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TAKING THE ERPSIM GAMES INTO MANAGEMENT EDUCATION

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Abstract:
To date ERPsim games have been used principally to teach business processes in Information Systems courses. This paper reports on using the games in a totally new context, in a senior level, undergraduate, managerial decision-making class. The objectives in introducing the game to the students in this class were to give them exposure to the use of information in tactical and operational decision making, as well as to illustrate concepts such as anchoring, bias and bounded awareness taught in the course. The use of the games has relevance to the new AACSB guidelines and the focus on analytical and evidence-based decision making in many business programs. Efforts by the instructor in drawing from the ERPsim games to explain class concepts, and using these interesting games that replicated the business environment contributed to a high level of student satisfaction and interest in the game and also promoted a perception of achievement of learning outcomes. The authors intend to continue this research, continually refining the way in which the simulations are used in the classroom to develop a model of best practice.

Keywords: ERPsim, gaming, management decision making, simulation

I. INTRODUCTION

Undergraduate students typically bring little business or work experiences with them into the classroom. Some of the concepts introduced in the classroom, particularly in the realm of management education are difficult to understand without such experience. Simulations aimed at replicating the business environment can enhance management training and complement the classroom experience by offering students practical understanding of concepts. A market place simulation game provides an opportunity to enhance student understanding and gain a realistic practical experience in using information for decision making.

Simulations that appear well-suited to the management classroom and have already been extensively tested in the Information Systems (IS) classroom are those developed in the HEC Montreal ERPsim Lab. They provide ERP related simulations using SAP software at varying levels of complexity (Leger, 2006; Leger et al, 2007).

To the best of the authors’ knowledge, the series of “experiments” reported in this and an earlier paper are the first time the ERPsim games have been used in a management decision-making class, although some work has been done in using the games to developing cognitive learning (Cronan et al 2012). Regardless, the games have been widely used in teaching business processes in IS courses (Leger et al 2010; Seethamraju 2011, Leger et al 2011; 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 managerial decision-making course and their satisfaction with it as a learning tool. 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. Therefore, the immediate objective of this ongoing study, reflected in the results reported here, is to determine whether or not the ERPsim, a simulation tool developed for IS courses, aids in student
understanding of the managerial decision-making concepts introduced in the course and if so, what factors contribute to that understanding.

In addition, the use of such simulations in the classroom may have implications for business schools around the world in that it seems directly relevant to the most recent AACSB guidelines (modified in 2017) regarding a new knowledge area in undergraduate programs:

“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.” (AACSB 2017)

Through this longitudinal study, of which the results reported here are a part, the authors hope to establish a “model of best practice” for the use of these simulations in managerial education which can be used in business schools around the world. Such a model would cover not only the running of the simulation but preparation for it in the classes leading to its use, presentation and training prior to its use and scoring of results. To get to this point the authors intend to continue to conduct studies of the simulation while making various changes to the way it is introduced into the class in an attempt to refine the procedures whereby the “model of best practice” will evolve.

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 a reduced time frame. The rapid feedback provided by the simulation and 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.

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 making 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. 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. They competed against other teams in class as to which team could make the most profit.

The game was played over 3 business quarters of 20 simulated days each quarter. When running the simulation, the software simulated 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 took 1-3 simulated days for the product to reach the customer and 10 days before the customer to pay. On the supplier side, replenishment of products also took 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 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 system. In a subsequent exercise (not part of this study) the data generated by the simulation was used for an analytics exercise, addressing more of the points mentioned in the AACSB requirements above.

The class

The class into which the game was introduced was a senior year undergraduate class titled 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, and generating and analyzing alternatives.

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 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 turned to the ERPsim 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 those seeing the game as easy to use and beneficial will most likely be more satisfied.

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 ERPsim 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 outcomes.

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 to accomplishment of the learning outcomes.

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 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, Heinissen 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 outcomes successfully and would experience less satisfaction with the game than those with less anxiety.

Student interest – is defined as an emotion that arouses attention to, curiosity about, and concern with a particular educational path (Akbulut, 2015). Instilling expectations that positive outcomes will arise as result of learning certain topics 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 positive perceptions about the learning outcomes and satisfaction with the game.

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

1. Were the learning outcomes 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 learning outcomes and student satisfaction?
III. RESEARCH METHOD

Given the objectives of the study, the survey methodology was utilized to collect the data. The scales used for the collection of the data were adapted from Alshare and Lane (2011) and Akbulut (2015). The data was collected from students enrolled in a senior year undergraduate course in management decision making. 36 surveys were returned from the two classes in which the game was run, of which all were useable. 36% of the respondents were male, 64% female, 80% were aged 21-23, and almost all of them were management majors.

The survey 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.

Learning outcomes measured whether the students believed the ERPsim provided a good demonstration of course concepts and served as a good example of decision making. Student satisfaction measured students’ satisfaction with the ERPsim game and with their learning experience with it. Attitude measured students’ beliefs regarding if using ERPsim in this course was a good idea. Effort expectancy measured whether using the game and interacting with it was easy and clear. Performance expectancy measured whether students believed that the exposure to the ERPsim game would be beneficial to them in their future. Task structure measured whether the game objectives, procedures, material was clear and understandable. Perceived instructor knowledge measured students’ perceptions about their professor’s knowledge of the game and topics. Self-knowledge measured students’ reported prior experience with ERP systems. Student anxiety measured whether students felt apprehensive about the game and student interest measured their perceptions about the ERPsim game being interesting. The full questionnaire is available upon request from the authors.

As recommended by Barclay et al. (1995), reliability and validity of the indicators and constructs were examined in three stages. First reliability of each construct was examined to ensure that the items collectively measured their intended construct consistently (Gefen et al., 2000). Reliability
was assessed by examining the reliability of individual items (Cronbach’s $\alpha$) and the composite reliability of constructs. As shown in Table 1 below, both types of reliability scores were well above the recommended level of 0.70; confirming the reliability of the scales (Barclay et al., 1995; Fornell and Larker, 1981).

Convergent validity was tested both at the individual item and construct levels by examining the individual item loadings and the AVE respectively (Fornell and Larker, 1981). All individual items exhibited adequate loadings (greater than 0.707) and no unacceptable cross loadings emerged. Moreover, as shown in Table 1, AVE values were greater than 0.50. Therefore, convergent validity of the items and constructs were confirmed (Fornell and Larker, 1981; Gefen et al., 2000).

### Table 1. Reliability and Convergent Validity

<table>
<thead>
<tr>
<th>Constructs</th>
<th>$\alpha$</th>
<th>CR</th>
<th>AVE</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Learning Outcomes</td>
<td>0.807</td>
<td>0.855</td>
<td>0.762</td>
</tr>
<tr>
<td>2. Student Satisfaction</td>
<td>0.939</td>
<td>0.955</td>
<td>0.841</td>
</tr>
<tr>
<td>3. Attitude</td>
<td>0.916</td>
<td>0.943</td>
<td>0.804</td>
</tr>
<tr>
<td>4. Effort Expectancy</td>
<td>0.809</td>
<td>0.919</td>
<td>0.792</td>
</tr>
<tr>
<td>5. Performance Expectancy</td>
<td>0.931</td>
<td>0.955</td>
<td>0.875</td>
</tr>
<tr>
<td>6. Task Structure</td>
<td>0.901</td>
<td>0.938</td>
<td>0.835</td>
</tr>
<tr>
<td>7. Instructor Knowledge</td>
<td>0.930</td>
<td>0.950</td>
<td>0.826</td>
</tr>
<tr>
<td>8. Self Knowledge</td>
<td>0.760</td>
<td>0.868</td>
<td>0.658</td>
</tr>
<tr>
<td>9. Anxiety</td>
<td>0.720</td>
<td>0.912</td>
<td>0.838</td>
</tr>
<tr>
<td>10. Interest</td>
<td>0.924</td>
<td>0.953</td>
<td>0.872</td>
</tr>
</tbody>
</table>

*Note. $\alpha$ = Cronbach’s alpha. CR = composite reliability. AVE = average variance extracted.*

Discriminant validity of the constructs was examined by comparing the average variance extracted (AVE) associated with each construct to the correlations among constructs. In Table 2 diagonal elements (in bold) represent the square root of the AVE, whereas off-diagonal elements represent the correlations among constructs. In order to claim discriminant validity, the square root of the AVE associated with a particular construct must be greater than its correlations with other constructs (Fornell and Larker, 1981). As shown in Table 2, each construct sufficiently differed from other constructs; confirming discriminant validity.

### Table 2. Correlations and Discriminant Validity

<table>
<thead>
<tr>
<th>Constructs</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>9</th>
<th>10</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Learning Outcomes</td>
<td>0.873</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. Student Satisfaction</td>
<td>0.656</td>
<td>0.917</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. Attitude</td>
<td>0.566</td>
<td>0.830</td>
<td>0.897</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4. Effort Expectancy</td>
<td>0.369</td>
<td>0.624</td>
<td>0.561</td>
<td>0.890</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5. Performance Expectancy</td>
<td>0.587</td>
<td>0.508</td>
<td>0.482</td>
<td>0.468</td>
<td>0.935</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6. Task Structure</td>
<td>0.596</td>
<td>0.555</td>
<td>0.569</td>
<td>0.569</td>
<td>0.591</td>
<td>0.914</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7. Instructor Knowledge</td>
<td>0.125</td>
<td>0.257</td>
<td>0.325</td>
<td>0.205</td>
<td>0.247</td>
<td>0.191</td>
<td>0.909</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8. Self Knowledge</td>
<td>0.123</td>
<td>0.334</td>
<td>0.216</td>
<td>0.379</td>
<td>0.211</td>
<td>0.137</td>
<td>0.291</td>
<td>0.811</td>
<td></td>
<td></td>
</tr>
<tr>
<td>9. Anxiety</td>
<td>0.323</td>
<td>0.154</td>
<td>0.119</td>
<td>0.327</td>
<td>0.237</td>
<td>0.386</td>
<td>0.091</td>
<td>0.158</td>
<td>0.915</td>
<td></td>
</tr>
<tr>
<td>10. Interest</td>
<td>0.687</td>
<td>0.764</td>
<td>0.769</td>
<td>0.425</td>
<td>0.582</td>
<td>0.573</td>
<td>0.357</td>
<td>0.122</td>
<td>0.061</td>
<td>0.934</td>
</tr>
</tbody>
</table>

Combined with the strong evidence for reliability and validity, the psychometric properties of the measures were reconfirmed.
IV. RESULTS

The majority of students saw the achievement of learning outcomes 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 outcomes as perceived by the students.

![Figure 2. Learning Outcomes](image)

Student satisfaction with the game indicated a high degree of approval. 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 the game is a good addition to the course, the distribution indicates strong support. – see Figure 3

![Figure 3. Student Satisfaction](image)
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. Contributing Factors](image)

In addition, Table 3 below gives the t values and significance for each of the loaded variables.

<table>
<thead>
<tr>
<th>Constructs</th>
<th>t-value</th>
<th>sig</th>
</tr>
</thead>
<tbody>
<tr>
<td>Student Satisfaction</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Attitude</td>
<td>8.384</td>
<td>.000</td>
</tr>
<tr>
<td>Learning Outcomes</td>
<td>4.820</td>
<td>.000</td>
</tr>
</tbody>
</table>

**V. DISCUSSION**

It seems student satisfaction is predicated on the game itself – that using it was a good idea and made the concepts of the course more interesting, the game itself was fun to engage with and interesting to learn. This would indicate that the quality of the game in replicating a business environment relevant to the course is an essential feature of student satisfaction. In classes leading up to the game the instructor spent a considerable effort in using examples of situations that would (or could) be experienced by the students in the game. For example, in discussion on “anchoring” reference was made to recent past pricing decisions and knowing 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.
Student interest in the game drove most of the perception of achievement of learning outcomes. Coming to grips with a software package that before the game was unfamiliar to most 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. By far the majority of the students saw the game as useful in them achieving the learning outcomes for the course. It is noted that performance in the game (making a profit and winning by achieving a higher profit than the other teams) is correlated with achievement of learning objectives ($p = .024$) It is possible that this “success” spilled over into the area of perceived achievement of learning objectives — more work is necessary here.

Despite the knowledge gained herein, some cautions are warranted. The findings vary somewhat from what have been expected from research based on the Unified Theory of Acceptance and Technology Use model. It maybe that the particular configuration of the simulation and the confined nature of the task has resulted in this, however further work needs to be done in this area. The study was conducted at a single university and the sample size was relatively small; limiting the generalizability of the findings. Future studies should utilize additional samples to increase the generalizability of the findings. Even though the current research model incorporated an important set of factors that could affect 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 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. The current study used regression, which is perhaps not the best technique for teasing out some of the nuances contained in the model. As such, complex causal chains will not be evident. 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. To this end, the authors are in the process of refining a more complex model and continuing to collect data. An update on this activity will be provided at the conference. These issues will be dealt with further in future studies too.

VI. CONCLUSION

In terms of achievement of learning objectives and satisfaction with the game, the results reported here are an improvement on those reported in an earlier paper (Dick and Akbulut, 2017). The previous study indicated that around a third of students found it dull, unhelpful and a waste of time. These numbers were considerably reduced for this group suggesting that the changes introduced in the way the simulation was introduced, presented to the class, played and scored may well have contributed to the improved satisfaction and achievement of learning objectives. The authors are conducting further work in an effort to determine the significance of those changes.

The authors have used the ERP Sim games extensively in business courses, especially in Information Systems courses. Given the satisfactory results so far, they intend to continue using the games in more general management courses, adapting and modifying them as needed. They are also refining their approach to how these games can be taught to non-IS students to enhance them as a sound teaching aid in general management decision making. It is proposed to compare the results from subsequent classes with those reported here to assess the value of modifications made. In addition it is noted that the results reported here are in line with the use of other games related to decision making (Tobail, A., Crowe, J. and Arisha A. 2011; Salas, et al 2009)

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 running of the games still further.

Hopefully this research will lead to a set of best-practice procedures and guidelines for the use of these simulation games. In addition, in the light of the modified AACSB requirements for evidence-based decision making, the authors consider this continued refinement of the use of the game will make a valuable contribution to business school undergraduate programs.
VII. REFERENCES


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