Student performance playing supply chain simulation games in different grading environments

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Abstract
The paper studies how students behave and perform when playing a supply chain simulation game, while being in a graded or non-graded environment. Two groups of students are observed and studied. The link between big five personality traits and student performance while in different grading environments is studied.

Keywords: Student Performance, Simulation Games, Grading

INTRODUCTION

The teachers need to embrace the fact that the new generations of students are technologically savvy. This needs to be exploited when designing the teaching process. One possible approach is applying of new technologies in the teaching process with traditional approaches that result in students doing some part of the course face-to-face and other parts by use of online technology. This thoughtful integration of classroom face-to-face learning experiences with online learning experiences is called blended learning (Garrison and Kanuka, 2004).

Simulation games can be one of the different tools and technologies to support blended learning. There are different types of simulation games available for the field of logistics and supply chain education. An interested reader can find an extensive review of different games in Wood and Reiners (2012).

When playing simulation games the students are motivated to participate for different reasons such as learning new things, having fun, competing with their peers, and after all the grades.

This paper addresses the question on how students behave while using blended learning approaches in different grading environments. An experiment was run where a case of an online simulation game together with classroom engagement was studied. The paper studies the differences between a group that is being graded and a group that is not being graded. The number of decisions that the student made, the time needed to make each decision, and the final results were compared between the groups.

Personality traits were also taken into consideration when comparing the two groups. They were defined via Big Five personality traits model which has recently gained widespread acceptance (Costa and McCrae, 2013). The model defines five personality dimensions of

personality that can be measured for each individual: extraversion, agreeableness, conscientiousness, neuroticism and openness. An extensive and detailed description of all five personality traits can be found in John et al. (2008).

METHODOLOGY

Simulation Game

The simulation game used for the experiment is The Supply Chain Game from Responsive Learning Technologies (Supply Chain Game, 2015). The game is an online simulation game in which the students assume a role of a supply chain manager and can make decisions about locations and capacities of production plants, locations of warehouses, sizes of production batches, order points, and transportation modes.

The game can run various different scenarios. For the experiment the basic scenario was used. In this scenario the students operate in one region which has one factory and one warehouse. The students need to decide on the size of the factory, types of transport, order points and the size of batches being produced. They can change these parameters during the entire game.

At the start of the game the students get historical data on all relevant operations and demand for the past two years (from simulation day 1 to simulation day 730). The students also get a classroom briefing about the case and some general pointers on how to approach the game and which concepts to apply. The game then simulates the environment for another two years (from simulation day 730 to simulation day 1460). In real time the simulation runs for one week. During the simulation the students can consult the class instructor. At the end of the simulation another classroom session is organized for debriefing and recap of the game.

The goal of the game is to end the game with as much money on the bank account as possible. The starting amount of money is the same for all students and the students cannot get any loans during the simulation. During the simulation the students can see the cash balance of other students and their relative position on the leaderboard.

Participants

Participants in the experiment were graduate students in their first year of studies attending Business Logistics Management course in the Business Logistics program at the Faculty of Economics, University of Ljubljana. There were two groups of participants. The first group was being graded, and their grade of the game was a part of the final grade of the course. The grade for the game was mainly based on the final position on the leaderboard, but could be adjusted by the course instructor based on the quality of decisions that led to the final position. The second group was not graded; however they were attending the same course as the first group.

The first group consisted of 24 participants, 12 male and 12 female. Their undergraduate average grade was 7.60 with standard deviation 0.70. The second group consisted of 12 participants, 6 male and 6 female. Their undergraduate average grade was 7.68 with standard deviation 0.78. The two groups were randomly selected from a same pool of students.

Most of the students in both groups (71 % in group one and 83% in group two) come from a business or logistics undergraduate programs.

Data Gathering

The simulation game data was gathered automatically in the game while the participants were playing the game. After the game was finished the participants had to export that data to a predetermined Excel document form and add some of their own data (such as time spent for making a decision, their position on the leaderboard at the time of the decision etc.) that together form a final report that the students hand in at the end of the game. The students also had to give comments on their report at the final briefing session.

For the assessment of the big five personality traits the student had to fill in a questionnaire that can be found in John et al. (2008). The questions were then analyzed and each student was evaluated on a scale from 1 to 5 for each of the five personality traits.

RESULTS

The two groups of students were tested in the same environment. The only difference was the presence or absence of grading. Group one (G) had their results graded (the grade represented 10% of the final grade), while Group two (NG) did not have the results graded. Table 1 shows some basic information about two different groups.

Table 1: Comparison of Group 1 and Group 2

	Group 1 (G)	Group 2 (NG)
Average final cash balance	$5.933.717,23	$6.340.500,51
Average final cash balance standard deviation	$748.947,20	$787.681,73
Average number of decisions	16,04	9,73
Average number of decisions standard deviation	8,68	6,33

The students in NG achieved better results than the students in G, with very similar standard deviations. Their result was 7 % higher on average. On the contrary, the average number of different decisions in G was higher than in NG, the number of decisions being higher for almost 65 %. So on one hand we have group NG that has the higher average final cash balance, while on the other hand the students in NG made less decisions on average.

In the next step the data was separated in quartiles based on the final result. This was done to see how students with different final scores acted during the simulation. The comparison can be seen in Table 2.

Table 2: Comparison of decisions in Group 1 and Group 2 by quartiles

		Quartile			
		1st	2nd	3rd	4th
Number of decisions	Group 1 (G)	10.17	10.33	14.33	15.50
	Group 2 (NG)	6.67	13.33	9.33	6.00
Time spent to make a decision (in minutes)	Group 1 (G)	12.36	9.55	5.24	5.65
	Group 2 (NG)	19.27	7.20	9.00	3.85

The students who performed best in G made a lower amount of decisions compared to the students in G who performed worse than them. Similar happened in the NG; however the

students in the last quartile in the NG made very few decisions compared to the other students in that group. On average, students in G made more decisions than the students in NG.

Time spent to make a decision was also highest with the best students in both G and NG. The same trend as with number of decisions can be observed: the last quartile of the students in NG spent relatively lower amount of time (when compared to first quartile of NG) than their peers from G (when compared to the first quartile of G).

The relative position on the leaderboard that the students can see during the game also affected their activity in NG. The students' activity from 3rd and 4th quartile (number of decisions and time spent to make a decision) fell as they started to lag behind their peers during the game. On the other hand, the students from G were constantly active throughout the game even when they started lagging behind.

Finally, the link between the two grading systems (or the lack of) and personality traits, in this instance the Big Five personality traits was also studied. However, there has been no significant differentiation between the two groups in relation to the personality traits. Based on the results and the personality tests there is no influence of different types of personality on the behavior in different grading environments. However, due to the limitation of a relatively small sample, further research is suggested and outlined in the next section.

CONCLUSION AND FURTHER RESEARCH

Simulation games are an important and widely used tool in supply chain management and logistics. There is a wide selection of different games that the lecturers can choose from. However, students behave differently, whether the games are graded or not.

The case from this paper shows, that the students who are graded will try and make more decisions in average, trying to pursue the best score possible in order to achieve a better grade. They do this by constantly tweaking the simulation parameters. However, by making more decisions they have to sacrifice time when making a decision, so their decisions are sometimes based more on intuition and trial and error rather than on analysis of available data. On the other hand the students that are not graded take more time for each decision and are thus able to make fewer decisions. However, those decisions are more informed and lead to a better final result. More decisions therefore do not mean that the final outcome will be better, if the decisions are made without adequate prior analysis.

Another important point of the research is that the students in the group that is graded will try and improve their result to the end of the simulation, even if they start lagging behind their peers. On the other hand, the students that are not graded and fall behind, will lose interest in the game and reduce the amount of time spent playing the game. Therefore if the introduction of grading is not possible they need to be motivated by other means.

When comparing the behavior in the two groups and taking personality traits into consideration, there has been no differentiation found. This can be due to a small sample. Therefore, further research will include a larger sample and will base on finding out whether personality traits, time taken and domain knowledge influence the confidence in decision and its quality.

ACKNOWLEDGEMENTS

The author acknowledges the support of Research Agency of Slovenia (grant no. J5-6816).

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