ABSTRACT

This paper advocates a cross-university effort to measure learning from playing simulations and to attempt to prove the validity of simulations by proving that those who play the best learn the most. In this effort, independent variables reflect how simulation play is organized and what leads to player success. The dependent variables are measures of learning.

THE PROBLEM

Much has been written about learning in the simulation. Most who teach with simulations believe that simulations are valid, and Faria and Wellington (2004), Crocco, Offenholle, and Hernandez (2016), and Wilson et al. (2009) are among those that contend that students do learn from them. But the evidence supporting that contention is not convincing. In most simulations, the difference between good and not good performance is clear. The trouble is that while simulation scholars contend that that simulation players who perform the best learn the most, there are no studies that clearly show that, because in no study that I can find has learning been independently measured.

There may be hundreds of studies that cover the topic of players learning from the business simulation experience. A review of the citations from Anderson and Lawton's paper on business simulations and cognitive learning (2009) shows that 35 of their 65 citations covered learning from playing a simulation. Twelve of the 21 citations from Washbush and Gosen (2001) dealt with whether or not students learned from playing a simulation, and only four of those 12 overlapped with the Anderson and Lawton list. That means that in those two papers alone, there are citations from 47 articles that focused on learning from playing a simulation. And as argued above, none have measured learning in such a way as to prove that learning has occurred.

Why Do We Lack Studies that Show that Simulation Players Learn from Playing

 Our research designs are inappropriate for trying to prove that students learn from simulations. When we do simple experiments contrasting one group with another, the results will often be significant and easy to understand. Much of

what we know comes from common sense observations of simple experiments comparing obviously different groups, with results that are likely to be obvious and predictable. If you had a basketball game between a random sample of 5' 8'' men on one team and a random sample of 6' 3" men on the other, the taller men would win most of the time and height would the reason. There are definitive studies that show that health related outcomes are significantly better for babies that are breast fed for their first six months than for formula fed babies, as long as other factors are held constant (www.babycenter.com, 2015). Both of my examples feature simple experiments with clearly differentiated, uncomplicated, independent variables.

On the other hand, many of the studies that focus on learning from playing simulations include variables that complicate matters. For example, instead of trying to determine whether players learn from playing a simulation, scholars such as Anderson and Lawton (2009), Hsu (1989), and Wolfe (1985) seem to want to understand the learning process and differentiate some kinds of learning from others in addition to determining whether or not simulation players are learning. Adding learning process variables complicates efforts to find out whether or not players are learning at all.

For example, Anderson and Lawton's study (2009) focuses on Bloom's Taxonomy (Bloom, Englehart, Furst, Hill, and Krathwohl, 1959) and distinguishes between learning complexity levels using the taxonomy to help distinguish low from high levels of learning. Understanding learning and distinguishing between learning complexity levels is valuable, and the Bloom model is still widely cited. However, the learning process is extremely complicated, and trying to understand its complexity in the context of one learning exercise (playing a business simulation) is very difficult, and if our goal is to prove that those who play simulations learn from playing, counter-productive.

THE PURPOSE OF THIS PAPER

The purpose of this paper is to propose a research design that will help us prove that simulation players learn from their playing experience. This paper presumes that active learning is the best way to learn. Learning to manage businesses is difficult, and learners need experience in managing in order to learn to manage.

That does not happen with lectures and does not happen by knowing theories. Reading and analyzing cases might help one learn to manage, but understanding cases is more valuable if learners have first hand experience in managing (or at least observing managers). Does learning ever take place for college management students? Yes, with internships and with on the job training. But learning inside the classroom is unlikely to take place without some active learning activity.

What is a good in-class active learning procedure for college undergraduates to learn how to strategize and manage? The computerised business simulation is one answer. Because playing simulations is a form of active learning, studies will likely show that simulation players who perform well will learn the most, and thus will verify the value of simulations. It is important that scholars active in this area of research perform studies that verify this.

How Do We Design Studies that Prove that Simulation Players Learn from Playing?

Research designs should be easy to follow. Independent variables should be features of the simulation experience, not complicated, and easily understood by the reader. Dependent variables should be a measure of learning.

INDEPENDENT VARIABLES

We can do experiments with simulations that attain results as clear as the above hypothetical basketball match or the breast feeding study. Below are some examples of independent variables. They are proposed to help show that learning does take place by playing a simulation. The first three of these examples were proposed by Faria (1986) and examples in #5 were proposed by Wolfe (2016) or borrowed from Micromatic, version 4. These independent variables are simple rather than complicated and are easy to understand.

1. Some students receive detailed explanations (or training) before the start of the simulation, while others do not receive such information.

2. Some students play in small teams, for example teams of three. Some students play in larger teams e.g., teams of five, and some students compete alone.

3. For some sections of students, the simulation is a large part of the final grade, and in other sections, the simulation is a smaller part of the grade.

4. Some students play the simulation and are also given many written assignments or tests related to the simulation, while other students only play the simulation.

5. Games are played with contrasting emphases as to what leads to success. Many games reward multiple emphases, so for research purposes, researchers can manipulate reward schemes so some emphases yield a higher grade than others. For example, some students will play games where sales volume is rewarded, while other students will be exposed to games with an emphasis on return on sales. Still other students will play games rewarding e.g., investments in technology, capacity utilization, or lower costs of goods sold.

What leads to success in a given game defines the independent variables for that game's student subjects. So if sales volume is rewarded in a given game, then one of the independent variables of a particular study would be whether or not (or the degree to which) sales volume is rewarded, and it would be hypothesized that those who played games in which sales volume is rewarded will learn more about the impact of sales volume on game performance than those playing games with other game goals (e.g., the impact of funding automation).

There are at least two studies where some of the above kinds of contrasts were researched, a study undertaken by Tony Faria (Faria, 1986) at the University of Windsor and a study by Joe Wolfe (Wolfe, 2016) at a large European university.

 In Faria's study, there were three independent variables.

1. Degree of Game Explanation. About half the students received detailed game explanations and about half received no game explanations.
2. Grade weighting. The game results counted for 40% of the final grade for about half the students and 20% for the other half.
3. Team size. The students were divided into groups of three (51 teams), four (35 teams), and five (49 teams).

Learning was not measured, but other dependent variables were. The teams of 3 outperformed the other two groups, but teams of 5 out performed teams of 4. High explanation teams worked together more cohesively than teams that we given no game explanation. Surprisingly those whose game score was 40% of the grade did not spend more time on the game than those whose game score was worth 20% of the grade.

Wolfe's paper (Wolfe, 2016) was a proposal to use simulations as tools to verify assurnce of learning in university business schools. Wolfe's simulation (Wolfe, 2016) is extremely complicated with seven types of decisions: scanning, accounting, finance, marketing, logistics, operations, and strategic alliances. In his 2016 article, Wolfe shows ten factors as keys to success in the game (Wolfe, 2016: table 9). Examples include reducing overhead, reducing cost of goods sold, increasing market share and increasing automation levels.

No one has tried to replicate these two studies, because of the large number of subjects required. Faria taught at Windsor University where all students in the capstone business course were required to play the same simulation at the same time. At Windsor, more than 500 students participated. At Wolfe's western European university, 836 students participated, all playing the same game with the same industry conditions. Most researchers interested in simulations do not work in universities where there are large enough numbers of students taking a simulation course at the same time to replicate the size of these two studies. So scholars from multiple universities must collaborate and work together to design the studies needed to gather and calculate results to verify that learning does take place for those who play simulations. This is difficult and requires a lot of work for researchers. Doing so is possible, though, and worth the effort if we want to prove beyond doubt that simulation play leads to relevant learning.

DEPENDENT VARIABLES

Though out this paper, I've argued that it is important to prove that learning takes place from playing a simulation and pointed out that there are few if any simulation related studies where an attempt was made to create a separate variable that clearly represents learning from playing a simulation.

I recommend that simulation scholars collaborate in determining learning goals from playing a simulation, and also create ways to test student players as to their understanding of the business related principles that the game they have played teaches. For example, some games reward training and treating employees well. Others reward investing in technology, still others reward size, still others may reward keeping debt low. Scholars must collaborate in identifying simulation objectives and ways to measure whether or not simulation players understand the reasons and consequences of pursuing a particular objective. In other words, simulation players should take tests to help us discover whether they have learned from simulation play. The same scholars who designed the experiments described above should also create the exams. The exam scores should be part of the simulation grade.

I recommend that the exams encourage short answers, with flexibility as to what "short answer" means. Below are some suggested questions:

What are the likely outcomes (positive and/or negative) of spending a considerable amount of money investing in advanced technology?

What are the likely outcomes (positive and/or negative) of maintaining a debt ratio of near zero?

What are the possible outcomes (positive and/or negative) of spending a considerable amount of money on training workers?

NOTES:

Reference to sales volume, and return on sales and as independent variables are from Micromatic: version 4. OakTree Simulations: support@OakTreeSims.Com

Reference to capacity utilization and cost of goods sold are from the Global Business Game as referred to in Wolfe, J. (2016). Assuring business school learning with games. *Simulation and Gaming,* 47 (1), 1-22

Reference to investment in technology as an independent variable came from both Micromatic version 4 and Wolfe (2016) .

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Abstract

Background. Much literature has theorized on the potential educational benefits offered by **game-based learning** (GBL). However, recent **meta-data analyses** of studies conducted on the efficacy of **GBL** offer **mixed results**. Furthermore, many of the studies available rely more on close reading, inference, small sample sizes, and qualitative responses than on quantitative, data-driven analyses.

Aim. This article describes a proof-of-concept study designed to assess the **effects** of **GBL** on **enjoyment**, **engagement**, and **learning** in **higher education** using a large sample size and quantitative measures.

Method. The study uses a large data set (n = 440) involving **English**, **Math** and **Science** undergraduate courses. For the first semester, faculty participants were trained in how to implement **game-based** pedagogy and created analog **game-based** lessons. In the following semester, each professor taught one section of a course using **games** and another section of the same course without **games**. Students in the game-based and control groups were given **attitude surveys** about the subject at the

beginning of the semester, a **post-lesson survey** after the game or regular lesson, and a **post-lesson quiz** with separate questions to assess **surface learning** and **deep learning**.

Results. **Enjoyment** correlated with improvements in **deep learning** in both the **game** and non-game classes. **Games** increased reported **enjoyment** levels, especially in subjects where students reported the greatest anxiety about **learning**, and this increase in **enjoyment** correlated positively with improvements in **deep learning** and **higher-order thinking**. These results may have particular impact on non-traditional students.

Conclusion. While **further investigation** is necessary to assess the specific affordances and long-term effects of GBL in higher education, this study offers **preliminary support** for the claim that **GBL** can improve **deep learning** in this setting, by increasing **enjoyment**.

I think we need simple studies where the independent variables are clear and easily understood by the reader. A not so recent example are the Harry Harlow Resis Monkeys studies in ghe 1950s

Harlow HF The Nature of Love American PsychologistPsychologistPsychologist 1958, 13, 673-685

Background. The evidence from past research suggests that business simulation games BSGs do offer a meaningful educational experience. One characteristic lacking across past research studies is the trait of indecisiveness.

Aim. This study sought to explore whether business students would self-report a change in their perceptions of their indecisiveness after participating in a business simulation games BSG. In addition, whether higher performance simulation decision makers would self-report being less indecisive i.e. able to make decisions in a timely manner than lower performance simulation decision makers.

Method. Using a pre-test and post-test design with a comparison to an untreated control group, the change in 386 business students' perceptions of their indecisiveness was assessed using a self-reporting questionnaire.

Results. The findings showed a statistically significant reduction in the level of perceived indecisiveness as a result of the simulation experience. The higher performance students reported being less indecisive than lower performance students while both higher performance and lower performance students reported a reduction in perceived indecisiveness. The level of self-reported perceived indecisiveness amongst a control group of 137 business students indicated no significant change.

Conclusion. If the combination of practice and positive reinforcement increases the comfort level reduce feelings of risk and threat of decision makers then perceived indecisiveness should decrease as a result of simulation participation, which may generalize across situations demanding decisions.

Wellington, William. J., Hutchinson, D.B., and Faria, Anthony J. (2017): Measuring the impact of a marketing simulation game, Simulation and Gaming 2017, 1, vol 48, 58-80

Theres a 2016 study I down loaded that gives an example it's from