participation	I tend to listen to what others have to say in classes using the business simulation games.	5.04	1.05	0.83
	I have an opportunity to express my opinions in classes using the business simulation games.	5.01	1.02	
Cooperative Learning	I like sharing information and my thoughts with the other students in classes using the business simulation games.	4.99	1.04	0.97
	I can learn important things from other students in classes using the business simulation games.	5.21	0.93	
	I like to cooperate with other students in classes using the business simulation games.	5.16	0.96	
Incentives: CR = 0.92 Bhattacherjee (2001b)				
Incent1	The teachers in classes using business simulation games provide learning incentives.	4.73	1.11	0.87
Incent2	The teachers in classes using business simulation games reward those students who attain their goal.	4.55	1.26	0.90
Incent3	The teachers in classes using business simulation games normally provide enough incentive to learn.	4.65	1.11	0.91
Goal conflicts: CR = 0.91 Cheong and Park (2005) and Venkatesh and Davis (2000)				
GI1	I plan to use business simulation games to learn new skills.	4.58	0.96	0.87
GI2	I will try my best to use a business simulation game more often.	4.75	1.04	0.90
GI3	If I have a chance to use a business simulation game, then I will think of using it.	4.94	0.97	0.89
Risk aversion: CR = 0.90 Norton and Moore (2006)				
RA1	When I choose a work atmosphere, I am not willing to take risks.	4.00	1.36	0.78
RA2	I would prefer a low risk and a highly secured working atmosphere with an anticipated salary.	4.74	1.37	0.83
RA3	I would prefer staying in a familiar atmosphere than a new atmosphere which has a high risk of unknown problems, even though it may provide more rewards.	4.47	1.37	0.87
RA4	I would not hesitate at all costs to avoid any risks in my work.	4.17	1.27	0.87
Learning performance: CR = 0.89 Premkumar and Bhattacherjee (2008)				
LP1	I can learn new skills if I use business simulation games.	4.95	0.91	0.86
LP2	Business simulation game helps me improve my results.	4.60	1.06	0.86
LP3	The learning periods are more flexible if I use business simulation games.	4.93	1.10	0.85
Confirmation level: CR = 0.94 Premkumar and Bhattacherjee (2008)				
Confrim1	Business simulation games being able to help me learn new skills have exceeded my previous expectations.	4.72	1.08	0.95
Confirm2	Business simulation games being able to improve my results have exceeded my previous expectations.	4.57	1.09	0.93
Satisfaction level: CR = 0.89 Yu, Chang, Liu, and Chan (2002)				
Sat1	It would be interesting to be able to attend a class using business simulation games.	5.11	1.01	0.90
Sat2	I like to learn new skills by using business simulation games.	5.04	1.05	0.89
Sat3	I wish that all the courses would apply the use of business simulation games in their class.	5.01	1.12	0.76
Continuance intention: CR = 0.93 Atchariyachanvanich, Okada, and Sonehara (2006), Thong et al. (2006) and Premkumar and Bhattacherjee (2008).				
Cont1	I intend to continuously use the business simulation games to learn new skills.	4.86	1.03	0.91
Cont2	I intend to increase my chances to use business simulation games.	4.77	1.04	0.93
Cont3	Business simulation games would be my prior choice when I learn a new skill.	4.79	1.05	0.89

Note: Classroom climate is formative indicator and thus has no CR value.

4.2. Reliability analysis

The results of the items in the reliability analysis is shown in Table 2, where the factor loading in each aspect of the items is greater than 0.5, and the internal consistency composite reliability (CR) values all exceeded 0.7, as suggested by Hair, Anderson, Tatham, and Black (1998).

4.3. Validity analysis

In Table 3, the value of the diagonal is shown as $\sqrt{\text{AVE}}$, and the value of the non-diagonal is its coefficient. All AVE values lie between 0.55 and 0.89, satisfying the suggested >0.5 by Fornell and Larcker (1981), which indicates that the convergent validity of this research is

Table 3
Discriminant validity analysis.

Constructs[c]	AVE[a]	Correlation of constructs											
		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
PU(1)	0.89	0.94[b]											
PEU(2)	0.75	0.65	0.86										
PA(3)	0.80	0.50	0.46	0.89									
PP(4)	0.80	0.62	0.57	0.63	0.89								
LM(5)	0.55	0.61	0.55	0.50	0.72	0.74							
Incent(6)	0.80	0.41	0.38	0.38	0.38	0.41	0.89						
GI(7)	0.79	0.62	0.44	0.54	0.65	0.70	0.57	0.88					
RA(8)	0.70	0.18	0.03	0.25	0.06	0.02	0.30	0.23	0.84				
LP(9)	0.74	0.67	0.41	0.29	0.53	0.61	0.41	0.69	0.29	0.86			
Confirm(10)	0.89	0.55	0.40	0.41	0.49	0.55	0.49	0.65	0.29	0.73	0.94		
Sat(11)	0.73	0.57	0.45	0.43	0.61	0.63	0.39	0.69	0.13	0.67	0.58	0.85	
Cont(12)	0.83	0.59	0.45	0.49	0.62	0.61	0.42	0.81	0.24	0.67	0.69	0.78	0.91

[a] Average variance extracted, AVE is required to exceed 0.5.
[b] Each of the diagonal $\sqrt{AVE}$ value is required to exceed the construct AVE value, and other related coefficients of the non-diagonal construct values.
[c] PU is taken as perceived usefulness; PEU is taken as perceived ease of use; PA is the perceived attractiveness; PP is the perceived playfulness; LM is the learning motivation; CC is the classroom climate; Incent is taken as the incentives; GI is the goal conflicts; RA is risk aversion; LP is the learning performance; Confirm is the confirmation level; Sat is the satisfaction level; and finally Cont is the Continuance intention.

acceptable. The discriminant validity in Table 3 indicates that every aspect of the square root of AVE exceeds the construct and other related coefficients of construct, therefore, tallying with the suggestions of Chin (1998) that there is a discrimination between the constructs.

4.4. Model verification

These 17 hypotheses were developed from five theories; thus it is easier and more understandable to present the results of the model verification from the perspective of the five higher-levels of theories in relation to corresponding hypotheses. The results of the model verification are shown in Fig. 4. Briefly speaking, most of ECT's hypotheses are established, none of the AT's hypotheses are established, all but the hypotheses of TAM regarding satisfaction are established, all hypotheses of learning factors are not established, and all hypotheses regarding the emotional factors are established.

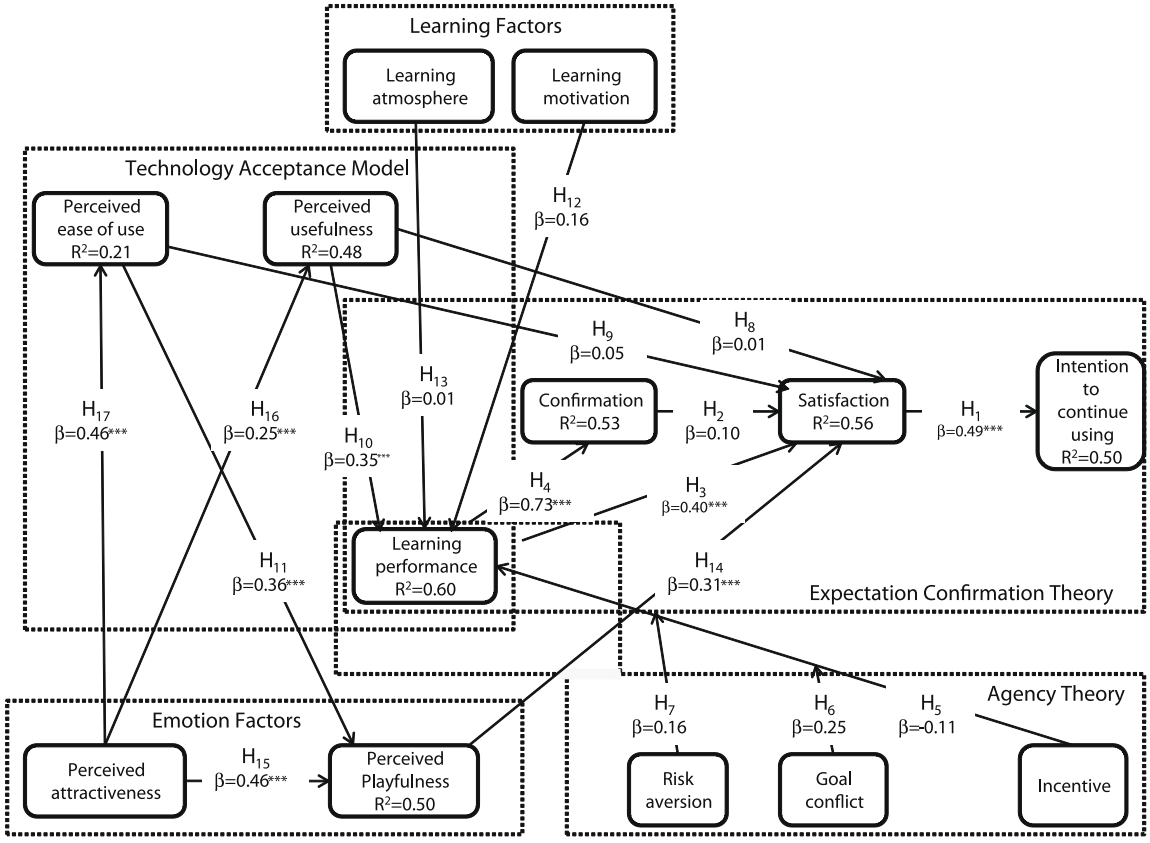

Fig. 4. Results of model analysis.

5. Discussions and findings

5.1. Discussions

Following the same approach used in the Model Verification, the hypothesis testing results are discussed in more detail by using the five theories.

Among H_1–H_4 in the ECT, the confirmation level has an obvious impact on the satisfaction level in all hypotheses except H_2, where confirmation has no significant impact on students' satisfaction. Because Chiu et al. (2005) also had similar results, the explanation maybe that business simulation games are edutainment (education and entertainment) oriented. The learning performance only needs to achieve an acceptable level rather than an outstanding level higher than one's expectation.

None of the H_5, H_6, and H_7 in the AT is established. The inter-organization IT study of Bhattacherjee (1998) had similar results regarding the interference of goal conflicts and risk aversion. Therefore, there may be two reasons to explain the failure of AT in this study. First, from the descriptive analysis of student profile, we know that after class, 81.6% of the students on average use the business simulation games for less than two hours. Therefore, the reason perhaps is that the time taken by the users to learn business simulation games is simply not enough, thus causing incentives to have an unnoticeable impact on students' learning performance. Second, our conjecture is that the wordings of the questions in the survey were not suitable because there was a big difference in the risk aversions that occurred in a working environment and a learning environment.

Among H_8–H_{11} in the TAM model, only the PU and PEU do not have obvious impact on the satisfaction level. This result if different from the past studies of Bhattacherjee (2001a), Devaraj, Fan, and Kohli (2002), and Hong et al. (2006) on Internet services as well as Hayashi, Chen, Ryan, and Wu (2004) and Roca et al. (2006) on the e-learning systems, but it matched with two studies on online (Hsu & Lu, 2004) and mobile games (Ha et al., 2007). In particular, in Hsu & Lu (2004) online games acceptance model, the PU did not encourage the user's willingness to use online games, but it affected the user's attitude. This could perhaps be explained by the fact that education in the form of simulation games is clearly intended to impart education through entertainment. Therefore, the interesting features of the simulation games are what the student actually pays much attention to. Furthermore, it had been verified earlier that PEU had a noticeable impact on the users, but such impact gradually became less obvious in the later studies (Karahanna, Straub, & Chervany, 1999). Therefore, this research conjectures that in the initial period of usage, the users realize that the simulation games are easy to use and will influence them in a positive manner. After using them for a while, however, the positive effects of the PEU of these games gradually become less noticeable; therefore, it is concluded that PEU does not have an obvious impact on satisfaction.

Both hypotheses H_{12} and H_{13} in learning factors are not sustained. It is surprising to conclude that both the motivation and atmosphere do not have significant impact on the students' learning performance through business simulation games. According to the additional comments provided by the student respondents, the possible reason could be that in a highly motivated learning group, there could still be students holding lower results, while in a low motivated learning group, there could still be students attaining high results. Therefore, we conjecture that learning motivation is just one of the factors that influence the learning performance. In other words, even if the learners have a high learning motivation, they still need to first possess enough knowledge so that while proceeding with the learning and operation of the simulation games, they could attain sufficient knowledge in the most efficient manner.

Hypotheses H_{14}–H_{17} on emotional-related factors are all established. Therefore, it sufficiently lays out that the perceived attractiveness and perceived playfulness of business simulation games have significant influences on the PU and PEU, which could be taken advantage of by the instructors.

5.2. Findings

Based on the results of the hypothesis testing and the corresponding discussions, two extended findings are discussed below.

The first finding is the positive and negative messages about the emotional factors where the two leads in emotional factors are confirmed: the playfulness provided by the business simulation games has an important influence on the student's continuing use of these games, while PU has an important influence on perceived playfulness, which was also supported in the case study of Heijden (2003) and Liao, Tsou, and Huang (2007). Meanwhile, the attractiveness effect of the screen designs of business simulation games on the students influence the PU, PEU, and playfulness. On the other hand, two clues lead us to a different view. First, the average perceived attractiveness is 4.49 out of the seven-point Likert scale, which lies just between the average and the satisfied. Second, 81.6% of the students use business simulation games for less than two hours after their class. Accordingly, it may imply that current business simulation games do not attract the students as we had expected or at least do not sustain the students' interest long enough.

The second finding is that there are still valuable lessons to be learned from the failure of the AT hypotheses: First, incentives for students to use business simulation games do not guarantee a better learning performance, especially when the students do not spend enough time on these games after their class. Therefore, the teachers must acquire a balance between their teachings and students' hands-on practicing time to use the simulation games. Secondly, given a suitable learning guide, the teachers may better promote students' learning motivation and at the same time avoid unnecessary operations and learning (Azevedo & Cromley, 2004; Brusilovsky & Pesin, 1995). Therefore, the teachers do not only play the role of knowledge providers under a simulation games environment but also their role may be changed to that of guiding learning, encouraging the learners through observation and discussion in interactive learning, and guiding the students to apply what they have learned in the simulation games (Robertson & Howells, 2008).

6. Conclusions and future work

Deviating from previous experimental-base studies mostly targeting teachers and students of the primary and secondary education, the primary research contribution of this study is establishing a research model and corresponding hypotheses for theorizing higher-education students' perception on business simulation games. In general, the empirical students' perceptions provide adequate evidence for Taiwan's teachers to adopt or continually use the business simulation games and to effectively integrate business simulation games into their

teaching activities and strategies. The findings have two research implications. First, the results are representative of the whole region of Taiwan context, which has not seen in business or educational simulation game studies. Second, the propose research model can serve as a base model like TAM or ECT for future related studies in Taiwan or other regions.

On the other hand, many well-established hypotheses tested in this study for business simulation games did not show sustainability. Based on our observations, this gap needs to be narrowed through the accurate designing of business simulation games, as well as in the proper implementation of business simulation games in the course activities. This is implied by the findings in Section 5.2. To incorporate business simulation into the class activity, a teacher needs to play both roles of instructor and coach to complement the concept of the learning pyramid (Lalley & Miller, 2007) as described in Section 3.1. On the one hand, business simulation games require the players to equip themselves with adequate multidisciplinary knowledge of different functional areas to make competitive, synthesized decisions to win in the game. Thus, as instructor, the teacher needs to effectively organize systematic lecturing, multimedia demonstration, and group discussions. On the other hand, to improve students' learning retention and persuade them to practice what they have learned, as a coach, the teacher needs to encourage the students to rationalize their decision making by sharing and discussing with their classmates and teacher in and after class. Obviously, this is time-consuming and not regularly implemented in Taiwan. In addressing the failure of games in schools, Lim (2008) provided an excellent summary on how schools can transform their culture and practices by "re-designing the curriculum around driving questions that are meaningful to students, creating opportunities for different students with different needs, re-organizing the highly segmented school day by leveraging upon the outside-classroom experiences and expertise of students, and shifting assessments away from evaluative structures that function to support social reproduction and towards opportunities to support learning."

For the game design, narrowing the gulf in attractiveness and playfulness between business simulation and commercial online games is the key. In addition to fun as one requirement for engagement, Prensky (2008) included goals, decision and discussion, emotional connection, cooperation and competition, personalization, and review and iteration to extract from the best commercial games those factors that make the games engaging for players. For example, different lines of businesses such as casinos can be designed in the context of the monopoly game, which is a popular property-transaction competition game, to bring up the business gains while experiencing the familiar fun of the monopoly game as discussed by Yeh et al. (2007). In addition, some past studies with positive research outcomes may provide directions in the design of more attractive screens and sustainable content of the games to increase students' satisfaction and intention to continue use. These directions include narrations (Schank, Fano, Bell & Jona, 1994), state of flow (Webster, Trevino & Ryan, 1993), interaction of simulation games, power in the hands of the users, and suitable rewards provided to guide the users (Garris et al., 2002), closing the gap between the simulation games and the actual situation to clearly define the link between the adopted policy and the results obtained (Adobor & Daneshfar, 2006).

Finally, to our disappointment, this research failed to establish that AT can be applied to the teacher–student relation similar to the agency relation, which was expected to be an innovative idea in the educational setting borrowed from the business settings. After going through the analysis mentioned in the Section 4.4, this research proposes to go further and be more thorough in future studies on either business simulation games or other educational settings.

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