2017

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Geoffrey Dick
George Washington University, gfdick@aol.com

Asli Yagmur Akbulut
Grand Valley State University, akbuluta@gvsu.edu

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Geoffrey N Dick
WA Franke College of Business
Northern Arizona University
gfdick@aol.com

Asli Y Akbulut
Grand Valley State University
akbuluta@gvsu.edu

Abstract:

This paper reports the results of the introduction of the ERPsim games into an undergraduate managerial decision-making class. To date, the games have been principally used to teach ERP and business processes to business and information systems students. The objectives in introducing the game to these students was to give them some exposure to the use of information in tactical and operational decision making, illustrating concepts such as anchoring, bias and bounded awareness taught in the course. The students' satisfaction with the game as a teaching tool was measured and is reported here. The objective of the study was to determine whether the use of the games improves the course and enhances student understanding. The results were mixed with some students (the majority) enthusiastic, others much less so. It appears that satisfaction and student perception of achievement of learning objectives are largely driven by their attitude to the game and the amount of effort required.

Keywords: ERP SIM games, simulation, gaming, managerial decision making

I. INTRODUCTION

Using simulations to enhance management training and complement the classroom experience offers the advantages of providing students with some practical understanding of concepts, which for undergraduates, or those without direct workplace involvement, are often difficult to comprehend.

The simulation games developed in the HEC Montreal ERPsimLab provide ERP related simulations using SAP software at varying levels of complexity (Leger et al, 2007). As such they are well suited to the classroom and can be used for significant to minor student involvement. In this instance, the basic "Distribution Game" was used, occupying about 6 hours of a 45 hour, 3 credit course. The objective of this game is to compete, in teams of about 4, in selling bottled water into a market place. Using information on inventory, sales, a whole-of-market periodic report and financial statements, the participants make decisions on pricing and marketing with the objective of earning the highest profit among the teams playing.

Many of the concepts around managerial decision making are unfamiliar to students, particularly undergraduate students. A market place simulation game provides an opportunity to enhance student understanding and gain a realistic practical experience in using information for decision making.

To the best of the authors' knowledge this is the first time the ERPsim games have been used in a management decision making class, although some work has been done in using game to developing cognitive learning (Cronan et al 2012). They have however been widely used in teaching business processes (Dick and Szymanski, 2013). In the study reported here the focus was on the extent to which the simulation game helped the students with the concepts in the course and their satisfaction with it as a learning tool. As a result of this and subsequent studies,

the authors hope to develop a model of best practice for using these games in the undergraduate management classroom environment. 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.

II. BACKGROUND

Simulation Games

The idea of using simulation games in the classroom is not new (Bredemeier and Greenblat, 1981). The literature provides multiple advantages to using simulations in conjunction with the classroom, (see for example Salas, Wildman and Piccolo, 2009). Playing games that simulate the workplace environment can give students the opportunity to experience practice and theory together and often provide an opportunity to acquire skills that are normally acquired through practice. Such learning is often acquired in are reduced time frame and by providing rapid feedback can lead to strategic or tactical adjustments, which in turn can be evaluated, in a complex and realistic learning environment.

Typically, simulations provide a simplified version of reality in a risk-free environment and can be best used for infrequent tasks. They are usually simple to operate and learn, inexpensive and sometimes provide some 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 introduced by makin involvement with the simulation competitive, providing regular feedback and promoting the atmosphere of a game rather than a classroom exercise.

The ERPsim game used for this study provides a practical application of using information for decision making. It also gives examples of standard business processes and experience in the use of information to make tactical 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 event. They were also provided with a written explanation of the game and how to play it, which they were encouraged to read before coming to class.

The exercise consisted of ordering and distributing various bottled water products into 3 regions of a European country. Each product was defined uniquely with a material number and each team sold the same 6 products – therefore, initially the playing field was level and no one team had any advantage over another. They would be competing against other teams in class as to which team could make the most 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.

The game was played over 3 business quarters of 20 simulated days each quarter. When running the simulation, the software simulates 20 days in about 20 minutes. 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 takes 1-3 simulated days for the product to reach the customer and 10 days before the customer will pay. On the supplier side, replenishment of products also takes 1-3 simulated days. The job aid detailed three key processes that lead to decisions – the sales process (the key decisions are 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 vendor for replenishment). The quantities in the purchase order resulted from the planning process. These decisions are made by the individual teams and then entered into the SAP system.

The class

The class into which the game was introduced was a senior year undergraduate class – Management Decision Making. 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 the problems, integrating internal and external business analysis, generating and analyzing alternatives, and making supported recommendations identifying risks associated with decisions, generating contingencies to address risks and describing common individual and group decision errors and corrective actions.

Many of the above concepts are not only complex and based on psychological experiments and literature, but the students largely lacked any meaningful work experience to which they could begin to relate these concepts. As a result, the course uses psychologically-based behavior and invites the students to consider the implications of this behavior in the workplace. The class presentation material is supplemented by instructor experience, anecdote and story, but there remains a gap between classroom consideration and exercise and the "real world" in which they will be gathering and using information for managerial decision-making activities. As such the class would on the face of it, benefit from a good dose of practical experience. For practical experience in managerial decision making, we turn to simulation games.

Learning Outcomes and Student Satisfaction

The degree to which students achieve the learning outcomes for a course is an indication of the degree of knowledge they have acquired from it. In this study, the SAP, ERP driven game was intended to provide the students with a base and some examples to help them understand the concepts of the course and to see those concepts in practice. The more salient concepts expected to be experienced in the simulation game included anchoring, bounded awareness, change blindness, framing and over confidence. Student satisfaction can be considered as the perceptions held by students of the quality of learning, supplemented by enjoyment and whether they would recommend the course (in this case the activity) to others. These concepts have been studied before as dependent variables – see Eon, Wen and Ashill (2006) and Alshare and Lane (2011).

What drives learning outcomes and student satisfaction? Alshare and Lane (2011) in their study of prediction of them in ERP courses, provide a wide ranging overview of the literature and suggest the following:

- *Attitude* – the way in which a student approaches a technology will influence the way s/he learns and uses it when required to do so. Venkatesh et al. (2003) state that "attitude toward using technology is defined as an individual's overall affective reaction to using a system," and after examining different constructs, reported they all "tap into an individual's liking, enjoyment, joy, and pleasure associated with technology use." If the attitude is not positive learning outcomes may be affected adversely.
- *Effort and Performance expectancy* – Venkatesh et al (2003) defined these as the degree of ease associated with the use of the system and the degree to which an individual believes that using the system will help him or her to attain gains in job performance". In other words, "how hard will the task be and what will I get out of it?" Hands on activities are required in the game therefore seeing the game as easy to use and beneficial will most likely be more satisfied.
- *Training* – the use of an ERP system in a classroom is likely to be a daunting prospect for many students and in the absence of an explanation of how the system will work and the instructor's objectives in using it may work against acceptance and achievement of those objectives and promote negative attitudes; proper training can help overcome this problem (Alshare, 2009).

- *Task structure* - if the instructor uses effective ways of delivering instruction by clearly stating objectives and expectations then student satisfaction will increase (Eom et al., 2006). In this case, while the game itself is somewhat intuitive, the use of the ERP software does require following business processes in a specific order and many students in management classes may not be aware of the structure involved in the process. An explanation of the components of the process and a clear understanding of the way these components are executed in the game is expected to aid both satisfaction and perceived achievement of the learning objectives.
- *Perceived instructor knowledge* – 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 should accomplish the learning objectives.
- *Self-reported knowledge* – students with more knowledge of ERP systems (particularly SAP software) may be more likely to perform well in the game. Moon and Kim (2001), reported knowledge and experience with technology could influence intention to use. In this case the students had had some prior exposure to SAP systems in earlier classes but it was questionable how much of the knowledge gained there had been retained.

In addition to the above Akbulut (2015), in a study of using ERP systems in the classroom suggested the following two criteria which seem to have relevance here:

- *Student interest* - instilling expectations that positive outcomes will arise taking courses can generate increased student interest. (Akbulut 2015) Utilizing a game with direct relevance to the course being undertaken and using software that the students might well expect to encounter in the workplace could prove to be helpful in engendering satisfaction with the game.
- *Student anxiety* – 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 (Harrington et al. 1990, Heinssen et al., 1987; Torkzadeh and Angula, 1992; Weil and Rosen, 1995). Therefore, students who feel apprehensive about using the ERPsim game would be less likely to achieve the course learning objectives successfully and would experience less satisfaction with the game than those with less anxiety.

The above suggests the model displayed in Figure 1 below to address the following research questions:

1. Were the learning objectives for the game achieved?

2. Were the students satisfied with the quality of the learning experience of the game?

3. What factors contributed to the outcomes for 1 and 2 above?

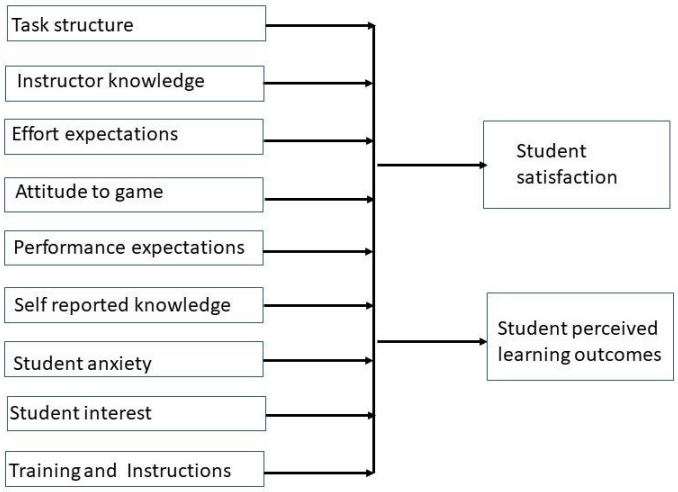

Figure 1 The Research Model

III. DATA

The data was collected from students undertaking a senior year undergraduate course in management decision making. 77 surveys were returned from the two classes in which the game was run, of which 76 were useable. As the survey was distributed and collected in class, all students completed it. 61% of the respondents were male, 39% female, 90% were aged 21-23, almost all were management majors.

The survey used for the collection of the data was adapted from Alshare and Lane (2011). It was distributed to the students in class at the conclusion of the entire game exercise, and the data was entered in Excel. Random checks of the data entry were conducted (with satisfactory results) before transferring the data to SPSS which was used for analysis. For the most part, the survey employed a 5-point Likert scale with respondents replying Strongly Disagree through Strongly Agree. Common method bias was avoided by having respondents choose a point on a scale between extremes such as "Overall this game was Enjoyable……Dull" for some statements. Construct validity was also enhanced by including a small number of negatively worded statements and variation of the wording. In terms of reliability analysis, the Cronbach's alpha for each of the constructs is given in Table 1 below.

Table 1 Reliability Analysis

Construct	No of items	Alpha
Student perceived learning outcomes	7	.844
Student satisfaction	4	.944
Attitude to game	4	.894
Effort expectations	5	.873
Performance expectations	3	.889
Task structure	3	.769
Instructor knowledge	4	.938

Student apprehension	3	.778
Student interest	3	.950
Training and materials	2	.552

As can be seen all are satisfactory except for Training and materials. This comprised only two items and they did address slightly different aspects – reading the instructions and whether the training given was sufficient.

IV. RESULTS

In terms of achievement of learning objectives as perceived by the students the majority saw these as accomplished, seeing the game as providing a good demonstration of tactical and operational decision making, covering the concepts and theories introduced in the course and, for the most part, having been able to perform well in the game. Figure 2 below gives the distribution in relation to the achievement of learning objectives as perceived by the students

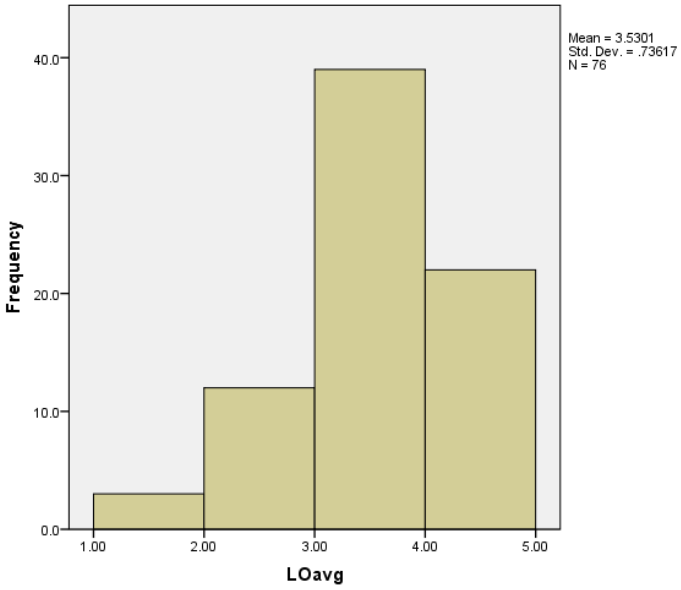

Figure 2 Learning Objectives Achieved

Student satisfaction with the game was a little more mixed. In terms of recommending that other students use the game to learn about making decisions, the quality of the learning experience, enjoyment and as to whether it is a good addition to the course, the distribution is somewhat bi-modal, although positioned around the middle – see Figure 3

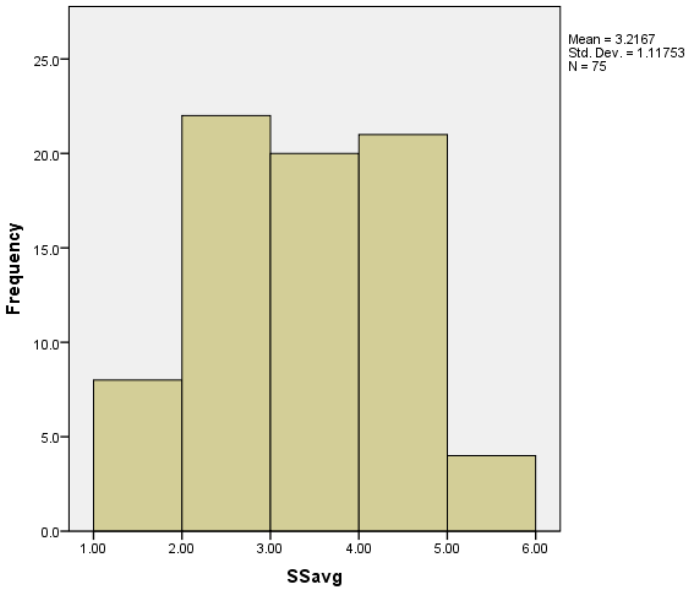

Figure 3 Student Satisfaction

Turning now to determining constructs providing the greatest explanation for the dependent variables, step-wise linear regression was conducted to determine the factors influencing the two outcomes above. Figure 4 below gives the results.

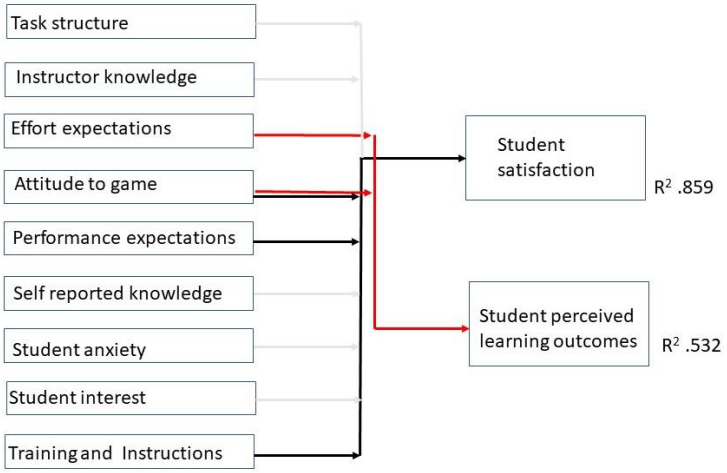

Figure 4 Influencing Factors

Table 2 below gives the t values and significance for each of the loaded variables.

Table 2 – Test statistics

Construct	t	Sig
Student satisfaction		
Attitude to game	11.636	.000
Training and materials	2.550	.013
Perceived effort	2.472	.016
Student perceived learning outcomes		
Attitude to game	4.469	.000
Effort expectations	2.685	.009

The students' attitude to the game is the significant factor in both sets of causality. Student satisfaction and what they got out of it depended on whether or not they considered it fun and a good idea to include in the course, if it made studying decision making more interesting and if they liked learning the game. The extent to which the students found the game enjoyable as opposed to dull, useful or unhelpful, and fun versus a waste of time, were all highly correlated (and all significant at the .001 level) with satisfaction and learning outcomes.

Learning outcomes and satisfaction were also highly correlated (and significant at at least the .05 level) with the student's performance in the game, as measured by the amount of net profit each team made, as compared to the profits made by other teams.

V. DISCUSSION

While the game was well received and appreciated by most students in the class, it is concerning that some 34% or the students found it more dull than enjoyable, 32% found it more unhelpful than useful and 26% found it more a waste of time than fun. While these three variables are highly correlated, nevertheless the exercise was not appreciated by around 1/4 to 1/3 of the class. It seems from the above that the more the students were able see the course topics reflected in the game the happier they were with it. There could be several factors contributing to the different views:

1. The course material contained many decision-making terms and concepts that would be unfamiliar to most undergraduate students. Examples are anchoring, bounded awareness, inattentional and change blindness, satisficing, confirmation bias, risk aversion and risk seeking action, competitive irrationality and impression management. All of these are represented (to varying degrees) in the game but many students may not have seen them. A debriefing was conducted stressing what the students had experienced but this was after the distribution and collection of the survey. In the next offering of this course the instructor intends to liberally pepper the classroom presentation material with examples drawn from information used for decisions more closely resembling the information in the game. As an example, anchoring could be explained as using the default prices as a starting point for pricing

decisions, bounded awareness could be described in terms of the reports available, etc.

2. Although the student anxiety or nervousness did not load in the regression, many students mentioned confusion and the fast pace of the game in things they did not like about the exercise. Performance is highly correlated with satisfaction and learning outcomes. If the students are not doing well in the game they may not be receptive to the lessons the game has for them. The game can be paused – perhaps more use of this feature would allow students who have fallen behind or are not comprehending what can be done to catch up.

3. The assessment for the course included a small component (5/100) for performance in the game. This was allocated as 5 for the winning team and 1 for the team with the lowest profit (or greatest loss) with the other teams receiving marks within that range. It is possible that the recognition that a low grade based on performance was seen as a surrogate for not getting much out of the game in terms of learning objectives achieved and satisfaction. Perhaps it would be worth dispensing with this component and providing prizes or maybe, just recognition.

4. There was a high correlation between the effort the students put into reading the training materials before the game and satisfaction. In this course, the students were asked to read the material before playing the game, although many did not. Perhaps it would be beneficial to spend more time in this training area, by asking students to complete a pre-game exercise or running a task to supplement the reading materials.

5. Many of the students in this course were also undertaking a capstone course that likewise employed a simulation exercise. The simulation there was more complex, with many more variables than the Distribution Game offered; it also ran for the duration of the semester. In responding to this survey, the students may well have had the other simulation in mind and this could have contributed to some degree of dissatisfaction with this game as a learning tool, particularly given the limited number of variables available in the Distribution Game.

VI. CONCLUSION AND FURTHER WORK

The authors have used these games extensively in business courses, especially with Information Systems majors. They intend to continue using the games in more general management courses, adapting and modifying them to take on board some of the suggestions mentioned in the Discussion section above. It is proposed to compare the results from subsequent classes with those reported here to assess the value of modifications made.

It is also proposed to compare the results of this class with those from a more general class in business schools to determine what drives achievement of learning objectives and satisfaction with the game in that environment with the purpose of modifying the approach and running of the games still further.

Regression is rather a blunt instrument. It may well be that structural equation modelling would provide a more refined result explaining some of the nuances in the use of the game not captured by the current model. The authors intend to modify the model accordingly and adjust the survey if necessary to facilitate this approach.

VII. REFERENCES

Akbulut, A. Y. 2015 “What Motivates Students to Study Enterprise Systems? A Social Cognitive Perspective” *Twenty-first Americas Conference on Information Systems*, Puerto Rico

Alshare, K. (2009) “Examining Factors That Influence Student Effort of Learning and Using Class-Related IT: The TAM Approach”, *SWDSI Proceedings*, Oklahoma City, OK, pp. 220–227

Alshare, K. A. and Lane, P. L. (2011) "Predicting Student-Perceived Learning Outcomes and Satisfaction in ERP Courses: An Empirical Investigation," *Communications of the Association for Information Systems*: Vol. 28, Article 34. Available at http://aisel.aisnet.org/cais/vol28/iss1/34

Bredemeier M and Greenblat C (1981) “The Educational Effectiveness of Simulation Games - A Synthesis of Findings” Simulation and Games 12(3) pp. 307-332

Cronan, T.P., Léger, P.-M., Robert, J., Babin, G. et Charland, P. (2012) “Comparing Objective Measures and Perceptions of Cognitive Learning in an ERP Simulation Game: A Research Note” *Simulation & Gaming*, vol. 43, pp. 461-480

Dick, G. N. and Syzmanski, R. (2013) “Integration of an SAP Simulation Game into an IS Course” *Conference of the Southern AIS* Savannah GA Available at http://aisel.aisnet.org/sais2013/7/

Eom, S., H. Wen, and N. Ashill (2006) “The Determinants of Students’ Perceived Learning Outcomes and Satisfaction in University Online Education: An Empirical Investigation” *Decision Sciences Journal of Innovation Education* (4)2, pp. 215–235.

Harrington, K. V., McElroy, J. C., and Morrow, P. C. (1990). “Computer anxiety and computer-based training: A laboratory experiment. *Journal of Educational Computing Research*, 6, 343-358.

Heinssen, R. K., Glass, C. R., and Knight, L. A. (1987). “Assessing computer anxiety: Development and validation of the computer anxiety rating scale” *Computers in Human Behavior*, 3 pp. 49-59.

Léger, P.-M., Robert, J., Babin, G., Pellerin, R. and Wagner, B. (2007), ERPsim, ERPsim Lab, HEC Montréal, Montréal, QC

Leidner, D.E. and S.L. Jarvenpaa (1995) “The Use of Information Technology to Enhance Management School Education: A Theoretical View”, *MIS Quarterly* (19)3, pp. 265–291

Salas E, Wildman J. L and Piccolo R. F (2009) “Using Simulation-Based Training to Enhance Management Education” *Academy of Management Learning & Education*, 8 (4) pp 559-573

Torkzadeh, G. and Angula, I. E. (1992). “The concept and correlates of computer anxiety” *Behavior and Information Technology,* 11, pp. 99-108

Venkatesh, V. et al. (2003) “User Acceptance of Information Technology: Toward a Unified View” *MIS Quarterly* (27)3, pp. 425–478

Weil, M. M., and Rosen, L. D. (1995). “The psychological impact of technology from a global perspective: A study of technological sophistication and technophobia in university students from twenty three countries” *Computers in Human Behavior,* 11 (1), pp. 95-133.