Teaching and Educational Methods

Personalizing Online Classes: The Use of Evaluation and Participation Tools

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Abstract

Self-directed online learning is challenging for many students. Limitations in interaction with the instructor, difficulty in focusing in the major messages of the course, and not active encouragement in the video lectures are common constraints. In this article, I present a case study in which I implemented in my classes two methods to overcome these limitations: the use of online evaluation tools and in-person review sessions. Utilizing regression modeling and the qualitative information of the class evaluations, I argue that the use of these methods has presented positive impact in the learning process of the students and improved the interaction between instructor and student.

1 Introduction

In recent years, online classes have become a more frequent alternative to taking courses on campus in many universities and colleges. Approximately 6.7 million students took at least one class online during Fall 2011, which is about one third of students enrolled in higher education (Allen and Seaman 2013; Kentnor 2015). Growth of distance education is steady and positive. The number of students taking an online course increases at an annual rate of 3.7 to 3.9 percent per year (Allen and Seaman 2016). However, online teaching faces several challenges and barriers (Horvitz et al. 2015). These include:

(1) *Low motivation for active learning*: Much of the online learning is self-directed, where success depends on attractiveness of the content and clearness of the instructions (Drange, Sutherland, and Irons 2015). Online videos often do not capture the attention of students, and many students may just watch part of the content that may help them to solve the assignments required for the course.

(2) *Student and instructor interaction limitations*: This is mainly accomplished through email, which is seen often as impersonal (Liu et al. 2007; Shea 2007). In addition, teaching mathematics in economic courses online may be challenging because students may have questions while watching the video lectures. This becomes a major issue with the increase in the number of students participating in the course.

(3) *Software compatibility issues*: When working with computer simulations for economics, many students may face difficulties when solving these exercises because of external factors such as the utilization of different types of operative systems (i.e., Windows, Linux, or MacOS), or versions of the software (Excel 2013 vs. Excel 2019; Perreault et al. 2002).

These challenges raise some important questions: How do you encourage active learning in online courses? How do we motivate students to watch videos lessons? How do we deliver the core messages of a course in an online platform? These concerns are especially critical when teaching economics, which involves the use of mathematical tools. Thus, there is a need to find an integrated methodology that is able to overcome these challenges to provide a similar experience as classes taught face-to-face.

In this article, I address these challenges by presenting several methods assessing active learning and engagement in student-instructor interaction through the use of online evaluation tools, and in-person review sessions and computer labs. Economic instructors may implement the proposed methodologies and adapt them to their specific courses at any higher-education level. This paper presents a brief description and procedure of each method and how to implement them, including a case study that discusses the implementation, evidence on students' performance, and students' perceptions of the class.

2 The Case Study

2.1 Course Background

During 2019, I was in charge of teaching an online the course entitled "Quantitative Methods in Food and Resource Economics (FRE)." This is a required upper division undergraduate course for FRE and agribusiness majors, which involves the use of math and economic theory, including the use of matrices, multivariate calculus, linear optimization, and computer simulations of economic problems. "Quantitative Methods in FRE" is divided into 10 units. Each unit is delivered via online lectures. The framework of each unit is described in Figure 1. This class is offered every semester.

This class has some special features, including: (1) in Spring 2019 the class was offered only online for the first time; (2) I am the sole instructor, with no in-person option; (3) the instructor is not located on the main campus; and (4) this core course is also a base and prerequisite for many other courses in the major. Therefore, this course required careful planning, especially because of the intensive use of math and Excel simulation, which is challenging for many students.

2.2 Methods to Personalize Online Classes

To address the challenges presented by online courses, I developed the following series of methods, which are classified depending on the concern being addressed. The first category is active learning, in which the instructor attempts to motivate students to engage in the online lessons and watch the video lectures through the use of two tools: *pre-labs* and *quizzes*. The second group is the personalization of online classes, in which the goal is to interact with students face-to-face on specific occasions, providing *review sessions* and *computer labs*.

Pre-labs are small tasks that may include a set of theoretical and practical questions that are required to be fulfilled before labs or assignments. Pre-labs are extensively used in biology and chemistry sciences because it allows students to learn the conceptual material and be prepared before the actual lab experience (Cann 2016). Thus, I developed one pre-lab per unit. The pre-lab task is intended to guide students to learn the most important concepts of the economics lecture videos. It is usually turned in four days before the homework assignments. Each pre-lab contains short theoretical questions and about four to five practical problems. The solutions to each question are presented in the video lectures. Thus, to finish the pre-labs, students must watch all videos to find the answers. The class also has *online quizzes* for each unit. These quizzes are variations of the pre-lab problems and are short in nature, usually two or three questions with a duration of 15 to 30 minutes. Both tools encourage students to watch the videos because the pre-labs and quizzes are graded. Solving these small tasks allow students to have a better idea where

Unit 1	Unit 2	Unit 3	Unit 4	Unit 5
System of Equations	Functions	Matrix Algebra	Foundation of Derivatives	Application of Derivatives
Unit 6	Unit 7	Unit 8	Unit 9	Unit 10
Multivariate calculus	Matrix in Optimization	Linear Programming	Computer Applications	Integration

Figure 1. Units of the "Quantitative Methods in FRE"

to focus their efforts. In addition, it allows me as an instructor to detect areas for improvement before homework assignment deadlines, to be able to provide more examples for challenging units.

The next two techniques address the in-person experience: *computer labs* and *in-person review sessions*. Unit 9 offers computer applications of economic problems (input-output tables and linear programming problems) using Microsoft Excel. Many students may face difficulties when solving the exercises because of external factors such as the utilization of different types of operating systems (i.e., Windows, Linux, or MacOS), or versions of the software (Excel 2013 vs. Excel 2019). For this reason, the Teaching Assistant (TA) of the class hosts optional computer labs, where the TA assists the students with examples presented in the video lectures. Thus, students have a better perspective on how to solve the computer applications.

The class has three exams (two midterms and one final exam). On average, three units of material are covered for an exam. Thus, the professor hosts review sessions every two or three weeks, which overall is the week before the midterm exams. The instructor travels to the main campus to meet with the students and assist with any questions from the class and provide a study guide for the exam, which summarizes the major concepts and methodology learned in the class. In addition, during these sessions, the instructor provides additional exercises to reinforce learning objectives.

2.3 An Evaluation of Personalization Methods

These methods were implemented in the "Quantitative Methods in FRE" class in Spring 2019. Overall, the structure is the following: midterms, homework assignments, pre-labs, and quizzes (Table 1).

A total of 53 students took the class in Spring 2019. To evaluate the effectiveness of the pre-labs and quizzes or homework assignments, a linear regression was estimated as shown in equation (1):

$$HW_i = \beta_0 + \beta_1 PL_i + \beta_2 Q_i + \varepsilon_i, \qquad (1)$$

where HW_i represents the grade on the assignment (0–30 points), PL_i is the score on the pre-lab (0–10 points), Q_i is the score in the quiz (0–15 points), and ε_i is the error term that is assumed to be mean zero, IID, and normally distributed (no heteroscedasticity or clustering were detected in preliminary evaluations of the data[1]). In case there are more than one quiz or pre-lab for each assignment, the average of the tasks was taken.

In addition, I collected qualitative information with respect to students' perceptions of the tools used in the class through anonymous surveys and students' teaching evaluations at the end of the semester. Questions regarding the effectiveness and perception on the review sessions, quizzes, and pre-labs were asked on the survey (Figures 2 and 3), and additional comments on the class organization and structure

Table 1. Distribution of Tasks in "Quantitative Methods in FRE," Spring 2019

Description	Quantity	Value per task	Total points
Pre-Labs	9	10	90
Quiz	13	15	195
Homework	9	30	270
Excel Application	1	30	30
Midterms	2	100	200
Mini-Project*	1	15	15
Final Exam	1	200	200
TOTAL			1,000

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[1] Results of evaluations for heteroskedasticity and heterogeneity are available from the author upon request.

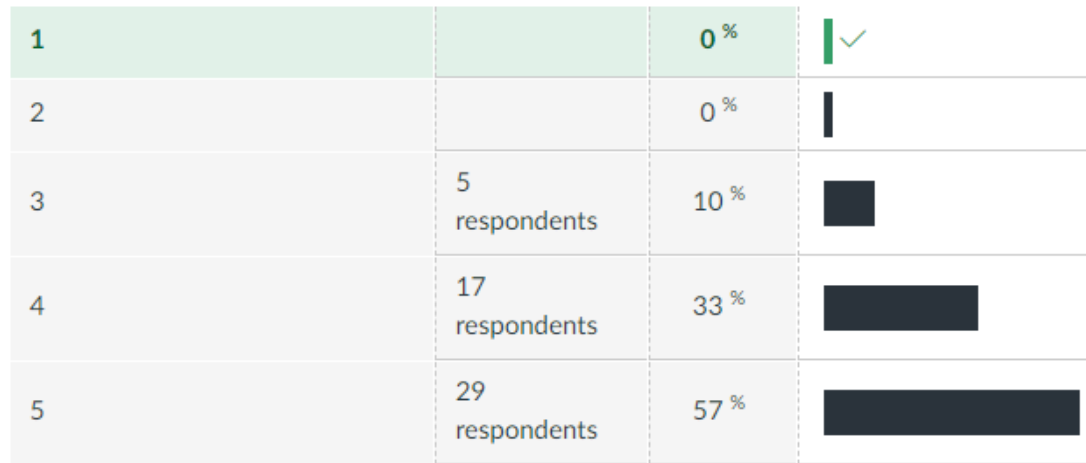Are the pre lab assignments adequate and helpful to understand the content of the class?

1		0 %	
2		0 %	
3	5 respondents	10 %	
4	17 respondents	33 %	
5	29 respondents	57 %	

Figure 2: Midsemester Survey Response with Respect to the Pre-Labs

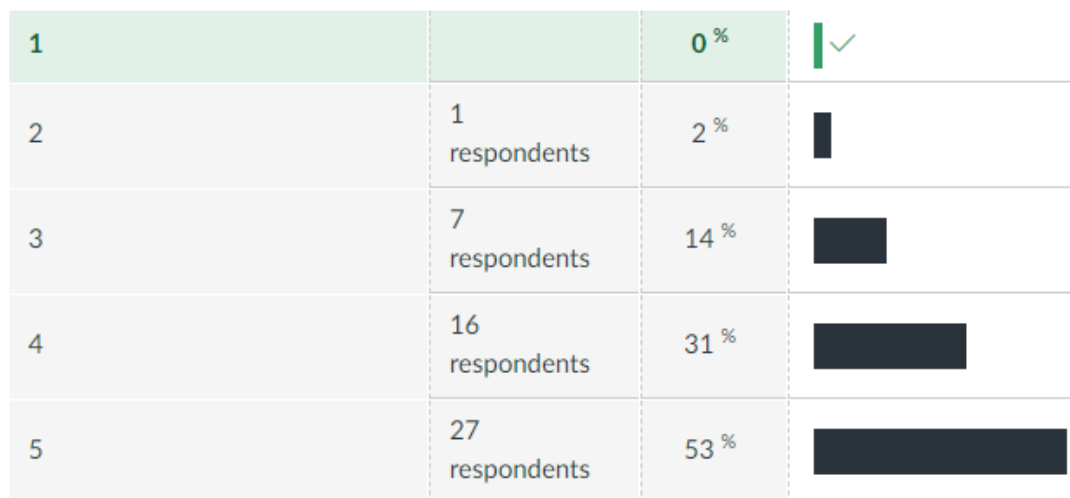Are the quizzes adequate and helpful to understand the course?

1		0 %	
2	1 respondents	2 %	
3	7 respondents	14 %	
4	16 respondents	31 %	
5	27 respondents	53 %	

Figure 3: Midsemester Survey Response with Respect to the Quizzes

were also asked in the faculty evaluation (for information regarding the questions in the surveys, please see the supplemental material).

3 Results and Discussion

Over the course of the semesters, there were a total of 1,000 points that students could earn (Table 1). A total of 477 observations were analyzed in the regression (53 students over 9 assignments). The average performance for each task is provided in the descriptive statistics in Table 2. Overall, students obtained an average value between 25 to 29 points on the assignments. Nevertheless, there was a standard deviation of 5 to 6 points in each assignment. The most challenging unit for the students was unit 7 (use of matrices in optimization).

The estimated linear regression of homework assignments (HW) with respect to pre-labs (PL) and quizzes (Q) is the following:

$$HW = 14.96 + 0.68PL + 0.39Q + \varepsilon \qquad\qquad (2)$$
$$(0.10) \quad (0.09) \quad (5.47)$$

The standard errors are in parentheses. The coefficients of the regressions are statistically different from zero at the 1-percent level of significance. The regression provides important insights. Overall, students that do not complete any pre-lab or quiz score only 50 percent on the assignments (15 out of 30 points). Pre-labs have a positive connection with assignments. On average students get 7 points higher when successfully solving the pre-lab problems. Quizzes also have a strong positive correlation with performance on assignments.

A mid-semester survey was provided to the class, in which 51 out of 53 students responded, resulting in a 96-percent response rate. The results show that most of the students find the pre-labs (Figure 2) and quizzes (Figure 3) adequate and helpful to understand the content of the class (90 percent and 84 percent of students, respectively).

The final course evaluation was filled out by 45 students (approximately 85 percent of the class). In the overall assessment, students praised the class as engaging and different from other online classes. The overall rating was 4.78/5, which provides a good indicator of the quality of the class. The text responses praised the enthusiasm of the instructor, review sessions, the quality of the video lectures, and the assignments, among some of the comments (provided in the supplementary section):

> "I thought the course was very good. Everything was set up and organized from the beginning of the semester, and it was very easy to follow along. There were not many printed materials, as it was an online class, but the course materials did include most things such as video lectures and notes, which were very useful. I really enjoyed how the class was set up to first have the pre-labs to give you an introduction to the concepts, then the quizzes to begin application, and the assignments, which were full application of the concepts. It was a gradual increase of difficulty that was appropriate."

Table 2: Average and Standard Deviation of Each Task Assigned in the Class

	N = 478																				
	Available	Unit 01		Unit 02		Unit 03		Unit 04		Unit 05		Unit 06		Unit 07		Unit 08		Unit 10	
	Pts.	Avg.	St.D	Avg.	St.D	Avg.	St.D	Avg.	St.D	Avg.	St.D	Avg.	St.D	Avg.	St.D	Avg.	St.D	Avg.	St.D
Pre-lab	10	9.6	1.6	9.8	1.4	9.3	2.3	9.5	1.5	9.5	1.6	8.7	2.9	7.8	3.9	9.2	2.6	9.3	2.0
Quiz A	15	14.4	2.0	14.4	2.9	13.4	3.5	13.7	3.1	12.5	3.0	13.1	3.8	12.1	3.4	14.0	2.5	13.2	3.4
Quiz B	15			13.7	3.2									13.0	2.7	12.5	2.7	13.8	4.0
Assignment	30	26.7	4.7	27.6	4.7	25.6	7.2	26.4	6.2	25.6	6.6	25.7	6.4	25.4	5.6	25.8	4.4	28.9	5.7

Avg. : Average score in the assignment.   St. Dv. : Standard deviation in the assignment.

(Note: Some units have two quizzes)

"I like how this course is organized. Good balance between lecture videos, assignments, and exams."

"The class was fair. Good online class. I like how the professor came to campus for in-person exam reviews."

"The review sessions are very helpful, and the professor and TA are always eager to help whenever I have questions. They show great concern for the students in the class."

"The course has taught me a lot. At first I was intimidated by it because calculus isn't my forte; however, the instructor explains his materials well and is very helpful towards his students."

"Paced well, assignments are easy to understand, reminders were wonderful."

On the other hand, there were other comments that suggested some improvements:

"Actually really enjoyed it. I learned a lot! Wish we would have used the book more, but I got most of my practice from assignments and pre-lab work."

"I believe the pre-labs were not always necessary depending on the difficulty of the module. For certain modules, I believe just a quiz and assignment would have been enough to learn the module."

To summarize, the efforts to personalize the online course have been praised by the students in their class evaluation reviews because they feel that the class is engaging and that the instructor is involved in the learning process. They found very valuable the effort of the professor in providing in-person review sessions, as they were able to solve inquiries regarding the class and reinforce the knowledge gained in the video lessons. The in-person computer labs were also useful for the students, especially for those who were working with Microsoft Excel for first time. However, one major drawback of this technique is the time commitment for the professor, as this requires substantial time to review the pre-labs and the time involved to conduct the review sessions.

4 Conclusions

In recent years, online classes have become a more frequent alternative to taking courses in many universities and colleges. However, teaching online classes faces many challenges, such as lack of interaction between students and instructors; and lack of focus from the students on the major concepts provided in the online video lectures. How do we include active learning in online courses? How do we improve the interaction with students to provide a similar experience as face-to-face class sessions? This article provides some insights to these questions. Two techniques may be used to improve the active learning: (i) pre-labs, which are short questions based on the videos, which can help students to focus on learning the major concepts; and (ii) quizzes, which provide further practice before attempting the homework assignments. To overcome the limitation of the student-instructor interaction, this commentary proposed the use of review sessions and computer labs, which require the instructor to meet with students face-to-face to reinforce major learning objectives, applications, and concepts of the class. These personalization methods were implemented in a required economic class and obtained positive reviews from students. Overall, students praise the effort of the professor to personalize the class, and some students perceive it as beneficial to have the online lessons together with in-person review sessions as a different learning experience.

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