COLLABORATING ACROSS A TWO COURSE SEQUENCE: DO STUDENTS REMEMBER ANYTHING?

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ABSTRACT

It seems that every year, business faculty revisit their course curricula. The goal is to keep the required course and sequence of courses up to date. In theory, one of the goals is to have more advanced classes build on the knowledge of the elementary, basic level courses. All too often, once the semester is over, students do a "knowledge dump" of all the material they learned during that specific semester. This paper reports on the results of a small study which used an experiential exercise to reinforce learning of some key concepts by teaming students from a basic course with those from an advanced course. The exercise and the classes which were used for the collaboration are described in the next paragraphs.

Keywords: Instruction, collaboration

THE COLLABORATIVE EXERCISE

An *operation* is the part of an organization that creates value for its customers by transforming raw materials, labor, capital, energy, and information into goods and services. All UMass Lowell business students are required to take a two-course sequence in operations. The first course, Operations Analysis (OA), covers a range quantitative decision making tools and is typically taken in the sophomore year. The second course, Operations Management (OM), covers management issues such as process design, planning, and control; this course is typically taken in the junior year. Despite the obvious connections between the two courses, they often do not complement each other. All too often, students do not absorb or see the value of the tools they learn in OA, and the OM teachers must review the techniques, or even start over given the six- to twelve-month break between taking the two classes. The goal of this project was to bridge the gap between the two classes through a group case project and thereby improve learning outcomes in both courses.

The best opportunity to connect the courses is via a method called *simulation*. Simulation is the practice of modeling real-life systems or processes using computers. System variables and relationships between different elements are defined, and the variables can then be changed in order to study different scenarios and make predictions about how the real system would behave. This technique can be used to model virtually any system or process and has been used in many fields including finance, marketing, education, and health care. From a pedagogical standpoint, simulation is important because it ties together several fundamental elements of the OA and OM courses. From a practical standpoint, simulation is important because it is a very powerful tool that facilitates the analysis of complex systems and decision scenarios.

After covering the relevant background material, students from the OA and OM classes were grouped into teams of four to six. The teams were assigned a case study, which involved analysis of a real-world business problem using simulation modeling. Groups were required to turn in a short report summarizing their findings and recommendations. Team activities and communication were coordinated through Blackboard, the University's learning management system.

Students performed the simulations using software called SimQuick. After surveying available simulation software, we chose SimQuick for three reasons. First, the package integrates with Microsoft Excel, which is the de facto standard for business number-crunching applications; therefore, it has a familiar look and feel to the students and could potentially enhance their Excel proficiency. Second, the package was developed by an OM professor specifically with students in mind; therefore, it has sufficient "horsepower" for realistic applications without including unnecessary features and complexity [2]. Third, SimQuick is inexpensive. Prices of commercial simulation packages range from $99 to $39,000 [3]. Although student versions of some packages are available at a reduced price, these typically have only 60- to 90-day licenses. Our hope is that students will continue to use the software beyond the OA and OM classes, so having an open-ended license was an important decision criterion.

Impact on learning

Research has shown that students learn more, retain more, and enjoy the process more when they work in small groups [1]. The OA students, typically sophomores, do not have sufficient background information to tackle "real" problems. The OM students, typically juniors, do not have sufficient skill with (or memory of) simulation models to use them effectively. Our thinking was that having the OA students act as technical consultants and the OM students serve as management specialists would benefit all involved. Rather than complete simple homework and/or exam problems, students were be required to demonstrate a much deeper understanding of the material and underlying concepts. The goal was for OA students to get a sense of how the models can be used to solve real-world problems, and the OM students to get an opportunity to mentor the OA students while solidifying their understanding of simulation modeling. Collaboration allowed us to cover material that would normally be beyond the scope of a single course. In addition to stretching the students' abilities, the case study also brought to light the connection between the two courses. Based on this pilot project, we expect this type of collaborative project to become a model for future classes.

Students learn more through experiential learning. Our expectation was that all students involved in this project would have a better understanding of simulation models and how to apply them. More importantly, students had a valuable opportunity to formulate and analyze a real-world problem, work in teams, and communicate their ideas to others. In addition, they benefit from the exchange of ideas between upper-level and lower-level classes. Students from the upper-level classes were able to mentor the lower-level students through the Blackboard interface.

Structure of the Exercise

The instructions for the exercise are listed in Appendix 1. In short, both classes were divided into teams of two to four students, who had to perform one exercise on their own, and submit documents through the combined course website corresponding to their roles as explained above. In addition, students were evaluated on their virtual interactions. Students were asked to use either or both the chat and discussion forums on the class website. Finally, students were to submit one final document from both class groups together on the outcome of the exercise. Evaluation was weighted heavily on the process and evidence of understanding, rather than on the final outcomes.

In an attempt to gauge the effectiveness of the exercise, students were required to fill out a simple, anonymous questionnaire prior to the exercise, and after the exercise. Because of the nature of the questionnaires, we were not able to perform any statistical hypothesis testing, but were able to gain anecdotal evidence of the success of the exercise on two dimensions: the value of virtual teams between two classes, and the impact of the exercise on the understanding of simulation of real world processes.

RESULTS

The questionnaires were submitted anonymously through the virtual course shell, Blackboard. Between five class sections, there were 100 OM students, and 80 OA students. Over 80% of the students participated. Students seemed quite familiar with simulation models before starting the exercise, with 92% indicating that they had discussed simulation before. When asked about their confidence in building and using a simulation model, slightly less than half the students indicated that they felt at least somewhat comfortable both building and using a simulation model. Interestingly, this percentage was fairly consistent between the introductory (OA) and advanced (OM) classes. Based on student performance, and responses to the general questions, the instructors feel that students tended to over estimate their comfort levels.

Students in both classes had much less experience in working with virtual teams (42% had had previous experience), or working on an assignment with another class (only 17% had). Thus, working together was a new experience for both groups of students. This part of the exercise elicited very strong responses from the students. When asked prior to the exercise on being asked to do group work with students from another class, responses were quite mixed. Sample positive responses included:

- "I think it will be interesting to blend two classes in different levels of a subject matter together to complete the project."
- "I think it will definitely be a challenge especially virtually with another class whom we never met before or seen. I am also not comfortable yet with the subject matter, I do not think the whole class is prepared enough to do this group project and more time in class should be spent focusing more on how to do waiting lines and sims."
- "I like working in group tasks my only concern is how it will work when not everyone is in the same class. This will be an interesting experience. Can't wait to see the outcome."

Negative responses included:

- “Like it matters.... I extremely dislike working with others whom I don't trust or don't know well enough to make a judgment call. Throwing two classes together like this kind of sucks. I don't mind it much when they are students we work with from the beginning, but not in the middle for a few classes.”
- “There are already dilemmas with working with people in your own class with scheduling and meeting up let alone people in other classes. Group work is too time consuming.”

The dilemmas and challenges suggested above turned out to be the norm. In the post survey, students were asked how the exercise could be improved, what they liked least, and what they liked best about the exercise. Some of the general results which can be summarized below:

- By a two or three to one margin, students disliked the virtual teams. Reasons included not getting to see other students in person, to students not responding to deadlines, to being confused about the assignment. A majority of the group s seemed to be dysfunctional, that is, the OM group “blaming” the OA group, and vice versa. Where the groups succeeded, a strong leader or facilitator from each class emerged.
- Communication was the biggest problem. Students tended to be very deadline oriented, not getting involved (if at all) until the last minute. Several students suggested that they liked the availability of discussion and chat sessions, but again, they were not used by everyone.

Results from the Instructor’s Perspective

Upon reflection, this exercise was difficult to manage from the instructor’s perspective as well. Some of the challenges are described below:

1) Class meeting times. The OM and OA classes met on different days of the week, and twice per week.
2) The logistics of groups communicating together overwhelmed the initial intent of the assignment. In over half the groups, no comments were made about the assignment itself, but rather about the logistics of communication.
3) Several students indicated that they would have liked to have met in person at least once. If at all possible, a time should be made available for students across classes to meet.
4) More time should be set aside in class to work on the exercise. Students all tended to be deadline oriented, which caused frustration to many.
5) The project outcome was worth a very small percent of the overall student grade, 5% in both classes. This percentage and the exercise itself were on one hand too simple for students to pay attention to, but at the same time was too difficult for students to get it on their own outside of class.
6) In this example, there seemed to be very little carry over of what was learned in OA to OM. The knowledge level of simulation was very small between the two groups.
7) Time requirements from the instructors’ perspective were very large. This is partially due to the development of the exercise, but all partially due to coordination between them as well as far as expectations, and communication of questions raised in their perspective classes.

CONCLUSIONS

Students gained value from this exercise, but in ways different than had been intended. Students learned how difficult it is to work in virtual teams, and the frustrations which can come with lack of or late participation of their teammates. In addition, there did not seem to be much evidence in the difference between the content of the group exercise, simulation or the specific exercise, waiting line theory. Rather, the differences seemed to be individual, students from either class who were motivated helped their classmates independent of which class they were in. We suspect that if this kind of project were institutionalized, that is all teachers of all sections using it, the success rate would become much higher.

APPENDIX

OA/OM Group Case Study
CALL CENTER SIMULATION

Customer waiting time is an important measure of performance, especially in service operations. In this assignment, your team of OA and OM students will analyze a tech-support call center. Using a simulation model, you will predict various performance measures of the system and determine if the current configuration is likely to meet customer expectations.

Problem Description

A computer software company provides online support for the company's products. Customers with questions call the hotline at an 800 number. During a typical 8-hour day shift, the time between calls can be approximated by an exponential distribution with a mean of **4** minutes. The call center has **10** phone lines and hence can handle up to **10** calls at once. If a call arrives and all the lines are in use, then the caller gets a busy signal and has to call back later. If a call arrives and fewer than **10** lines are in use, then the call goes directly to a customer service (CS) person, if one is available, otherwise is put on hold. The amount of time for a CS person to handle a call, once answered, can be approximated by a normal distribution, with a mean of **10** minutes and a standard deviation of **2** minutes.

Part 1A: 63.371 Group (OM)

Draw the process flow map for the call center [Hint: Look at Sample problem, p. 10 of handout]. Include in the map the time between arrivals, the arrival pattern using SimQuick notation, the maximum queue length, and the service pattern including mean and standard deviation using SimQuick notation.

Include this as an Excel attachment to Blackboard under Assignment A. This assignment is due on October 29, 2009 at 11PM.

Part 1B: 63.210 Group (OA)

Create the simulation model including the appropriate entrances, buffers, work stations, and final buffers. Management wants to determine how many CS people to use during the day shift so that two things are both true: the mean number of minutes a customer waits is less than 2 minutes and the service level is at least .99. Consider using from one to five CS people. For each possibility, run 50 simulations of an 8-hour day shift and record the service level and mean cycle time through Line. [*Hint*: Look at sample output on p. 15–16 of handout.] Assume that the initial number of callers on hold at the beginning of the day shift can be approximated by the normal distribution with a mean of 2 and a standard deviation of 0.5. How many CS people would you recommend for the day shift? Include the output as an Excel attachment to Blackboard under Assignment B. This assignment is due by Sun., Nov. 8, 2009 at 11PM.

Part 2: 63.371 and 63.210 Combined Teams

Answer the following questions. Submit one final group report by Fri., Nov. 13, 2009 at 11PM.

1. How many customer service representatives should the company have working during the day shift? Justify your answer with the simulation results, and discuss the pros and cons of other alternatives considered/tested.
2. If you were trying to get information, would you be satisfied with the current situation? Why or why not? If you were the manager of the call center, would you be happy with the situation? Why or why not?
3. Suppose that three operators called in sick? What would be the impact? (To answer this question, you will need to re-run the simulation under the new situation.)
4. A new training regimen is put into place. The average time to finish a call is reduced by 0.5 minutes. What is the impact on the system performance?
5. Why do we need to run the simulation multiple times?

Guidelines for Part 2 Write-ups

- It is important to justify your answers. These explanations are as important as the numbers.
- Assume that the reader of the write-up is familiar with the background of the case.
- Calculations and other quantitative analyses should be explained.
- Write-ups usually range in length from two to three pages.
- Write-ups will be evaluated on the basis of content, clarity, and style. Make sure that your write-up is complete, well-organized, and free of grammatical and spelling errors.

REFERENCES

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