Advantage of Simulation in Online Project Management Education

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Abstract

Online/Distance education (DE) courses are one of many impacts digital disruption has had on higher education. Simulations are a type of active learning method that are important to incorporate in DE project management courses to engage students and give them practical experience. This research study sought to determine how students respond to the use of a simulation to learn project management concepts. A small group of 24 students taking a graduate project management course were assigned a project management simulation. A survey and a lessons-learned session were used to help determine if the simulation assisted the students in a better understanding of project management concepts. Student self-reporting indicated proficiency levels rose in at least three project management knowledge areas of scope, time and cost after the simulation exercise. Researchers concluded students responded well in project management courses to the addition of a simulation exercise instead of using a textbook alone.

Keywords

Simulations, Project Management Education, Pedagogy, Higher Education, Experiential Learning, Active Learning.

Introduction

Digital disruption has left its' mark on higher education just as with other industries, leading to implementation of online/distance education (DE) offerings at most universities. Concurrently, the Project Management Institute (PMI) predicts project management shortages through 2020, particularly in the Information Services and Business Services areas (PMI 2013). This has caused many working adults to seek out project management (PM) education as a means of advancement; and to balance work/life demands, with online learning. The DE challenge is how to provide quality online Project Management courses when team projects and traditional lectures are not practical.

The researchers in this study have taught PM in higher education using both a FTF and DE model for several years and conducted professional development workshops for industry. For both delivery formats, they have found simulation to be a successful active learning method in a project management course. However, in the DE format a simulation more closely mimics virtual project teams used in the workplace. Simulation helps students put their textbook knowledge into practice when learning project management. Unlike some other subjects, it is often the case that project management processes, procedures, tools and techniques must be readily applicable in real world situations soon after course completion. To validate the perceived benefits of simulation in project management courses, the researchers conducted a study to investigate the question: "How do students respond to the use of a simulation to learn project management concepts?" The research methodology involved a survey questionnaire and a lessons-learned session.

Prior literature indicates a similar study was conducted with the same simulation software, however, a major limitation was a lack of diversity in the sample of 47 participants who were from technical or engineering industries (Jeong and Bozkurt 2014). This study addresses that limitation with participants from a variety of business industries leading to some varied findings. This research was conducted in a graduate online project management course at a large public university in the Southeastern United States taught by one of the researchers in the fall 2017 semester. The sample size of 24 was small, however data

will continue to be collected in 2018. The remainder of this paper will cover general background information on simulation, a description of the methodology, results, discussion and a conclusion.

Background

Traditional project management (PM) courses are often taught by using a textbook that includes the 10 knowledge areas of the PMI Project Management Body of Knowledge (PMBOK) which are recognized globally as best practice project management techniques (PMI 2013). Although students can absorb information about the knowledge areas from reading the textbook and listening to lectures, successful students should be able to apply those concepts in real world situations upon completion of the course. A simulation is an active learning technique that is engaging while forcing the student to determine which of the PM knowledge areas to employ in a given situation.

A review of literature found a great deal of research and empirical evidence regarding the benefits of active learning. Braxton, et al. (2004) stated that active learning was "vitally important" for the mastery of skills such as critical thinking (UNC OFE, 2009). Active engagement is an excellent method to help break down student's pre-conceived notions and/or misconceptions (Prince, 2004), something of particular interest when teaching graduate students who may have prior project management experience. In this research, the PM outcomes are based on student perception of competency of PMBOK processes and techniques. A recent major study on simulation involving project management also used self-perceptions about skill level of their participants as well as lessons learned reflections (Geithner and Menzel 2016). Prince (2004) points out that active learning activities intended to promote student engagement need to be "designed around important learning outcomes" (Prince 2004). With respect to types of active learning, research by O'Neal and Pinder-Grover, shown in Figure 1, demonstrates that simulations are on the higher end of the active learning complexity scale (O'Neal & Pinder-Grover, 2005). Prior literature also suggests conducting a lessons-learned session is essential to simulation-based pedagogy (Geithner and Menzel 2016). As noted in Figure 1, "active review sessions" were the post-simulation debriefings found to be necessary to crystallize learning that occurred during the simulation process (Léger et al., 2011). Therefore, the authors will share some of the review session feedback.

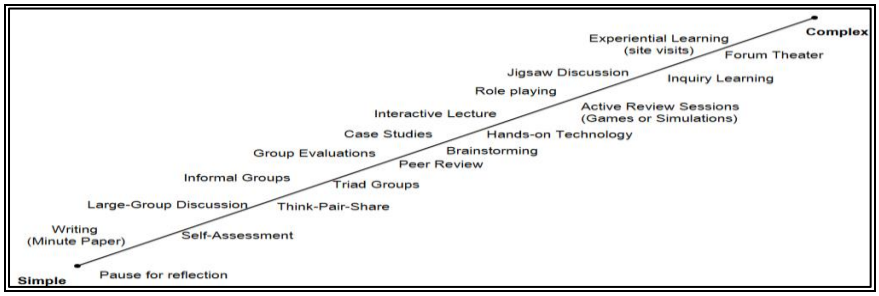


Figure 1. Active Learning Techniques (O'Neal & Pinder-Grover, 2005)

Methodology

The majority of students in the class were familiar with the PMBOK, including some but not all of the 10 knowledge areas. Many, but not all, concepts needed to conduct the simulation had been covered during the course and the textbook was available as a reference. Although students worked in groups for other course assignments, the simulation was an individual assignment. The simulation came with detailed instructions, checklists, and videos to assist with execution. Students were able to run the simulation up to 3 times to allow for a learning curve.

The researcher recorded a video introducing the simulation for the students. Other extensive documentation was included such as an organization chart, resource backgrounds and personality information. The goal of the simulated project was to build an e-commerce website for a company, within a virtual 11-week time frame and a fixed budget. Students were given a network diagram showing all tasks and their dependencies. Students had to assign appropriate resources to each task from a pool of provided resources. Project planning included establishing a budget, creating a risk management plan, a training plan, a communication plan, and a staffing plan. Once plans were completed, each student executed the

project on a virtual week-by-week basis until completion. At the end of each virtual week, a report was generated to indicate progress, including earned value. Students were to review the report and make adjustments before activating the next weeks' execution. During each weeks' run, issues were generated by the simulation and students were required to select possible solutions from a short list of possibilities. Unlike some other simulation studies, the instructor established a goal to complete the project within 10% of the budget, schedule, and quality measurements. The simulation results (i.e. % within completion goals) were used to evaluate the effectiveness of the simulation in using learned PM skills.

A common method for evaluating effectiveness of using PM skills in simulations is through the use of a survey questionnaire, therefore, the researchers created a survey for this study based on information found in prior literature (Geithner and Menzel 2016, Jeong and Bozkurt 2014). The resulting survey was also modelled from a survey of ERP simulations currently under revise and resubmit review for publication (Angolia and Reed n.d.). The simulation employed was SimProject by Fissure (SimProject 2011) which was conducted a third of the way into the 15-week semester since the desired outcome was to develop concepts instead of being a recap at the end of the course (Angolia and Reed n.d.). In contrast, the Jeong and Bozhurt simulation was run in week 12 of a 15-week semester (Jeong and Bozkurt 2014).

Given that the research question focused on "how students respond to the use of simulation," the survey focused on "student engagement" to support simulation as a learning tool. The importance of engagement is based on research that concluded there is a need for the instructor to impart a sense of purpose for a simulation and reinforce lessons-learned through lecture-based pedagogy (Avramenko, 2012). The research was a longitudinal study from 2007 to 2010 with a total of 250 management students to investigate simulation-based pedagogy that shifted the reliance from the simulation software to the instructor in order to impart experiential learning to students (Avramenko, 2012). That study conducted a survey of literature and identified benefits as teamwork, motivation, variety (to maintain engagement), cost-effective experiential learning, critical rethinking, negotiation skills, and time management. Limitations included gaming the system, no transfer of knowledge and significant time commitment (Avramenko, 2012).

Results and Discussion

After the simulation each student was asked to complete an anonymous survey in order to assess the simulation impact. Extra credit was given for completing the survey but the data remained anonymous.

First, students were asked if they liked the simulation and if they felt it was engaging. An advantage of active learning is increased engagement by students (Prince, 2004). Table 1 shows positive results from this question. Only 4% of students did not find it engaging while 54% found it very or extremely engaging.

How engaging did you find the Simulation?	%	Count
Not at all engaging	4%	1
Slightly engaging	13%	3
Moderately engaging	29%	7
Very engaging	33%	8
Extremely engaging	21%	5

Table 1. Student engagement

Figure 2 shows results of a question that gets to the heart of this study, a better understanding of project management concepts. Results support simulation aided learning in this course. 75% of participants agreed the simulation helped with understanding while 16% felt it didn't.

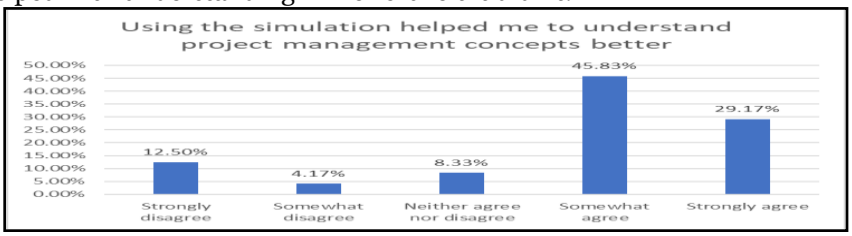
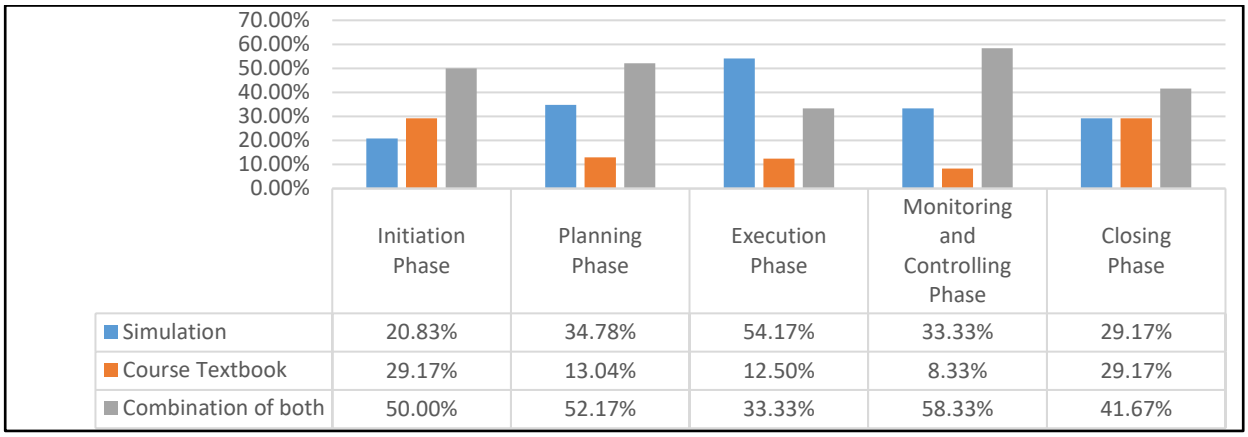


Figure 2: Simulation impact on learning PM concepts

One student commented: "I was not super familiar with Gantt charts, network diagrams, or the concept of earned value. This simulation helped me understand their functionality more fully; I have been able to understand and use these concepts more effectively in my other work as a result." One saw no advantage to the simulation, commenting on "gaming the system".

The survey asked about the impact of the simulation on various course learning objectives such as the five project management life cycle phases. Participants were to choose which method provided the better learning experience; the simulation, the textbook, or a combination. Figure 3 shows the highest percentage was 58% for a combination of both in learning monitoring and controlling. 54% of participants felt the simulation alone was the best method for learning in the execution phase. A participant commented "It's harder to see the execution phase in action when just reading about it in the book. A more hands-on approach with the simulation was very helpful." Overall, the percentages for textbook alone were the lowest across all phases except the initiation and closing phases. This may have occurred because those two phases were barely included in the simulation. Overall, the results from this question show a clear advantage to adding the simulation to help with learning concepts in the planning, executing, and monitoring and controlling phases.



	Initiation Phase	Planning Phase	Execution Phase	Monitoring and Controlling Phase	Closing Phase
Simulation	20.83%	34.78%	54.17%	33.33%	29.17%
Course Textbook	29.17%	13.04%	12.50%	8.33%	29.17%
Combination of both	50.00%	52.17%	33.33%	58.33%	41.67%

Figure 3: Best method for learning PM life cycle phases

A series of questions was used to explore impact of the simulation on other course learning objectives, including some of the knowledge areas and PM tools such as Work Breakdown Structure (WBS), Gantt Charts, Network Diagrams and Earned Value. Only the three core knowledge areas of scope, time and cost will be addressed here. The question was "Rate your level of proficiency (knowledge and skills) regarding the following project management concepts". Figure 4 shows the pre and post-simulation results. Scope Management shows the self-reported level of "somewhat proficient" had a 26% increase in participants who reported this level of proficiency after completing the simulation. A 14% increase in participants was reported for the "very proficient" level after the simulation. Also, those who were not proficient before the simulation dropped from 37.50% to 4.76% after the simulation. These are impressive improvements; however, the researchers acknowledge that other factors may have had some influence on the results.

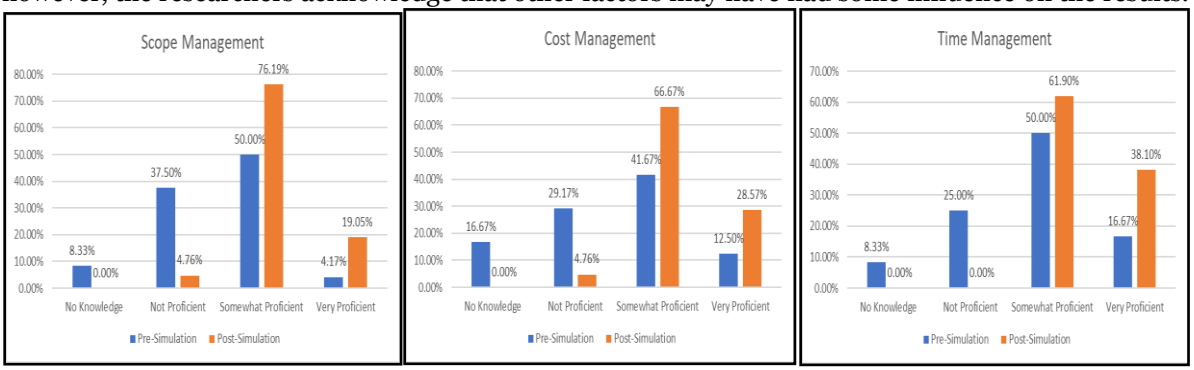


Figure 4: Pre and Post Scope, Time, Cost Management Proficiency

Time Management results show the "somewhat proficient" level had a 11% increase in participants who reported this level of proficiency after completing the simulation. A 21% increase in participants reported the "very proficient" level after the simulation. Participants in the "not proficient" level dropped to zero after the simulation. These changes may have occurred because participants became more aware of time management since they were forced to balance it during the simulation to prevent disaster. Cost Management results show the "somewhat proficient" level had a 25% increase in the participants who reported this level of proficiency after completing the simulation and a 16% increase in participants who reported the "very proficient" level after the simulation. Participants in the "not proficient" level dropped by 24% after the simulation. These results, as in the previous two knowledge areas show a clear difference in how proficient students felt before and after the simulation.

Conclusion

This research sought to determine if the utilization of a simulation in graduate online project management courses would have any advantages. A questionnaire was used to investigate the research question: "How do students respond to the use of a simulation to learn project management concepts?" The course included reading a textbook to learn concepts as in the traditional FTF courses but added a simulation about a third of the way into the semester. Overall, students found the simulation engaging, and in most cases felt the simulation improved learning, either on its' own or in combination with the textbook. Survey questions showed the simulation helped students to better understand project management concepts in general. Specific results indicated students reported their proficiency levels rose impressively after the simulation in the three core knowledge areas of scope, time and cost. These results contribute to the researcher's confidence that simulations improved learning of project management concepts. The limitations of this study are the possibility that other aspects not tested for had a significant impact on learning and bias may exist from the self-reporting of survey results by students. Future research in this area will continue by surveying classes in 2018 and 2019. After additional data is collected correlation analysis will be conducted on the data.

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