ERP Simulation Games in Asynchronous Online Classes

Mark Hwang
Information Systems
Central Michigan University, USA
mark.hwang@cmich.edu

Abstract

Using simulation to teach business related concepts has been shown to improve student performance and learning. Developed almost two decades ago, an Enterprise Resource Planning (ERP) simulation game has seen wide adoption in traditional classrooms. However, report of its use in online classes has been rare. This teaching note shares experiences in using the game in an asynchronous online environment. Students in two separate online MBA classes were evaluated through a pre-test post-test knowlede measurement. The findings were that there was a significant improvement post-game to their knowledge pre-game. In addition, students reported that they were highly satisfied with the experience and that they considered the game an effective learning tool.

Key words*: Computer-based instruction; Instructional design; ERP simulation; Online instruction.*

Introduction

Modern organizations rely on Enterprise Resource Planning (ERP) systems to run their daily business. In response, many business schools have incorporated ERP into their curriculum. While teaching keystrokes is easy, learning how business processes are integrated and supported by ERP systems remains a challenge (Cronan and Douglas, 2012; Shen et al., 2015). Educators have developed different approaches to address the integration challenge including role-playing exercises (Shen et al., 2015), gamification (Alcivar and Abad, 2016), and ERP simulation (Léger, 2006). The latter approach is especially promising as simulations in general have been shown to improve student performance and learning of business concepts (Salas et al., 2009; van der Merwe, 2013; Levant, Coulmont, and Sandu, 2016; Parle and Laing, 2017). The ERPsim game developed by the faculty at HEC Montréal has seen widespread use in recent years, with adoption by over 200 universities worldwide (Labonte-LeMoyne et al., 2017)..

In addition to the need to teach process integration, another challenge in teaching ERP is the need to bring the training online. The move toward more online education is undeniable, both in school and at the work place. Healthy growth in online enrollment at post-secondary academic institutions is projected around the world (Hwang and Cruthirds, 2017; Kumar et al., 2019). Similarly, in a recent survey of 865 SAP professionals from over 50 countries, 67 percent indicated a preference for online training over any other delivery method (Michaels, 2017). The ERPsim game has been shown an effective tool to learn ERP concepts in traditional classrooms (Cronan et al., 2011, Cronan and Douglas, 2012; 2013). With more learning occurring in an online environment, there is a need to understand how to run a simulation game effectively online, both synchronously and asynchronously.

When running an ERPsim online in a synchronous setting, participants take part in the game at the same time from different locations. Not much difference exists between this type of games and the games that run in a traditional classroom with the exception that face-to-face communication among students and between the instructor and students being replaced with text messaging, audio or video conference. This format has been used by HEC Montréal to run the annual International ERPsim Competition for many years that featured student teams from around the world competing against each other at the same time.

More often than not, an online class is designed to be self-paced and hence most, if not all, activities are completed asynchronously. It is generally not desirable or even possible to schedule a synchronous meeting when a large portion of the student body is composed of working professionals. Consequently, the most feasible venue for running an ERPsim game online is an asynchronous setting. Table 1 summarizes the different formats that ERPsim games have been used in the past. Note that to run a game in the same place at different times can be used in a traditional class if the game has to be spread out to different dates due to time constraints. The focus of this teaching note is on using the ERPsim game in an online class where the game has to be run in an asynchronous setting. While extant research on ERPsim games has shown the benefits of their use in traditional classes (Cronan et al., 2011, Cronan and Douglas, 2012; 2013), it is not clear if and how the same benefits can be replicated in an online class. This teaching note seeks to fill the gap in the literature and spur more interest in the use of the ERPsim games in online classes.

Table 1:
ERPsim Games Format

	Same Time	**Different Times**
Same Place	Traditional Classes	Traditional Classes
Different Places	International ERPsim Competition	Online Classes

Simulation Learning Objectives

Through the ERPsim games students can learn to operate as a team in using an ERP system to make and implement business decisions. Specifically, students are expected to obtain the following knowledge or skills:

- Business process; students learn how individual business processes including planning, procurement, production, inventory, sales and marketing work, as well as how the processes are integrated.
- ERP transactions; students learn how to execute ERP transactions using SAP in response to business activities triggered in business process such as sales and marketing.
- **Decision effectiveness; by observing the effect on their team's financial** performance from the execution of ERP transactions, students learn to make strategic and tactical business decisions.

Assessment is based upon survey of students of their knowledge pre- and post-game. Additionally, student satisfaction with the game is assessed to gauge its effectiveness as a learning tool.

Implementation Guidelines

The ERPsim game has been shown an invaluable tool in teaching enterprise systems concepts in traditional classrooms (Cronan et al., 2011, Cronan and Douglas, 2012; 2013). Due to the dispersion of time and space; however, running an ERPsim game in an online class presents significant challenges. When members of a team are separated by time or space, communication and coordination requires considerably more time and effort (Espinosa, Cummings, and Pickering, 2012; Marlow et al., 2018). Consequently, it is necessary to slow down the pace of the game as much as possible. However, questions remain about both the timing and duration of the game. Our first implementation experimented with a game played for 24 hours over two days. The duration was shortened gradually for subsequent games and eventually a six hour period over a Saturday seemed to work reasonably well. Other formats may also be feasible. For example, Hwang and Cruthirds (2017) show that an online game can be played for 72 hours over three weekdays. While this format gives students plenty of time for teamwork, it requires working professionals to get permission from their employers to engage in school activities while at work, a requirement that may not be feasible for all students. In addition, some organizations may not allow their employees to access external systems at work. Nevertheless, this approach will appeal to instructors who do not want to spend extra hours over weekends for the game. Additionally, any technical questions can be addressed more efficiently during weekdays. While both formats may work, it may be a good idea to survey the students in advance to see which approach is preferred.

A second critical component to an effective implementation of online games is learner support. This includes all the preparations before the game is played. Just like in a traditional class, the instructor should explain the game in detail in an online class. Recorded lectures are a must, which may be supplemented by a short quiz over the materials to make sure students watch them. Online discussion boards are a good venue for students to post common questions both before and during the game. Expect plenty of questions in the form of postings and private emails during the game. At the end of each round, the instructor should debrief the students, provide any feedback and tips for improvement. This should be done whether the game is played in a traditional class or an online class. Finally, if the game is played over a weekend, expect delayed response to technical problems, a fact that needs to be communicated to students in advance.

In short, an online game requires extra preparations beforehand and close monitoring during the game. In addition to monitoring the simulation software closely, be prepared to respond to emails or postings on the discussion boards about questions or problems related to the game. Even though students play the game asynchronously **(they logon at different times to plan, execute and monitor their team's activities), the game's progression during the entire period needs to be monitored.** This means the devotion of at least six hours of one day on a weekend to ensure smooth running of the game. This will be on top of any time that the instructor has budgeted for teaching during the weekend. For games that are played over multiple weekdays, the instructor needs to continuously monitor the game progression too.

Assessment Method

The effectiveness of the online game was assessed in two ways: student learning and student satisfaction. The first aspect was assessed through questionnaire administered pre- and post-game using the instrument developed by Cronon and colleagues (Cronan et al., 2011, Cronan and Douglas, 2012; 2013). In the first week of classes students filled out a survey related to their existing knowledge about ERP and their attitude toward SAP. After the game was finished, they submitted a post-game survey, which contained the same questions as the pre-game survey but with additional questions related to their simulation experience. These additional questions were used to assess student satisfaction with the game. Additional evidence of student satisfaction was obtained from end-of-semester course evaluation. A few students completed the pre-game survey but not the post-game survey and others did the opposite. Those pre- and post- surveys that could not be matched up were discarded. In the end, 23 usable responses were obtained and analyzed.

Table 2 contains the pre- and post-game results. The first two measures are related to attitude toward SAP and the next three measures are related to ERP knowledge. As shown in Table 2, the mean in four of the five measures increased from pre- to post-game, indicating a positive effect of the game on learning. A paired t-test was conducted and the improvement was significant in three measures (attitude toward SAP, business process knowledge, and SAP transaction knowledge), as shown at the bottom of Table 2. Learning of enterprise systems knowledge also showed an improvement post-game, although the effect was not significant. Overall, a positive effect of learning can be observed from the use of the game.

Table 2:
Simulation Learning Results

	Attitude		EOU		BP		ES		SAP	
	Mean	Std Dev	Mean	Std Dev	Mean	Std Dev	Mean	Std Dev	Mean	Std Dev
Pre	5.87	0.80	5.89	0.80	4.36	1.19	4.69	0.95	3.75	1.58
Post	6.10	0.91	5.84	0.84	4.88	0.90	4.98	0.83	4.94	0.97
t-statistic		1.76		-0.35		3.19		1.49		4.34
p-value		0.04		0.36		0.00		0.07		0.00

* Attitude: attitude toward SAP
  EOU: SAP ease of use and usefulness
  BP: Business process knowledge
  ES: Enterprise systems knowledge
  SAP: SAP transaction knowledge

On the post-game questionnaire, students were also asked about their perception of the game. Using a scale of 1 to 7 where 1 being the least favorable and 7 being the most favorable, students answered five questions related to their experience with the game. Table 3 presents results from two semesters.

Table 3:
Mean Response to Simulation Experience Questions

Question	Fall 2015	Spring 2016
ERP Simulation was a worthwhile learning experience	6.50	6.47
I learned about Enterprise Resource Planning as a result of the ERP Simulation	5.33	5.24
I learned about SAP as a result of the ERP Simulation	4.83	5.88
I learned how to use SAP to accomplish business processes as a result of the ERP Simulation	5.83	5.82
SAP is a great system to accomplish integrated business processes	6.33	5.88

Figure 1 presents the same data in a column chart. It's clear that students had a very positive experience and that the perception was consistent in both semesters. Additionally, on the course evaluation that students filled out at the end of the semester, they were asked to describe one learning activity that was particularly helpful to their learning. Nine out of 14 students from the fall 2015 class who responded

singled out the ERPsim game while six out of 12 students from the spring 2016 class felt the same way, as shown in Tables 4 and 5.

Figure 1:
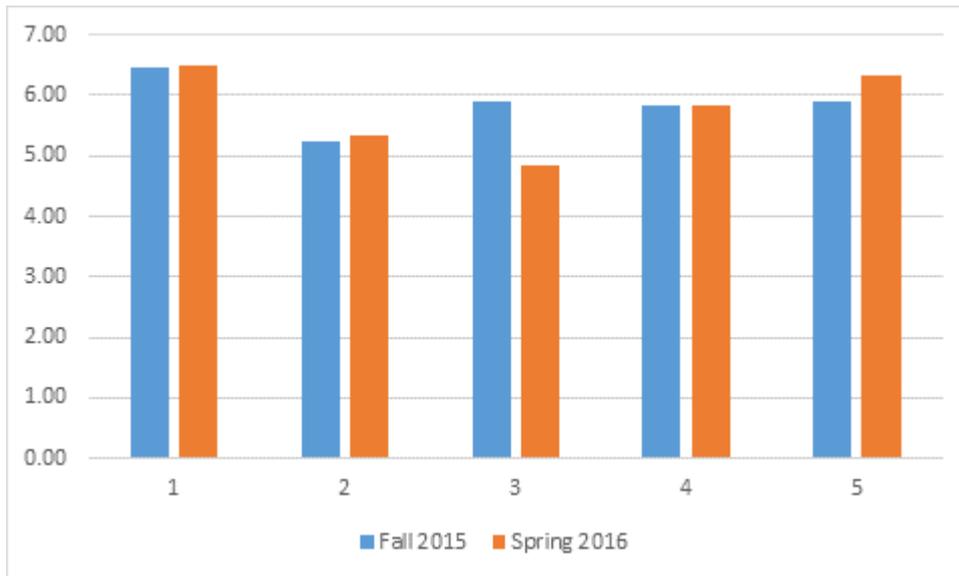*Mean Response to ERPsim Experience Questions*

Table 4:
One Helpful Learning Activity, Fall 2015

Table 5:
One Helpful Learning Activity, Spring 2016

Please describe one specific learning activity that was particularly useful in helping you to meet the learning objectives of this course.
Exercises in SAP and ERPsim game was very helpful. The class text book was well written and presented the material nicely.
I would say assignments given by Prof[____] and lectures recorded by him was very helpful throughout the course.
Assigned pratical SAP projects were really helpful.
Playing ERP Simulation game is the exciting part of this course and the material provided to play that game was very useful. Other assignments in the course helped us to get an overview of the business integration in ERP.
Discussion Board
SAP Simulations were helpful and made the course enjoyable
Playing the erp sim
Online course material was good
ERPsim game helped me understand the course a lot better
the several hands-on SAP exercises we had to do brought out the practicality of the course as against just being taught in abstract.
Self paced learning is helpful
The ERP Sim was very useful

The ERPsim Game Overview

HEC Montréal has developed different types of games each with multiple versions over the years. In each game the object is to maximize profit from the sales of various products. The manufacturing game was chosen for our implementation because it covers core business processes including marketing and sales, production, procurement and production planning. The game is usually played in three rounds with each round lasting from 20 to 30 days. In the first round student teams execute marketing and pricing strategies by running relevant transactions in the SAP system. In round two the production function is added: student teams have to decide when to replenish various products with fixed quantities of raw materials. In round three the restriction on fixed raw materials is removed: student teams can produce as much as they want by executing a production plan. After the production plan is created, they can then execute MRP and subsequently the procurement transaction to get the raw materials needed for the new production run. As long as there is inventory, marketing and sales can continue to generate more sales and profits. The process continues until the end of round three is reached.

The game can be used in any ERP fundamentals class, both at the undergraduate and graduate levels (Cronan and Douglas, 2012). Because the game involves different functional areas in different rounds, it is best to run the three rounds on different occasions after the relevant business processes and SAP modules have been discussed in class.

A Case Study

The game was used in an online MBA class at a Midwest university. Students in this program take an introduction to ERP class that lasts eight weeks. The three rounds of the game were played in weeks two, five, and seven, respectively. The main challenge in running a simulation game in an online class is that students are separated not only by space but also by time. Students in general complete all class activities at their own pace and it would be difficult to require all of them to meet at the same time for the game. Since most of the students were working professionals, it was decided to play the game over two days on weekends.

In the first implementation, the game was run for 24 hours over two days: from 8 a.m. to 8 p.m. Eastern Standard Time on both Saturday and Sunday. In other words,

the 30 simulation days ran for a period of 24 hours over two days. The major change to the simulator program was the minutes set for each simulation day. In a regular class, it is usually set to one minute per simulation day. For this class it was set to 48 minutes (24 * 60 / 30 = 48). While the students were very enthusiastic about the game, playing it for two days straight was probably too much of a burden. Based on student feedback the game was changed to Saturday only (still from 8 a.m. to 8 p.m.) for the remaining two rounds. Consequently, in the simulator program the time was changed to 24 minutes per simulation day. In subsequent semesters, the game was shortened to nine and eventually six hours on Saturday. The shortened playing time was partially in response to the change to the game made by HEC in 2016 where each round was shortened to 20 days. The most recent game was played from 12 to 6 p.m. with each simulation day lasting 18 minutes, which seemed to be adequate for the teamwork required to complete the tasks effectively. The schedule and pace seemed to have worked well.

In addition to allowing ample, but not excessive, time for each round of the game, learner support for the game was critical to the effective implementation in online classes. Before the game was played, recorded lectures on the intricacies of the game were posted online for student review. The system had to be configured and programs executed before the game was ready. Students were encouraged to logon before game day to familiarize themselves with the environment and to practice executing transactions. Despite all the preparations, things could go wrong and did both before and during the game. In one instance the starting inventory needed for the game was present for some but not all of the teams. The problem was not discovered until only a few hours before scheduled game time. The technical support team at HEC had to be contacted, as did the team at the University Competence Center (UCC) that hosted the server. The problem was eventually solved but the wait and suspense was agonizing. Because the games were played on weekends to accommodate working professionals, any technical questions would get delayed response from the technical support team, a fact that needed to be kept in mind and communicated to students for their understanding.

Conclusion

The trend toward online education means more activities will be completed online. The use of ERPsim games has been found useful to student learning in traditional classrooms and will likely be adopted by more instructors looking to incorporate the tool into their online classes. Experiences shared in this teaching note should help the implementation process. As mentioned earlier, there could be more than one format for effective use of the games in online classes. With increasing adoption of the games, more formats can be explored to bring different games to the online world.

References

Alcivar I., & Abad, A.G. (2016). Design and evaluation of a gamified system for ERP training. *Computers in Human Behavior*, 58, 109-118.

Chauhan, S., & Jaiswal, M. (2016). Determinants of acceptance of ERP software training in business schools: Empirical investigation using UTAUT model. *International Journal of Management Education*, 14, 248-262.

Cronan, T.P., & Douglas, D. E. (2012). A student ERP simulation game: A longitudinal study. *Journal of Computer Information Systems*, Fall, 3-13.

Cronan, T.P., & Douglas, D. E. (2013). Assessing ERP learning (management, business process, and skills) and attitudes. *Journal of Organizational and End User Computing*, 25(2), 59-74.

Cronan, T.P., Douglas, D. E., Alnuaimi, O.A., & Schmidt, P.J. (2011). Decision making in an integrated business process context: Learning using an ERP simulation game. *Decision Sciences Journal of Innovative Education*, 9(2), 227-234.

Cronan, T.P., Léger, P.-M., Robert, J., Babin, G., & Charland, P. (2012). Comparing objective measures and perceptions of cognitive learning in an ERP simulation game: A research note. *Simulation & Gaming*, 43(4), 461-480.

Espinosa, J.A., Cummings, J.N., & Pickering, C. (2012). Time separation, coordination, and performance in technical teams. *IEEE Transactions on Engineering Management*, 59, 91-103.

Hwang, M.I. & Cruthirds, K. (2017). Impact of an ERP simulation game on online learning. *International Journal of Management Education*, 15(1), 60-66.

Kumar, P., Kumar, A., Palvia, S., & Verma, S. (2019). Online business education research: Systematic analysis and a conceptual model. *International Journal of Management Education*, 17(1), 26-35.

Labonte-Lemoyne, E., Léger, P.-M., Jacques, R., Gilbert, B., Patrick, C., & François, J. (2017). Business intelligence serious game participatory development: Lessons from ERPsim for big data. *Business Process Management Journal*, 23(3), 493-505.

Léger, P.-M. (2006). Using a simulation game approach to teach enterprise resource planning concepts. *Journal of Information Systems Education*, 17, 441-448.

Levant, Y., Coulmont, M., & Sandu, R. (2016). Business simulation as an active learning activity for developing soft skills. *Accounting Education*, 25(4), 368-395.

Marlow, S.L., Lacerenzab, C.N., Paolettia, J., Burkec, C.S., & Salasa, E. (2018). Does team communication represent a one-size-fits-all approach?: A meta-analysis of team communication and performance. *Organizational Behavior and Human Decision Processes*, 144,145–170.

van der Merwe, N. (2013). An evaluation of an integrated case study and business simulation to develop professional skills in South African accountancy students. *International Business & Economics Research Journal*, 12(10), 1137–1155.

Michael Management Corporation. (2017). *SAP Training Survey*. Available at https://www.michaelmanagement.com.

Parle, G. & Laing, G.K. (2017). Investment Portfolio Simulation: An Assessment Task in Finance. *e-Journal of Business Education & Scholarship of Teaching*, (11)1, 118-126.

Salas, E., Wildman, J., & Piccolo, R. (2009). Using simulation based training to enhance management education. *Academy of Management Learning & Education*, (8)4, 559-573.

Shen, Y., Nicholson, J., & Nicholson, D. (2015). Using a Group Role-Play Exercise to Engage Students in Learning Business Processes and ERP. *Journal of Information Systems Education*, 26(4), 265-280.