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INNOVATIVE USE OF THE ERPSIM GAME IN A MANAGEMENT DECISION MAKING CLASS: AN EMPIRICAL STUDY

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ABSTRACT

Aim/Purpose	Enterprise Resource Planning (ERP) simulation (ERPsim) games have been used in Information Systems courses to teach students ERP systems and business processes. This study investigates whether the use of ERPsim games can be extended to other management disciplines. More specifically, this study reports on using the ERPsim games innovatively in a new context, in an undergraduate managerial decision making course, to enhance student perceived learning outcomes and satisfaction.
Background	In this study, the ERPsim games were used to provide students with practical experience about using information in tactical and operational decision making and to illustrate important course concepts such as anchoring, bias, and bounded awareness, among others. The theoretical framework leveraged in this study was derived from the literature on technology acceptance in educational settings and the studies on virtual learning environment effectiveness.
Methodology	Survey methodology was used to collect the data and test the research model. One sample t-tests and partial least squares (PLS) were used for empirical analysis. 138 students participated in the study.
Contribution	By developing and testing a sound research model, we conclude that the use of ERPsim games can be successfully extended from their current domain of Information Systems to management courses that are not technical to enhance student understanding of managerial concepts in a fun and enjoyable

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	way while enabling students to gain realistic practical experience in using information for decision making. While, the ERPsim games have been used in IS education; this paper presents an opportunity to use them in a different context.
Findings	The study confirms that the ERPsim games are useful in improving student perceived learning outcomes and the level of satisfaction in management courses. It also identifies the factors that directly or indirectly shape student learning outcomes and satisfaction in such courses.
Recommendations for Practitioners	The use of the simulations has relevance to the new Association to Advance Collegiate Schools of Business (AACSB) guidelines that emphasize the need to incorporate evidence based, technology and data-driven decision making to solve real-world business problems into business curriculum. The study should also encourage educators to innovate in their own courses by experimenting with this particular simulation or similar simulations.
Recommendations for Researchers	Researchers should use additional samples to increase the generalizability of the findings. They should also extend the current research model by incorporating additional factors.
Impact on Society	The study provides support for the use of a simulation game to improve students' learning experiences and to help them better understand managerial decision making, which would allow graduates to more effectively transition into managerial roles.
Future Research	Future research should include establishing and validating the best practices surrounding the use of these simulations in the classroom.
Keywords	curriculum innovation, ERPsim, gamification, management decision making, simulation

INTRODUCTION

It is difficult to teach managerial concepts and their impact on decision making to undergraduate students, who typically bring little or no business or work experience with them into the classroom (Strong et al., 2003). While instructors can draw on personal experiences, anecdotes, and case studies to supplement textbook material, some of the concepts introduced in the classroom, particularly in the realm of management education, are more abstract and difficult to understand for students without such real-world experience (Mintzberg, 1980; Smith, 2005; Strong et al., 2003). Without first-hand experiential practice of managerial concepts and skills, by just hearing or reading about them, students usually miss the opportunity to gain a deep understanding of the material and its implications. When it comes to studying certain managerial skills, such as tactical and operational decision making, learning is most effective when students actually practice these skills, in a realistic environment and then analyze their performance explicitly and receive feedback from someone who understands these skills (Hsu, 1989; Mintzberg, 1980). Simulations and games, particularly those aimed at replicating the business environment can enhance management training and complement the classroom experience by offering students practical understanding of concepts (Dey & Ede, 2016; Pasin & Giroux, 2011). A marketplace simulation game, such as ERPsim, may provide an opportunity to enhance student understanding in a fun and enjoyable way while enabling students to gain realistic practical experience in using information for decision making.

The simulation games developed in the HEC Montreal ERPsim Lab provide ERP (Enterprise Resource Planning) related simulations at varying levels of complexity (Léger, 2006; Léger et al., 2007).

As such, they are well-suited to be used in the classroom and can be used for minor to significant student involvement. In this study, among the suite of the ERPsim games offered (9 in all) by the ERPsim Lab, the basic "Distribution Game" was used. The game enables students to compete, in teams of about 4, in selling bottled water products into a marketplace. Using information on inventory, sales, period market reports and financial statements, the participants make decisions on pricing and marketing. Each team has the objective of earning the highest profit among all the teams. The main reason for using the game in a management course was to improve student comprehension of the managerial decision making concepts discussed in class and of the practices followed in managerial decision making. The authors initially used this simulation in a smaller scale with encouraging results (Dick et al., 2018) and as a result decided to expand their research by developing and testing a comprehensive framework to investigate its role in enhancing student perceived learning outcomes and satisfaction in a management decision making course.

While the use of simulations and games in the classroom is not a new practice (Legner et al., 2013; Levant et al., 2016), a review of the literature reveals that, this is the first time the ERPsim games have been used in a management decision making class. Léger (2010, p.1) describes an ERPsim game as a "serious game for learning ERP concepts". ERPsim games were developed to be used in IS courses to teach students ERP systems and underlying business processes. Therefore, they have been widely used for this purpose in different IS courses including introduction to IS, ERP fundamentals, and business intelligence and analytics courses with encouraging results in improving student learning experiences in such courses (Babin et al., 2011; Cronan et al., 2011; Chen et al., 2015; Dick & Szymanski, 2013; Dunaway, 2015; Labonte-LeMoyne et al., 2017; Lee et al., 2016; Léger 2010; Léger et al., 2011; Seethamraju, 2011). The games have also been used in a capstone course that was specifically designed around the ERPsim game to help students understand the integrated nature of cross-functional business process (Legner et al., 2013). Moreover, it has been suggested that the games could be used in more technical courses such as information technology, computer science and industrial engineering (Léger et al., 2010). Therefore, using this game in a new context, in a general management course that focuses on teaching decision making concepts, represents an innovative approach to improving the business curriculum.

The main objectives of this study are twofold: (1) to determine whether the ERPsim games could be used as a learning tool to enhance student learning outcomes and satisfaction in management courses, and (2) to identify the factors that shape student perceived learning outcomes and satisfaction with the ERPsim game in such courses. As a result of this and subsequent studies, the authors hope to develop a set of best practices for using these games in similar management classes. These best practices would encompass not only the running of the simulation, but also the way in which it is introduced to the students and any preparatory work in the classes leading up to its use – all aimed at improving the efficacy of the simulation in this management education context. As such the practical implications of this study can be directly related to improving the classroom experience and aiding in comprehension of managerial decision making practices.

Turning now to the need and the potential to improve classroom experiences, today's students, particularly business students, are required to have an in-depth understanding of different information technologies and innovations in order to make an impact in our technology-driven world (Fichman et al., 2014). Moreover, experiential learning (learning by doing) has become an important part of business education. Devasagayam et al. (2012) refer to experiential learning as one of the best ways to teach information literacy in business education programs. Griffs (2014) reports many manifestations of experiential learning, driven by improved student learning, demand from employers, raising the profiles of the business schools and attention from accreditation agencies. Recent Association to Advance Collegiate Schools of Business (AASCB) guidelines emphasize the importance of data and information driven technology supported decision making practices that integrate applied real-world experiences as a new requirement in undergraduate programs (AACSB, 2017):

> *"Evidence-based decision making that integrates current and emerging business statistical techniques, data management, data analytics and Information Technology in the curriculum. Student experiences integrate real-world business strategies, privacy and security concerns, ethical issues, data management, data analytics, technology-driven changes in the work environment, and the complexities of decision making."*

Simulations, or the use of games, in business courses is seen as a potential way to achieve such requirements (Dey & Ede, 2016). The use of such ERPsim type simulations in the classroom may provide great opportunities for business schools around the world. ERPsim games are readily available to universities and many schools already use them to teach Information Systems (IS) concepts. This paper proposes extending ERPsim use to other domains outside IS to help students gain practical experience in addressing the complexities of decision making (such as limited information intake, anchoring and bias) while utilizing evidence-based real time analytics in a dynamic environment.

Therefore, the issue being studied here has several dimensions – enhancing student understanding of managerial decision making concepts, increasing their satisfaction and engagement in management courses and incorporating data and technology driven tools into the curriculum to address the need to improve existing business school programs. The use of the ERPsim games seems to provide an opportunity to achieve these multiple objectives.

The remainder of this paper is organized as follows. The next section provides a brief overview of the background and underlying theory bases. A research model and an interrelated set of hypotheses are then put forth. The research methodology is subsequently outlined and the results presented. The paper concludes with a discussion of the findings, implications, limitations and future research directions.

LITERATURE REVIEW

SIMULATION GAMES

The idea of using simulation games in the classroom is not new (Bredemeier & Greenblat, 1981; Teach, 1990; Wolfe & Roge, 1997). The literature provides examples of multiple advantages in using simulations to enhance student learning and satisfaction in the classroom (see for example Salas et al., 2009). Playing games that simulate the workplace environment can give students the opportunity to experience practice and theory together and to acquire skills that are normally acquired only through the hands-on application of concepts. Such learning is often acquired in a reduced time frame with the help of simulations. The rapid feedback provided by the simulation and/or the professor, can lead to strategic or tactical adjustments, which in turn can be evaluated and discussed in the classroom, resulting in a complex and realistic learning environment (Salas et al., 2009; Webb et al., 2014).

Typically, simulations provide a simplified version of reality in a risk-free environment. They are usually simple to operate and learn, relatively inexpensive and may provide an opportunity to work at a preferred pace. Finally, the more "game like" the simulations are made, the more engaging they are – the more interesting, motivating and enjoyable. The game environment can be enhanced by making involvement with the simulation competitive, providing regular feedback and promoting the atmosphere of a game rather than a classroom exercise. thereby increasing student engagement (Cruikshank & Tefler, 1980; Salas et. al, 2009).

THEORY

The conceptual framework guiding our study was developed based on Alshare and Lane's (2011) research on the factors that influence student perceived learning outcomes and satisfaction in ERP courses, which include a blend of theoretical ERP concepts and hands-on exercises. Alshare and Lane combined elements from Venkatesh et al.'s (2003) research on the antecedents of technology acceptance and Eom et al.'s (2006) research on the antecedents of student perceived learning outcomes and satisfaction in online courses into a new research model.

IS researchers have used different theories to explain information technology acceptance and use. One such theory that is particularly appealing and has received a great deal of empirical attention since its introduction is the Unified Theory of Acceptance and Use of Technology - UTAUT (Venkatesh et al., 2003). UTAUT has been developed after an extensive review of user acceptance literature by integrating factors from eight prominent theories including the technology acceptance model and its extensions, the theory of reasoned action, the theory of planned behavior, innovation diffusion theory, as well as social cognitive theory. Many of these precursor theories have been used separately to understand student acceptance of different technologies including ERP systems in business schools (for example see Akbulut, 2015; and Shivers-Blackwell & Charles, 2006). As a unified theory, UTAUT focuses on the interplay among effort and performance expectancy, social influence and facilitating conditions (external variables) in order to explain how intentions and usage behaviors are formed. The UTAUT model also suggests that performance is influenced by the individual's attitudes and intentions toward the particular usage behavior (Alshare & Lane, 2011).

On the other hand, borrowing from Piccoli et al.'s (2001) conceptual framework of learning effectiveness in virtual learning environments, Eom et al.'s (2006) research focuses on the factors that impact student perceived learning outcomes and satisfaction in online courses by recognizing that academic behaviors are shaped by personal (human dimension) and environmental (design dimension) factors. The human related dimension is centered around the students (e.g. interest, anxiety) and instructors (e.g. knowledge level), whereas the design related dimension is centered around the technologies used, content design and delivery (e.g. task structure, training). This is consistent with the social cognitive theory, which emphasizes the central role of personal factors in enabling people to assert personal control over their educational and occupational behaviors, efforts, and attainments; and the environmental factors that may promote or restrict the exercise of personal control over behaviors (Akbulut, 2015).

Integrating UTAUT and Eom et al.'s (2006) framework, Alshare and Lane (2011) identified effort and performance expectancy, attitude and a set of human and design related facilitating conditions (hands-on training, perceived instructor knowledge, and course structure) as the determinants of student learning and overall satisfaction in ERP courses.

While our study leverages Alshare and Lane's (2011) work, it significantly differs from it as well. Alshare and Lane (2011) examined factors that influence student perceived learning outcomes and satisfaction in ERP courses. Therefore, their sample consisted of students enrolled in an ERP course who would potentially pursue careers in this field. These students received training on many aspects of ERP system concepts, implementations, as well as hands-on training using SAP's ERP package before they were surveyed about their experiences. The students in our sample were business students enrolled in a managerial decision making class and they had no prior experience with ERP systems and were not pursuing degrees or careers in an ERP or IS related field.

While learning how to use an ERP package (SAP) was among the main objectives of the ERP course in Alshare and Lane's (2011) study, in our study learning the ERPsim game is not related to course objectives at all. We are principally concerned with using the ERPsim game as an unconventional tool to teach (explain and demonstrate) managerial decision making concepts such as tactical and operational decision making against a background of the managerial decision making environment. This environment often includes detrimental factors and constraints such as anchoring, bounded awareness and bias.

Consequently, Alshare and Lane (2011) measured the perceived learning outcomes and satisfaction as they related to the whole course, whereas our focus is on measuring the role of the ERPsim game in enabling students to achieve the learning outcomes of understanding and comprehending concepts central to the course and determining whether this was a satisfactory way of doing so.

RESEARCH MODEL AND HYPOTHESES

Figure 1 represents the research model used in our study. As illustrated, task structure, training, student interest and anxiety are facilitating factors that affect students' performance and effort expectancies; which in turn determine their attitudes toward the ERPsim game. Attitude, perceived instructor knowledge and game performance independently and cumulatively affect student satisfaction with the ERPsim game and perceived learning outcomes. The following sections describe the hypotheses in detail.

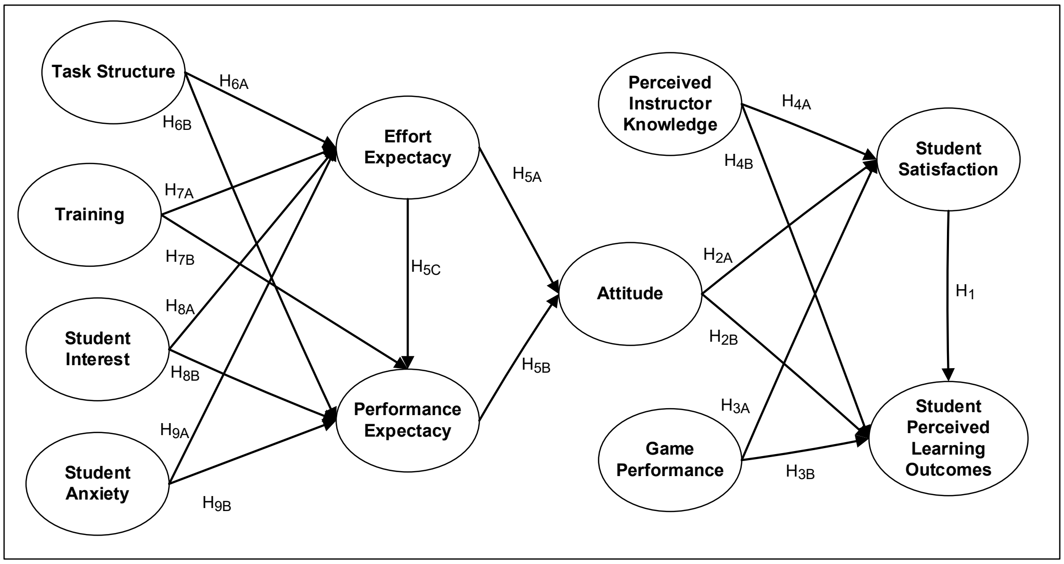


Figure 1: Research model

Student perceived learning outcomes and student satisfaction: Student perceived learning outcomes and satisfaction play important roles in student learning and academic success and have been used as dependent variables in a variety of studies investigating learning environment effectiveness (Alshare & Lane, 2011; Chen et al., 2015; Eom et al., 2006).

Student perceived learning outcomes can be defined as students' perceptions regarding how well they learned in a particular learning environment (Wighting, 2011). In the context of our study, learning outcomes refer to the students' judgement about how well the ERPsim game helped them learn the decision making concepts and theories introduced in the course. Student satisfaction refers to students' judgements about the quality of their learning experience with the ERPsim game, supplemented by the enjoyment they felt and whether they would recommend the ERPsim game to other students to learn about managerial decision making. In a student centered learning environment in which students are active learners, higher levels of student satisfaction would lead to higher levels of student perceived learning outcomes. We put forth the following hypothesis to test this assertion:

> H_1: Student satisfaction will have a significant positive influence on student perceived learning outcomes.

Attitude: Attitude refers to an individual's positive or negative feelings about performing a given behavior (Fishbein & Ajzen, 1975). In terms of technology usage, Venkatesh et al. (2003) define attitude as a person's overall affective reaction to using a particular technology and further state that attitude is directly related to an individual's liking, enjoyment, joy, and pleasure associated with using that technology. Therefore, in the context of our study, the way a student feels about using the ERPsim game would influence the way the student learns and uses the game in class. When a student feels good about the use of the ERPsim game in class, they would be more eager to participate in the game leading to positive outcomes and satisfaction. However, if a student's attitude is not positive, then the student would potentially resent using the game and under-utilize it. As a result; student perceived learning outcomes and satisfaction may be adversely affected. Based on this logic, we offer the following hypotheses:

H_{2a}: Attitude will have a significant positive influence on student satisfaction.

H_{2b}: Attitude will have a significant positive influence student perceived learning outcomes.

Game performance: The ERPsim game is competitive. Students compete in teams against each other to make the most profit. Game performance refers to the amount of profit (net income) accumulated by each team at the end of the game and is an objective indicator of how well the team performed in the game. While there is limited work relating performance in simulations to actual achievements of the desired outcomes, a study by Liu and Ma (2006) indicate that the performance enabled by the system in use may affect the satisfaction with the system (in this case the ERPsim game) and achievement of learning outcomes. Students whose teams performed better in the game would have a better sense of satisfaction and accomplishment regarding course concepts. Thus, the following hypotheses are offered:

H_{3a}: Game performance will have a significant positive influence on student satisfaction.

H_{3b}: Game performance will have a significant positive influence on student perceived learning outcomes.

Perceived instructor knowledge: Perceived instructor knowledge refers to students' perceptions about the level of expertise displayed by the instructor teaching the course. Prior research indicates that knowledgeable and effective teachers cultivate student learning (Looney & Akbulut, 2007). Leidner and Jarvenpaa (1995) suggest that when a transfer of knowledge from instructor to student is the adopted approach (as opposed to a more learner-centered instruction), the perceived knowledge of the instructor will contribute to satisfaction and to accomplishment of the learning outcomes. Given that the students had no knowledge of the course topics and of the ERPsim game, they relied heavily on their instructor's knowledge to learn the material. Therefore, students who perceived their instructor as a highly knowledgeable subject expert would be more satisfied with their experiences with the ERPsim game and would exhibit higher levels of learning outcomes. Based on the logic above, the following hypotheses are put forth:

H_{4a}: Perceived instructor knowledge will have a significant positive influence on student satisfaction.

H_{4b}: Perceived instructor knowledge will have a significant positive influence on student perceived learning outcomes.

Effort and performance expectancy: Effort expectancy refers to the degree of ease associated with using a particular technology and is similar to the concepts of perceived ease of use and complexity studied in previous research (Venkatesh et al., 2003). Effort expectancy has been found to be more salient in the early stages of a new behavior such as the use of a new technology (in this case the ERPsim game), where the user has no or little previous experience with the given technology, which is the case in our study.

Performance expectancy refers to the degree to which an individual thinks that using a particular technology will improve his/her job performance (Venkatesh et al., 2003). The performance expectancy construct is similar to perceived usefulness, outcome expectations, extrinsic motivation and the like. Performance expectancy has been shown to be a strong determinant of technology usage in both voluntary and mandatory settings and unlike effort expectancy remains significant regardless of the user's experience levels with the technology.

When faced with a new technology in class, it is expected that students would consider how easy the use of the technology would be and what they would get out of it. The use of the ERPsim game requires students to perform various hands-on activities and tasks using the system and to analyze the results to make operational and tactical decisions. Students who think that the ERPsim game is easy to use and beneficial to their learning of the course material would find the ERPsim game more compelling and would develop a positive attitude towards the ERPsim game. The following hypotheses are proposed:

H_{5a}: Effort expectancy will have a significant positive influence on attitude.

H_{5b}: Performance expectancy will have a significant positive influence on attitude.

In addition, research has also indicated that effort and performance are interrelated (Oh et al., 2009) and effort expectancy not only directly but also indirectly effect attitude through performance expectancy. Students who view the ERPsim game as easy to use would feel that it was more efficacious and would be more likely to develop optimistic performance expectations. Therefore, the following hypothesis is offered:

H_{5c}: Effort expectancy will have a significant positive influence on performance expectancy.

Task structure: Task structure refers to the extent to which the task objectives/expectations and design can accommodate students' needs (Eom et al., 2006). Task structure is an important factor that can influence the learning process as well as the learning outcomes (Eom & Ashill, 2016; Swan et al., 2012). In our case, while the game itself is somewhat intuitive, the use of the ERPsim software does require following business processes in a specific order. The students in management classes did not have any previous experience with the game or the structure involved in the process. While the tasks undertaken in the simulation are repeated, they do vary in different stages and are unfamiliar to the students. If the students feel that the objectives/expectations of the game and the tasks to be performed are clearly stated and the material is easy to follow, then they will find the ERPsim and easy interaction and easy to use. They will also find the game more useful and develop positive outcome expectations about their performance. Therefore, the following hypotheses are offered:

H_{6a}: Task structure will have a significant positive influence on effort expectancy.

H_{6b}: Task structure will have a significant positive influence on performance expectancy.

Training: Training is another important factor that can impact students' experiences with the ERPsim game. In order to create a positive attitude to the simulation and give the students realistic information about the effort required and what they need to achieve to get the most from the exercise, prior training is seen as necessary (Alshare & Lane, 2011). Keeping in mind that students have no previous experience with the ERPsim game, without such hands-on introductory training, students would have difficulty navigating the system and seeing its value. However, with the proper training, the use of the system would appear easy to learn and students would expect reduced effort and a higher performance. Based on the above discussions, the following hypotheses are offered:

H_{7a}: Training will have a significant positive influence on effort expectancy.

H_{7b}: Training will have a significant positive influence on performance expectancy.

Student interest: Student interest is defined as an emotion that arouses attention to, curiosity about, and concern with a particular educational tool, subject or path (Akbulut, 2015). The simulation is a fun exercise, a break from the normal class routine and is a competitive game; which makes it interesting to students. In addition, using software that the students might well expect to encounter in the workplace could increase student interest. Students who are interested in the ERPsim game and the underlying software, would be more likely to think that the game would require minimal effort and enhance their learning of the material and performance in the course. Therefore, the following hypotheses are put forth:

H_{8a}: Interest will have a significant positive influence on effort expectancy.

H_{8b}: Interest will have a significant positive influence on performance expectancy.

Student anxiety: Anxiety is defined as anxious or negative emotional reactions when it comes to performing a behavior such as using the ERPsim game in class (Venkatesh et al., 2003). Previous research has demonstrated that a high level of computer anxiety has been negatively related to learning new computer skills and results in resistance to using computers as well as in poor task performance. More specifically, computer anxiety was found to have negative influences on constructs similar to effort and performance expectancies (Harrington et al., 1990; Torkzadeh & Angula, 1992; Weil & Rosen, 1995). Students who feel apprehensive about the ERPsim game would be less likely to see their participation in the game as an easy effort and they would feel that they would not perform well. Based on this logic, the following hypotheses are offered:

H_{9a}: Anxiety will have a significant negative influence on effort expectancy.

H_{9b}: Anxiety will have a significant negative influence on performance expectancy.

RESEARCH METHOD

SAMPLE AND PROCEDURE

The survey methodology was employed to collect the data and test the research model. The study sample consisted of students enrolled in a senior level undergraduate course at the business school of a large state university located in southwestern United States.

The course was a 3-credit course, titled Management Decision Making. It focused on tactical and operational decision making for managers in today's global business environment. The learning objectives of the course, inter alia, were to understand and improve decision making processes, demonstrate the use of descriptive, normative and prescriptive approaches to managerial decision making, frame decisions by effectively describing and analyzing organizational problems, integrate internal and external business analysis, and to generate and analyze alternative solutions.

Many of the above concepts are not only complex and based on psychological experiments and literature, but also the students largely lack any meaningful work experience to which they could draw upon to relate to these concepts. As a result, the course used psychologically-based behavior and encouraged the students to consider the implications of this behavior in the workplace. The class presentation material was supplemented by instructor experience, anecdotes and case study discussions. However, there remained a significant gap between lecture materials and exercises and the "real world" in which the students would be gathering and using information for managerial decision making activities. As such, it was obvious that the students would benefit extensively from a good dose of practical experience. For practical experience in managerial decision making, we turned to the ERPsim games.

The ERPsim game used for this study provides a practical application of using information for decision making. More specifically, it gives examples of standard business processes and hands-on experience in the use of information to make operational, tactical and strategic managerial decisions.

Students were placed in teams (about 4 to a team) for this exercise and were provided with a job aid (a .pdf file of procedures to follow) so that they could familiarize themselves with the exercise prior to the first day of the simulation. They were also provided with a detailed written explanation of the game and how to play it, which they were encouraged to read before coming to class.

The ERPsim game consisted of ordering and distributing various bottled water products into 3 regions of a European country, with the objective of maximizing profit. Teams could focus on different overall strategies in order to maximize their profit. Students were able to make decisions about pricing (per product) and how much to spend on marketing (product per region). Initially, all teams were provided with the same inventory of each product, so they could simply begin by selling that stock. Each team sold the same 6 products – therefore, initially the playing field was level and no one team had any advantage over another. They competed against other teams in class as to which team could make the most profit.

A total of 4 hours was spent in class preparing for, playing, reviewing and reflecting on the game. The game was played over 3 business quarters of 20 simulated days each quarter. When running the simulation, the software simulated 20 days in 20 minutes, (although this can be varied by the instructor and the game can be paused as necessary). This means business happened rather quickly, so students had to be prepared to respond accordingly to changes in the business environment. Extra complexity was added in the form of lead times for customers and suppliers. With regards to customers, it took 1-3 simulated days for the product to reach the customer and 10 days before the customer would pay. On the supplier side, replenishment of products also took 1-3 simulated days. The job aid detailed 3 key processes that lead to decisions – the sales process (the key decisions were pricing and marketing expense) – the planning process (what markets to concentrate on and how much to order) and the procurement process (sending purchase orders to the vendors for replenishment). The quantities in the purchase order resulted from the planning process. These decisions were made by the individual teams and then entered into the ERPsim and all information about the game was retrieved from the standardized or customized reports generated in the system (such as inventory reports, sales and purchasing related reports) (Léger, 2010).

The teams analyzed these reports and used the information to improve their decision making processes. For example, they analyzed the market, their performance, including their operations and their strategies they used to make profit, and reviewed their performance against the overall market reports produced periodically by the simulation. They also discussed their operational and tactical objectives and what worked/what did not work and how this experience could be used to make better decisions in the next business quarter. In order to encourage the teams to ask meaningful questions in analyzing the data, the instructor guided them by asking some important questions such as: “Did your marketing strategy work?”, “Did your pricing strategy work?”, “Did you run out of inventory?” etc. The instructor also asked questions to help them with the decisions they need to make to improve their current standing such as: “What is your overall strategy going to be?”, “How will you prepare for the next round so you do not run out of inventory?”, “Do you want to change your marketing plan?”, among others.

The data was collected over three semesters from students enrolled in five different sections of the course, taught by the same professor. A paper-based survey was administered during the last week of classes. The survey consisted of a consent form, a background questionnaire, and a set of instruments capturing the constructs in the research model. The teaching assistant distributed and collected the surveys. Students completed the survey anonymously. Students completing the survey received 5 points credit out of 100 in their overall assessment for the course. All of the students who were in class on the day the survey was administered completed the survey and all the responses were usable. In order to reduce response bias, the following measures were taken (a) the survey was kept relatively short to prevent the respondents from getting fatigued and mindlessly selecting the same response for all similar items, and (b) the items measuring the instruments were represented in random order to prevent any bias that could happen due to the order of the questions. The survey also included two optional open-ended questions asking the respondents to comment on what they liked or didn’t like about the simulation for feedback to the instructor.

A total of 138 usable responses were obtained. Table 1 provides the demographic profile of respondents. Forty-seven percent of the respondents were female and respondents averaged 22.01 years of age (SD = 1.59).

Table 1: Demographic profile of respondents

	Number	Percent
Usable Responses	138	100%
Business School Classification		
Management	104	75.4
Management and Marketing	19	13.7
Other	15	10.9
Gender		
Male	72	52.2
Female	65	47.1
Not specified	1	0.7
	Mean	*Std. Dev.*
Age	22.01	1.59

CONSTRUCT OPERATIONALIZATION

A total of 11 scales were required to test the research model. Appendix A provides a list of the constructs used in this study and the set of items used to measure each construct. In order to capture the underlying theoretical dimensions comprehensively, multiple indicators were used to measure each construct, except game performance. Game performance was measured by the amount of profit each team made in the simulation and was converted to a 1- 5 scale from lowest to highest.

The remaining scales were adopted from Alshare and Lane (2011), Akbulut (2015), and Compeau et al. (1999) and were subjected to rigorous pre-testing in separate studies. Perceived learning outcomes and student satisfaction scales consisted of five and four items respectively. Perceived instructor knowledge and attitude scales were both measured with four items. Effort expectancy scale consisted of four and performance expectancy scale consisted of three items. Task structure and training scales consisted of three and two items respectively (Alshare & Lane, 2011). Interest scale was adopted from Akbulut (2015) and included three items. Finally, anxiety scale which consisted of 3 items was adopted from Compeau et al. (1999). The response format for all the measures consisted of a 5-place Likert-type scale ranging from 1 (strongly disagree) to 5 (strongly agree). Table 2 represents the descriptive statistics for the constructs in the model.

Table 2: Descriptive statistics

Construct	No. Items	Avg. Item Scores	
		Mean	*Std Dev*
1. Perceived Learning Outcomes	5	3.67	.77
2. Student Satisfaction	4	3.59	1.05
3. Attitude	4	3.70	.99
4. Game Performance	1	3.02	1.27
5. Perceived Instructor Knowledge	4	4.18	.63
6. Effort Expectancy	4	3.21	.90
7. Performance Expectancy	3	3.36	.99
8. Task Structure	3	3.50	.80
9. Training	2	3.09	.82
10. Interest	3	3.69	1.03
11. Anxiety	2	2.90	1.09

DATA ANALYSIS AND RESULTS

The reliability and validity of the measures were examined in three stages following the recommendations of Barclay et al. (1995).

First, the reliability of items compromising each construct was examined to ensure the items collectively measured their intended construct consistently (Gefen et al., 2000). In this respect, Cronbach's alpha coefficients and composite reliabilities were calculated to assess internal consistency reliability (Nunnally, 1978). Cronbach's alpha coefficients ranged from 0.800 to 0.935. Composite reliabilities were even higher, ranging from 0.756 to 1. Therefore, both reliabilities exceeded the generally agreed upon lower limit of 0.70 (Fornell & Larker, 1981; Nunnally, 1978), confirming the reliability of the scales (Barclay et al., 1995; Fornell & Larker, 1981). Appendix B depicts the reliability estimates.

Second, convergent validity was assessed both at the individual item and construct levels by examining the individual item loadings and the average variance extracted (AVE) respectively (Fornell & Larker, 1981; Gefen et al., 2000). In order to claim convergent validity at the item level, items should load on their intended constructs at 0.707 or greater and no undesirable cross-loadings should emerge (Gefen et al., 2000). As shown in Appendix A, all individual item loadings exceeded the 0.707 recommended level; indicating that the items converged adequately on their intended constructs. No undesirable cross-loadings emerged.

In order to claim convergent validity at the construct level, AVE values should be 0.50 or greater (Fornell & Larker, 1981) demonstrating that the construct as a whole shares more variance with its indicators compared to error variance. As shown in Appendix B, AVE values for each construct were greater than the recommended threshold value of 0.50, confirming that the items collectively demonstrated convergent validity, (Fornell & Larker, 1981; Gefen et al., 2000).

Third, discriminant validity was examined by comparing the AVE associated with each dimension to the correlations among the dimensions (Barclay et al., 1995). The calculations emerging from the discriminant validity analysis are provided in Appendix B. Diagonal elements (in bold) in Appendix B represent the square root of the AVE and the off-diagonal elements represent the correlations among dimensions. In order to claim discriminant validity, diagonal elements (square root of AVE) should be larger than any corresponding row or column entry. For each construct, the calculated AVE values exceeded the correlations between different constructs, confirming discriminant validity (See Appendix B).

Combined with the strong evidence for reliability and validity, the psychometric properties of the measures were re-confirmed.

RESULTS

The data was analyzed in two major steps. We first examined the data to determine whether the ERPsim games could be used as a learning tool to enhance perceived student learning outcomes and satisfaction in management courses.

For this purpose, a series of one-sample t-tests were employed to detect the extent to which the students perceived the learnings objective as achieved and their overall satisfaction with the ERPsim as a component of the course. A score significantly different from the scale midpoint (3) would indicate the degree of agreement. The t-statistic could also be used to detect the directionality of students' perceptions. The t-test results are given in Table 3.

Table 3: One-sample t-test results

N = 138							
	Avg Item Score					*95% Confidence Interval*	
Construct	*Mean*	*Std Dev*	*df*	*t-statistic*		*Lower*	*Upper*
Learning Objectives	3.67	.77	137	10.15	***	.538	.782
Student Satisfaction	3.59	1.04	137	6.58	***	.411	.763

Note. *** $p < .001$

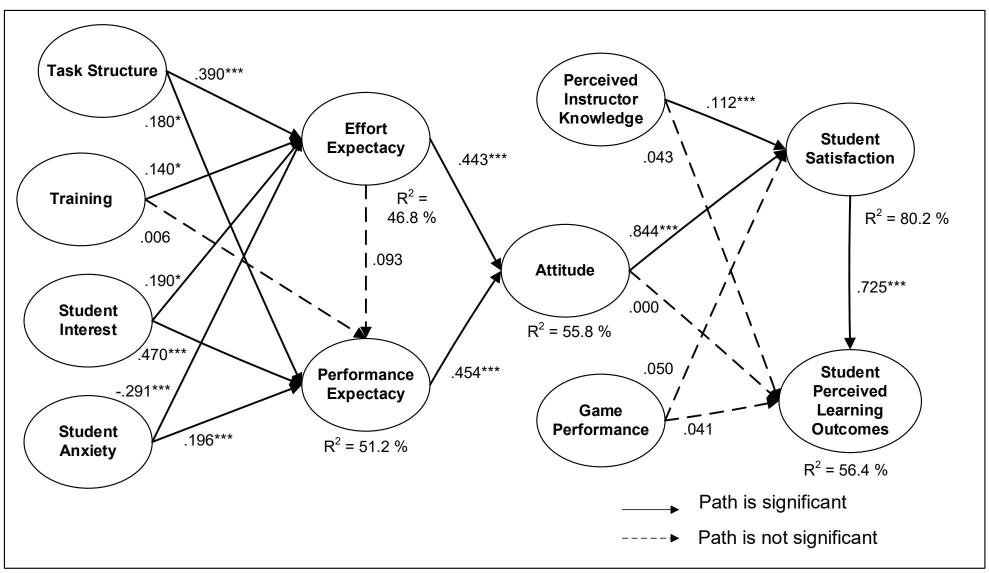
For the perceived learning objectives construct, the t-test revealed a significant value ($t = 10.15$, $p < .001$), meaning that the average item score ($M = 3.67$, $SD = .77$) was significantly higher than the scale midpoint. This indicates that students felt that the learning objectives had been achieved with the use of the ERPsim game.

For the student satisfaction construct, the t-test also revealed a significant value ($t = 6.58$, $p < .001$), meaning that the average item score ($M = 3.59$, $SD = 1.04$) was statistically significantly higher than the scale midpoint. This indicates that the students agreed that the ERPsim game was a satisfying component in the course content.

These findings together indicate that the ERPsim games, developed to teach business process and ERP concepts in information systems courses, can be successfully leveraged in other business courses aimed at teaching managerial concepts.

In the second step, we tested the research model to understand how student learning outcomes and satisfaction were formed. Partial least squares (PLS) was used to test the research model. PLS is a latent structural equations modeling (SEM) technique that use a component based approach to estimation (Joreskog & Sorbom, 1993). More specifically, PLS Graph Version 3.0 (Chin, 2003) was used. A bootstrapping method with 500 samples was employed to test the model.

The structural model was tested by estimating the path coefficients among constructs. Figure 2 represents the results of the structural model analysis.



Note. * $p < .05$; ** $p < .01$; *** $p < .001$

Figure 2: Structural model results

The results indicate that the research model explains a sizeable portion of the variance in learning outcomes. Student satisfaction, attitude, game performance, and perceived instructor knowledge cumulatively accounted for 56.4% of the variance in learning outcomes. Combined, attitude, game performance and perceived instructor knowledge explained 80.2% of the variance in student satisfaction. Effort expectancy and performance expectancy together accounted for 55.8% of the variance in attitude. Task structure, training, interest and anxiety together explained 46.8% of the variance in effort expectancy and 51.2% of the variance in performance expectancy. Overall, the model is a good fit.

H1 anticipated that student satisfaction would have a significant impact on perceived learning outcomes and this hypothesis was supported (.725, $p < .001$).

H2a and H2b predicted that attitude would have a significant impact on student satisfaction and perceived learning outcomes. Attitude was found to be a significant predictor of student satisfaction (.844, $p < .001$), supporting H2a. However, no support was offered for H2b (.000, ns).

The next set of hypotheses, H3a and H3b suggested a positive relationship between game performance and student satisfaction and perceived learning outcomes, respectively. Neither of these two hypotheses were supported (.050, ns and .041, ns).

H4a and H4b anticipated that perceived instructor knowledge would have a significant positive influence on student satisfaction and perceived learning outcomes. The results indicated a significant positive relationship between perceived instructor knowledge and student satisfaction, supporting H4a (.112, $p < .001$). Perceived instructor knowledge was not a significant predictor of perceived learning outcomes. Therefore, no support was offered for H4b (.043, ns).

H5a and H5b stated that effort expectancy and performance expectancy would have significant positive influence on attitude. Both effort expectancy (.443, $p < .001$), and performance expectancy (.454, $p < .001$) were found to be significant predictors of attitude, supporting H5a and H5b. In addition, H5c suggested a significant positive relationship between effort expectancy and performance expectancy. As opposed to our expectations, this hypothesis was not supported (.093, ns).

Hypotheses H6a and H6b anticipated that task structure would have a significant positive influence on effort expectancy and performance expectancy. Both hypotheses were supported (390, $p < .001$ and .180, $p < .05$).

Hypotheses H7a and H7b proposed that training would have a significant positive influence on effort expectancy and performance expectancy, respectively. As expected, training was a significant predictor of effort expectancy (.140, $p < .05$), supporting H3g. However, training was not a significant predictor of performance expectancy (.006, ns) and H7b was not supported.

Hypothesis H8a suggested a significant positive relationship between interest and effort expectancy, whereas H8b suggested a significant positive relationship between interest and performance expectancy. As expected, support for both hypothesis H8a (.190, $p < .05$) and H8b (0.470, $p < .001$) were received.

The last set of hypotheses, H9a and H9b suggested that anxiety would have a significant negative influence on effort expectancy and performance expectancy. Both hypothesis H9a (-.291, $p < .001$) and H9b (-.196, $p < .001$) were supported.

A summary of the hypotheses, results, and conclusions are presented in Table 4.

Table 4: Summary of hypotheses testing

Hypothesis		Coefficient	t-statistic		Conclusion
H_1:	Student satisfaction will have a significant positive influence on student perceived learning outcomes.	.725	6.672	***	Supported
H_{2a}:	Attitude will have a significant positive influence on student satisfaction.	.844	25.633	***	Supported
H_{2b}:	Attitude will have a significant positive influence on student perceived learning outcomes.	.000	.000	NS	Not Supported
H_{3a}:	Game performance will have a significant positive influence on student satisfaction.	.050	1.362	NS	Not Supported
H_{3b}:	Game performance have a significant positive influence on student perceived learning outcomes.	.041	.683	NS	Not Supported
H_{4a}:	Perceived instructor knowledge will have a significant positive influence on student satisfaction.	.112	2.617	***	Supported
H_{4b}:	Perceived instructor knowledge will have a significant positive influence on perceived learning outcomes.	.043	.551	NS	Not Supported
H_{5a}:	Effort expectancy will have a significant positive influence on attitude.	.443	6.825	***	Supported
H_{5b}:	Performance expectancy will have a significant positive influence on attitude.	.454	6.398	***	Supported
H_{5c}:	Effort expectancy will have a significant positive influence on performance expectancy.	.093	.918	NS	Not Supported
H_{6a}:	Task structure will have a significant positive influence on effort expectancy.	.390	4.124	***	Supported
H_{6b}:	Task structure will have a significant positive influence on effort expectancy.	.180	2.033	*	Supported
H_{7a}:	Training will have a significant positive influence on effort expectancy.	.140	2.100	*	Supported
H_{7b}:	Training will have a significant positive influence on performance expectancy.	.066	.853	NS	Not Supported
H_{8a}:	Interest will have a significant positive influence on effort expectancy.	.190	2.270	*	Supported
H_{8b}:	Interest will have a significant positive influence on performance expectancy.	.470	5.524	***	Supported
H_{9a}:	Anxiety will have a significant negative influence on effort expectancy.	- .291	4.394	***	Supported
H_{9b}:	Anxiety will have a significant negative influence on performance expectancy.	- .196	2.805	***	Supported

Note. $*p < .05$; $**p < .01$; $***p < .001$

DISCUSSION AND CONCLUSION

The two purposes of this research were to (1) to determine whether the ERPsim games developed to teach ERP concepts could be used as a learning tool to enhance student perceived learning outcomes and satisfaction in management courses and (2) identify the factors that shape student perceived learning outcomes and satisfaction with the ERPsim game in such courses. Based on the results, we can conclude that the use of ERPsim games can be successfully extended from their current usage domain of Information Systems to management courses to enhance student perceived learning outcomes and satisfaction. These findings have important theoretical and practical implications.

The findings indicate that perceived student learning outcomes are determined by student satisfaction. The relationship between satisfaction and perceived learning outcomes is an important one that has not been tested in previous studies. In today's student centered learning environments, the role of the students has changed from passive learners to active learners, taking responsibility for their own learning by involving themselves in the knowledge construction (Prince, 2004). As such, it is important for the instructors to create a learning environment that facilitates student satisfaction. When students are satisfied with the learning environment, they are more likely to believe that the appropriate instructional methods and materials that prompt student learning are employed. It is more likely, in such an environment, students would feel more powerful and in control of their own learning.

The results did not provide support for the direct effects of game performance, perceived instructor knowledge or attitude on perceived learning outcomes. Interestingly, game performance did not have any impacts on satisfaction or perceived learning outcomes. Students did not really care whether their team won the game or not, rather they valued their learning experience with the ERPsim game. However, even though neither perceived instructor knowledge nor attitude had any direct impacts on learning outcomes, they are still considered important factors as their effects on learning outcomes were channeled indirectly through student satisfaction. Since the students had no prior knowledge with the ERPsim game, they relied heavily on their instructor's knowledge. The more the students believed in their instructor's knowledge and skills, the more they were satisfied with the course. Also, attitude was significant in predicting student satisfaction. This relationship was the strongest relationship in the model. Thus, we can say that it is important for the instructors to generate positive attitudes towards the methods and tools used in class to facilitate student satisfaction and learning. Student attitudes can be enhanced by heightening students' performance and effort expectancies as these were found to be significant predictors of attitude.

It was also found that performance expectancy was determined by task structure, interest, and anxiety. Effort expectancy was determined by task structure, training, interest and anxiety. Therefore, it is important for the instructor to clearly explain the game objectives and expectations as well as the procedures to be followed to students. Moreover, the game material needs to be organized into logical and understandable components that are easy for student consumption and students must be properly trained. Since anxiety has a negative effect on both effort and performance expectancy, it is important for instructors to aim at reducing student anxiety, while promoting student interest. For example, in classes leading up to the ERPsim game the instructor spent a considerable effort in providing examples of situations that would (or could) be experienced by the students in the game. For example, in discussions on "anchoring" reference was made to recent past pricing decisions and to the in-warehouse cost of a product. Both of these were clearly evident in the game and students would have recognized that these two components affected their decisions. Recalling this information while playing the game, most likely reduced student anxiety and increased interest. Moreover, it is possible that coming to grips with a software package that was unfamiliar to students increased their curiosity in relation to what the game was about and why it was seen by the instructor as a central component of the course.

This research contributes a step toward understanding the use of ERPsim games in a new and innovative context - management courses that focus on teaching managerial concepts. This is the first quantitative study designed to examine the use of ERPsim games in management courses from both a theoretical and empirical perspective. Building on a sound theoretical framework derived from previous research, the study also identified a set of factors that interact to shape student perceived learning outcomes and satisfaction. The framework developed here can be leveraged and extended to include additional factors and examine the applicability of the ERPsim game in other non-IS courses. It is worthy of note too, that the success of the ERPsim in the context reported here mirrors findings for its use in IS related courses – see, for example Leger (2006), Seethamraju (2011), Legner et al. (2013) and Chen et al. (2015).

Clearly, the addition of the ERPsim game into the course was a good idea and allowed the students to actively experience and apply the concepts discussed in the course lectures, providing them with valuable hands-on experiences. As noted by one of the students, using the ERPsim game, "made class and learning about topics more interesting". Another student mentioned that "the fast-paced competition and decision making with automated reports made learning more fun". Other sample comments from students mentioned "experiencing hands-on learning topics being introduced in class was the best part of using the game", "We got to make the decisions of the company working with a team like in real life. It made the class more enjoyable, less lecture/discussion was better".

In addition, in the light of the AACSB requirements for evidence-based decision making, the authors consider the continued use of the game will make a valuable contribution to business school programs.

Despite the knowledge gained herein, some cautions are warranted. The study was conducted at a single university and the sample size was relatively small, limiting the generalizability of the findings. Future studies should use additional samples to increase the generalizability of the findings. Even though the current research model incorporated an important set of factors that could affect perceived learning outcomes and student satisfaction, it was not possible to include all potential factors. Moreover, the study only examined the direct effects of these factors on perceived learning outcomes and student satisfaction. In order to develop a better understanding, additional factors need to be considered and validated using more comprehensive models incorporating both direct and indirect effects.

Considering the likelihood that the majority of the instructors teaching management courses could lack experience with the ERPsim game, there is a neehe d to provide a model of best practice and clear guidelines for faculty so that they can successfully incorporate the game into their classes. Therefore, the authors are in the process of creating such guidelines to assist faculty to help them with the planning and execution of the game in management classes. These guidelines will be improved in subsequent iterations based on the results and the value of the modifications made will be assessed. It is also proposed to compare the results of this class with those from general classes in other business schools where the games were used to teach business processes, to determine what drives achievement of learning outcomes and satisfaction with the game. This should enable a study of a wider environment with the purpose of modifying the approach and the running of the games still further, leading to continued enhancement of the way in which the simulations are used.

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APPENDIX A: CONSTRUCTS, ITEMS AND LOADINGS

Construct / Item	Loading
Perceived Learning Outcomes	
Using the ERPsim game helped me learn about tactical decision making	.8739
Using the ERPsim game provided me with a good practical example of decision making	.8609
Using the ERPsim game helped me learn about operational decision making	.7845
I practiced many of the concepts we covered in the course in the ERPsim game	.7899
Using the ERPsim game provided me with a good demonstration of many theories introduced in the course	.7967
Student Satisfaction	
I would recommend the ERPsim to other students to learn about making decisions	.9195
I am satisfied with the quality of the learning experience of the ERPsim game	.9090
I enjoyed the ERPsim game	.9059
The ERPsim game is a good addition to the course	.9252
Attitude to Game	
Using the ERPsim game is a good idea	.8779
The ERPsim game made studying decision making more interesting	.9876
Playing the ERPsim game was fun	.8492
I liked learning the ERPsim game	.9023
Effort Expectancy	
Learning to use the ERPsim game was easy for me	.8813
My interaction with the ERPsim game was clear and understandable	.8474
It took a long time for me to understand the ERPsim game	-.7205
I found the ERPsim game easy to use	.8596
Performance Expectancy	
Exposure to the ERPsim game will be useful in my degree	.9049
Exposure to the ERPsim game will be useful in my future job	.9521
Using simulations such as the ERPsim game will increase my productivity in my future job	.8768
Task Structure	
The ERPsim game objectives and procedures to be followed were clearly communicated	.8543
The ERPsim game material was organized into logical and understandable components	.8990
The expectations from the ERPsim game were clearly stated	.7794
Perceived Instructor Knowledge	
My instructor is very knowledgeable about ERP concepts	.9106
My instructor is very knowledgeable about the ERPsim game we used	.9100
My instructor understands the topics discussed in the ERPsim game very well	.8900
My instructor knew the ERPsim game very well	.8605
Student Anxiety	
I was hesitant when using the ERPsim game for fear of making mistakes that I cannot correct	.8961
The ERPsim game was somewhat intimidating to me	.9360
Student Interest	
In the end, I found the ERPsim game to be interesting	.9514
In the end, using the ERPsim game was intriguing	.9427
The challenges faced when using the ERPsim game were interesting	.9252
Training	
I feel the training for the ERPsim game prepared me for it	.7339
I believe the training for the ERPsim game was sufficient	.9106

APPENDIX B: RELIABILITY, CORRELATIONS, AND DISCRIMINANT VALIDITY

Construct	∝	CR	AVE	1	2	3	4	5	6	7	8	9	10	11
1. Learning Outcomes	.878	.912	.676	**.822**										
2. Student Satisfaction	.935	.954	.837	.749	**.915**									
3. Attitude	.905	.933	.778	.663	.688	**.882**								
4. Effort Expectancy	.848	.898	.688	.394	.604	.620	**.829**							
5. Performance Expt.	.898	.937	.831	.597	.673	.626	.389	**.912**						
6. Task Structure	.800	.882	.715	.486	.611	.657	.587	.539	**.846**					
7. Instr. Knowledge	.915	.940	.797	.320	.378	.311	.196	.363	.336	**.893**				
8. Anxiety	.811	.913	.840	.035	.002	-.033	-.318	.173	-.073	.142	**.916**			
9. Training	.804	.756	.616	.320	.535	.489	.407	.372	.431	.280	-.063	**.785**		
10. Game Performance	-	1.00	1.00	.191	.203	.172	.268	.022	.163	.075	-.238	.156	**1**	
11. Interest	.934	.958	.883	.604	.762	.807	.471	.670	.607	.291	.051	.425	.133	**.940**

∝ = Cronbach's alpha. CR = composite reliability. AVE = average variance extracted.

BIOGRAPHIES

Geoffrey Dick currently teaches at St John's University in New York City. He was first appointed Professor of Information Systems at Dowling College NY in 2009, and since then has taught at North Georgia, Georgia Southern, George Washington and Northern Arizona universities. His previous academic career has included the position of Director of the Bachelor of Commerce programs at the University of New South Wales. He first used the ERPsim games to teach Information Systems at GSU, then adapted them to teach Management at NAU. He is an ABET Commissioner with expertise in Information Systems programs and has chaired several visits for the accreditation body the NCAAA in Saudi Arabia. He is a long-term co-chair of the Education track at AMCIS and was doctoral consortium co-chair for AMCIS 2019. His research (over 100 publications) is mainly in the areas of telecommuting (his PhD) and on-line education – he is the recipient of the ICIS prize for best paper in education and was awarded the 2009 Emerald Management Review Citation of Excellence for one of the best papers published worldwide, from over 400 business journals. He has been a visiting fellow at UC Davis, the University of Malaya, the Tec de Monterrey in Mexico, University of Agder in Norway and has taught in the prestigious programs of the ESAN Summer School in Lima, Peru, the CETYS International Summer Program in Ensenada and at ITAM in Mexico City.

Asli Yagmur Akbulut is Professor of Information Systems at Grand Valley State University. She earned her Ph.D. and M.S. degrees in Information Systems and Decision Sciences from Louisiana State University. She also holds an M.B.A. degree. Her research interests include IS education, business intelligence and analytics, and enterprise systems (ERP/SAP). She is an SAP certified business associate as well as ERPsim certified instructor. Her work has appeared in publications such as *Decision Sciences, Communications of the ACM, Communications of the AIS, Journal of Computer Information Systems, Journal of Information Systems Education, Journal of Information Technology Education*, and in various national and international conferences. She has served as the President of the Association of Information Systems' Special Interest Group on Education (AIS SIGED) and organized the pre-ICIS SIGED conference for many years. She has also served as an associate editor for the *Communications of the AIS* and the ICIS Education Track. She is an associate editor for the *Journal of the Midwest Association for Information Systems (JMWAIS),* and a long-term co-chair of the IS Education Track at AMCIS. She has received numerous awards including the Pew Teaching Excellence Award and Alumni Association's Outstanding Educator Award.