*Southern Economic Journal* 2016, 83(1), 321–331
DOI: 10.1002/soej.12128

## Targeting Teaching

# Flipping the Undergraduate Economics Classroom: Using Online Videos to Enhance Teaching and Learning

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The flipped classroom has been proposed as a teaching method with the potential to enhance student learning by removing much of the ‘‘transmission of knowledge’’ from the classroom and replacing this with active learning approaches that enable the assimilation of information. This article analyzes the impact of a flipped undergraduate economics course that leverages an existing suite of online lectures by Khan Academy. The study employs a quasiexperimental design to evaluate the impact of two different flipped treatments on an undergraduate microeconomics principles final exam. Student achievement is compared for students in (i) a "traditional" undergraduate course; (ii) a "complemented" (or partially flipped) classroom including traditional "mini" lectures complemented with online video lectures assigned as homework; and (iii) a flipped classroom. Results suggest that students in both of the flipped courses scored between 4 and 14 percentage points higher on set of common questions and a cumulative final exam.

**JEL Classification: A22**

## 1. Introduction

The inverted, or "flipped" classroom—where content delivery includes video lectures watched outside of the classroom and lecture time focuses on in-class exercises and applications—has been proposed as a groundbreaking method for creating improvements in student learning in a variety of undergraduate courses (Deslauriers, Schelew, and Wieman 2011; Mason, Shuman, and Cook 2013; Wilson 2013). This approach allows instructors time to do "homework" in class and provides students time to watch video lectures that mimic one-to- one tutoring at home. Thus, students can benefit from the ability to control their studying environment by re-watching complex material, reviewing topics as often as needed, and gaining more practice in class.

It has long been known that interactive classrooms can improve student understanding of concepts, maintain engagement, and create interest in the field (Becker and Watts 1995; Durham, McKinnon, and Schulman 2007; Carter and Emerson 2012). A wide range of methods for addressing apparent deficiencies in undergraduate education have been proposed with differing levels of success. Most recent concerns have focused on addressing

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Received January 2015; accepted September 2015.

 

student retention and graduation rates. Although graduation rates have been increasing since the 1990s, less than 40% of undergraduate students graduate in 4 years; with an increase to only 60% by 6 years (Field 2013). At the classroom level, a growing body of literature points to the need to rethink the traditional in-class, lecture-based course model to increase student achievement and likelihood of success in their classes (McLaughlin et al. 2014). The flipped classroom allows more time for the activities and interactions that have been shown to have positive impacts on student learning (Lage and Platt 2000; Lage, Platt, and Treglia 2000).

Active learning, defined as methods that allow students to construct their own understanding of course material and engage in the learning process, has been found to increase examination scores by an average of 6% in undergraduate science, technology, engineering, and mathematics (STEM) courses and reduce failure by 36% (Freeman et al. 2014). And in undergraduate physics classes, these methods have been found to enhance problem solving ability; leading to an almost 50% increase in pretests and post-tests (Hake 1998). Similarly, Prince (2004) identifies an average increase of 6 percentage points in engineering grades and a 22% reduction in retention for students enrolled in interactive classes. In economics, experiments have been found to increase pretest and post-test scores by between 2 and 3% more than the control (Emerson and Taylor 2004) and to result in cognitive gains (Durham, McKinnon, and Schulman 2007). Furthermore, cooperative learning has been found to increase final exam grades 4-6 percentage points (Yamarik 2007) and increase economic reasoning (Marburger 2005).

Benefits of the flipped class are twofold: the method enables the instructor to allocate more time to active learning and provides students with online videos which serve as additional review and a "virtual on-demand tutor." Studies of the flipped classroom have reported positive impacts on student learning for up to 20 percentage points on classroom quizzes (Forsey, Low, and Glance 2013) resulting from increases in classroom discussion time, individual problem solving, and critical thinking (Lage and Platt 2000). Courses that use this inverted format have also been found to cover more material with no loss in student understanding (Mason, Shuman, and Cook 2013) and are highly recommended for equipping students for future careers (McLaughlin et al. 2014). Opponents, conversely, argue that evidence of true effectiveness has not been established by these and other studies (i.e., Bergtrom 2011; Tune, Sturek, and Basile 2013) due to a lack of rigorous evaluation and the ability to identify causal factors that change between different applications of the treatment (Jensen, Kummer, and Godoy 2015). Still others have found no quantitative learning gains (Strayer 2012; McLaughlin et al. 2014; Roach 2014).

This article uses a quasiexperimental design to evaluate the impact of two different flipped treatments on an undergraduate microeconomics principles final exam. This study compares academic performance of students in (i) a control: a "traditional" undergraduate course including chalk-and-talk lectures mixed with in-class exercises and clicker questions ($n = 58$); (ii) treatment 1: the "complemented" (or partially flipped) approach including traditional chalk-and-talk "mini" lectures, in-class exercises, clicker questions and online video lectures assigned as homework ($n = 55$); and (iii) treatment 2: a flipped classroom including mini lectures, clicker questions, significant classroom time allocated to in-class exercises, and online video lectures assigned as homework ($n = 50$). This approach leverages an already existing suite of undergraduate-level online lectures prepared by Khan Academy (Khan Academy 2014), a web resource that has already been innovating secondary education (Thompson 2011).

## 2. Data

Students included in the study were enrolled in one of six sections of microeconomic principles at Salisbury University during three semesters from 2011–2013.[1] Students were not aware of the different teaching approaches applied in these courses prior to enrollment. These relatively small sections of approximately 27 students met the same times and days in each of these semesters (Tuesdays and Thursdays at 9:30 and 11:00) for 75 minutes. The same methods of teaching (i.e., the traditional, complemented, or flipped) were used in each of the two sections taught in a single semester. The instructor, topics covered, textbook used, and online homework program (i.e., Aplia) were identical for all the course sections included in this study. A mixture of homework assignments, quizzes, and three exams (including a cumulative final) were used to evaluate performance in each class. The same clicker questions were used to break up lecture and review material in each of these six sections. In-class exercises (i.e., active learning approaches) were also applied in each of these courses. With the exception of the final, exams included essay and multiple choice questions. The final exam was made up of only multiple choice questions covering the same topics and of the same level of rigor in each semester. The comprehensive final exam included a common set of 16 identical questions administered in each of these semesters. These questions were developed by department faculty to assess student learning, and were tested for rigor, quality, and the ability to discriminate between good and poor performing students before they were used in assessment (Caviglia-Harris and Hill 2010). These two measures are used to evaluate impact to ensure that the results are not reflections of different unknown rigor (a possibility with the final exam score) or stem from students stealing questions (via cell phones, etc.) between semesters (a possibility with the common questions).

Students in the treatments were assigned approximately two Khan Academy videos (of an average of 8 minutes in length) per week to be completed prior to lecture. These videos are white board scribe animation (i.e., do not include images of people), known to be conducive to learning economics or any other complex material that can be presented in steps (such as graphs and equations). Students were not quizzed on these videos nor were any additional incentives provided, however, the topics and methods matched closely with the material presented in class and in the textbook (and therefore the material tested on the course exams). The videos were discussed in class.

The in-class activities included a mix of end-of-the chapter questions, exercises created by the instructor, and in-class games. Student groupings varied in one of three ways: they were told to work alone, to work with a neighbor, or paired randomly. Detailed answers (prepared by the instructor and posted on the course web site) were provided on an overhead screen after each question (or question part) was answered.

## 3. Results

Extensive research has been undertaken on the factors impacting the academic performance of students in principles of economics courses. The education production function provides a framework for determining the relevant covariates. Under this framework there are three categories of inputs that should be included or controlled for in the estimation of grades (Edwards 2000). These include: (i) human capital (i.e., SAT scores, prior grades), (ii) utilization rates (such as

[1] The courses were taught in the Fall 2011, Fall 2012, and Spring 2013 semesters.

**Table 1.** Variable Definitions and Descriptive Statistics by Teaching Method

| | | No Flipping (no online videos) mean/sd | Complementing (videos and lectures) mean/sd | Flipping (videos and "mini-lectures") mean/sd |
|---|---|---|---|---|
| **Dependent Variables** | | | | |
| Final Exam | Score out of 100 on 60–70 multiple choice questions | 61.30 (14.36) | 66.60 (12.06) | 71.63 (10.54) |
| Common Questions | Score out of 100 on 16 of the 60–70 multiple choice | 60.99 (19.46) | 73.64 (16.03) | 75.00 (12.56) |
| **Student Characteristics ($Z_i$)** | | | | |
| Gender | Gender; =1 if female, 0 otherwise | 0.38 (0.49) | 0.29 (0.50) | 0.40 (0.50) |
| Minority | Minority status; =1 if African American, 0 otherwise | 0.14 (0.34) | 0.33 (0.47) | 0.14 (0.35) |
| Pell | Dollar amount of Pell grants received | 703.40 (1659.2) | 477.30 (1477.5) | 675.00 (1644.9) |
| **Human Capital ($K_i$)** | | | | |
| Hours | College credit hours completed prior to taking the course | 33.60 (31.48) | 29.38 (13.43) | 51.54 (26.08) |
| SAT | SAT score—sum of the math and verbal SAT scores | 1092.60 (109.6) | 1089.10 (100.8) | 1076.60 (112.7) |
| High School GPA | High school grade point average | 3.31 (0.81) | 3.39 (0.74) | 3.41 (0.37) |
| *n* | observations | 58 | 55 | 50 |

student characteristics and effort), and (iii) technology (including teaching methods, teacher effectiveness, etc.). This framework highlights the error that could result when evaluating the impact of a new teaching technology. For example, a shift in the production function resulting from a change in teaching methods assumes that all other factors are held constant between the groups. If these factors are not controlled for, comparisons of student achievement may represent output at different levels of inputs that lie on different production functions; making it difficult to disentangle differences from a true technology effect from changes in the rate at which inputs are transformed into outputs (Siegfried and Fels 1979). The empirical model employed here is motivated by this standard production function:

$$\text{Grade}_{ij} = \alpha + \beta_1 Z_i + \beta_2 K_i + \beta_3 T_j + \varepsilon_{ij} \tag{1}$$

where the parameters include $\alpha$, the intercept, and $\beta_n$, the respective matrix of coefficients. The performance of student $i$ subject to the $j^{th}$ teaching method is hypothesized to be a function of

**Table 2.** OLS Estimation Results

| | Final (1) | Common Questions (2) | Final (3) | Common Questions (4) | Final (5) | Common Questions (6) |
|---|---|---|---|---|---|---|
| Constant | 59.554*** | 58.449*** | 15.057 | 16.856 | −9.896 | 3.985 |
| | (2.142) | (2.853) | (10.174) | (13.906) | (13.034) | (18.737) |
| Complementing | 4.628* | 11.912*** | 6.351*** | 13.902*** | 7.303*** | 14.674*** |
| | (2.353) | (3.133) | (2.329) | (3.183) | (2.363) | (3.397) |
| Flipping | 8.272*** | 11.632*** | 10.293*** | 13.898*** | 12.582*** | 14.685*** |
| | (2.459) | (3.275) | (2.380) | (3.253) | (2.504) | (3.599) |
| Gender | −5.013** | −4.256 | −5.355*** | −4.583 | −6.318*** | −4.078 |
| | (2.080) | (2.770) | (2.040) | (2.789) | (2.203) | (3.166) |
| Minority | 2.664 | 3.442 | 2.09 | 5.167 | 3.224 | 6.837* |
| | (2.449) | (3.261) | (2.316) | (3.166) | (2.545) | (3.658) |
| Pell | −0.001 | −0.001 | −0.001* | −0.002** | −0.001** | −0.002** |
| | (0.001) | (0.001) | (0.001) | (0.001) | (0.001) | (0.001) |
| Hours | 0.119*** | 0.135** | 0.119*** | 0.176*** | 0.128*** | 0.196*** |
| | (0.041) | (0.054) | (0.039) | (0.053) | (0.040) | (0.057) |
| SAT | | | 0.041*** | 0.036*** | 0.034*** | 0.025* |
| | | | (0.009) | (0.012) | (0.010) | (0.014) |
| High School GPA | | | | | 9.307*** | 6.988** |
| | | | | | (2.391) | (3.438) |
| R-squared | 0.17 | 0.18 | 0.36 | 0.33 | 0.44 | 0.36 |
| Adjusted R-squared | 0.14 | 0.15 | 0.32 | 0.29 | 0.40 | 0.31 |
| Observations | 163 | 163 | 132 | 132 | 111 | 111 |

Standard errors in parenthesis.
*Significant at 10%
**Significant at 5%
***Significant at 1%.

individual characteristics ($Z_i$) such as gender and race; human capital ($K_i$) (including prior knowledge as measured by SAT score and high school GPA and/or college GPA prior to taking the course); and college experience (such as college credit hours) and the technology $T_i$, a dummy variable for each of the teaching approaches.

This study classifies technology in three ways: (i) "traditional" teaching methods; (ii) the "complemented" approach; and (iii) the flipped classroom. The complemented approach was adopted to provide more time for lecture and discussion of complex material before attempting in-class exercises only after experiencing declining class preparation for the flipped course in the semester prior. Based on class discussion and clicker questions based on these videos, it became obvious that students watched the videos prior to class at a higher frequency earlier in the semester.[2] This prewatching declined over time. However, students commented in both semesters that they watched them frequently when studying for exams.

Descriptive statistics suggest that the final exam and common question scores are higher for classes that employed one of the two treatments and that there are significant differences between students as divided between these three teaching approaches (Table 1). According to data collected from university records, there were fewer women, students with Pell grants (need based grants awarded to low income students), and minorities in the complemented class. Students had significantly more college-credit hours completed in the flipped course, while other indicators of human capital (SAT scores and high school GPA) were similar between the groups.

[2] These videos were discussed briefly in class almost every day they were assigned to encourage watching and provide evidence there were valued by the instructor.

**Table 3.** Heckman Selection Estimation Results

| | Final (1) | Common Questions (2) | Final (3) | Common Questions (4) | Final (5) | Common Questions (6) |
|---|---|---|---|---|---|---|
| Constant | 61.040*** | 61.379*** | 21.419** | 32.93 | −2.406 | 27.231** |
| | (2.092) | (2.992) | (9.693) | (21.024) | (12.870) | (13.557) |
| Complementing | 4.410** | 10.943*** | 6.225*** | 12.523*** | 6.955*** | 14.865*** |
| | (2.248) | (3.009) | (2.217) | (4.493) | (2.247) | (0.809) |
| Flipping | 7.884*** | 10.647*** | 9.918*** | 12.834*** | 12.249*** | 13.415*** |
| | (2.376) | (3.220) | (2.273) | (4.585) | (2.381) | (1.062) |
| Gender | 0.102** | 0.097* | 0.106*** | 0.144* | 0.117*** | 0.151*** |
| | (0.040) | (0.057) | (0.038) | (0.077) | (0.038) | (0.052) |
| Minority | −3.878* | −2.387 | −4.648** | −2.633 | −5.407** | −0.953 |
| | (2.088) | (2.859) | (2.032) | (4.264) | (2.180) | (3.125) |
| Pell | 1.912 | 2.273 | 1.175 | 2.929 | 2.668 | 4.556 |
| | (2.473) | (3.333) | (2.335) | (4.934) | (2.516) | (3.719) |
| Hours | −0.001 | −0.001 | −0.001* | −0.002 | −0.001** | −0.002*** |
| | (0.001) | (0.001) | (0.001) | (0.001) | (0.001) | (0.001) |
| SAT | | | 0.036*** | 0.026 | 0.030*** | 0.014 |
| | | | (0.009) | (0.018) | (0.009) | (0.011) |
| High school GPA | | | | | 8.637*** | 4.933*** |
| | | | | | (2.327) | (1.548) |
| Wald | 27.45*** | 22.75*** | 61.34*** | 18.24*** | 71.60*** | 1.89e+08*** |
| Observations | 178 | 178 | 147 | 147 | 126 | 126 |

Standard errors in parenthesis.
*Significant at 10%.
**Significant at 5%.
***Significant at 1%.

Estimations of the final exam and common questions are made using OLS regressions and variables for individual characteristics, human capital, and technology (Table 2). Data on high school GPA and SAT scores were not available for some students due to missing administrative data and the SAT optional policy at the university. The estimations are therefore run in a step-wise fashion with increasing controls (for human capital) but decreasing observations.

The inclusion of these controls has been debated for almost a century with camps forming on whether high school grades or entrance exams are better predictors of college grades (Lincoln 1917; Passons 1967; Aitken 1982; Mulvenon et al. 1999). Many recent studies have found both SAT score and high school GPA to be strong predictors of student achievement (Emerson and Taylor 2004; Robbins et al. 2004; Durham, McKinnon, and Schulman 2007; Schmitt et al. 2009; Carter and Emerson 2012). Here, SAT scores and high school grades are not correlated[3] and are, therefore, both included in the regressions for the sample for which both these scores are available.

The estimations suggest that students in the flipped and complemented classes did significantly better on the final exam and common questions (Table 2). While the inclusion of SAT scores and high school GPAs increases explanatory power, the significance of these "technology" variables does not change. Also significant is gender: females did significantly worse on the final according to all three estimations, but did not do significantly worse on the common questions. Students with greater income need (Pell) tended to do poorer on the exams, with a greater significance of this variable with the estimations that control for SAT and high school GPA. Finally, all

[3] The correlation coefficient = 0.01.

**Table 4.** Heckman Selection with Interactions Estimation Results

| | Final (1) | Common Questions (2) | Final (3) | Common Questions (4) | Final (5) | Common Questions (6) |
|---|---|---|---|---|---|---|
| Constant | 60.378*** | 60.422*** | 21.951** | 33.304 | −8.53 | 23.673 |
| | (2.271) | (3.220) | (9.877) | (21.163) | (27.906) | (34.238) |
| Complementing | 6.593** | 13.283*** | 9.366*** | 18.321*** | 12.387 | 14.703 |
| | (3.034) | (4.089) | (3.119) | (6.286) | (29.104) | (35.708) |
| Flipping | 8.396*** | 12.181*** | 11.173*** | 16.458*** | 49.414 | 27.642 |
| | (2.987) | (4.019) | (2.931) | (5.881) | (32.306) | (39.636) |
| Gender | −2.367 | −0.632 | −2.545 | 1.62 | −2.813 | 1.157 |
| | (3.369) | (4.544) | (3.222) | (6.665) | (5.530) | (6.785) |
| Gender* | −3.159 | −2.437 | −4.253 | −7.586 | −0.632 | −3.843 |
| complementing | (4.855) | (6.304) | (4.697) | (9.082) | (7.562) | (9.277) |
| Gender* Flipping | −3.676 | −5.436 | −5.129 | −9.825 | −3.167 | −8.11 |
| | (4.713) | (6.302) | (4.551) | (8.982) | (7.482) | (9.180) |
| Minority | 1.456 | 4.119 | 1.695 | 7.01 | 1.052 | 16.697* |
| | (4.734) | (6.284) | (4.403) | (9.162) | (8.250) | (10.122) |
| Minority* | −3.083 | −5.834 | −4.262 | −9.979 | 1.598 | −16.976 |
| complementing | (5.839) | (7.751) | (5.536) | (11.119) | (10.196) | (12.509) |
| Minority* Flipping | 7.676 | 4.245 | 6.101 | 2.072 | 3.493 | −8.885 |
| | (6.985) | (9.255) | (6.540) | (13.152) | (10.805) | (13.257) |
| Pell | −0.001 | −0.001 | −0.001 | −0.002 | −0.001 | −0.002* |
| | (0.001) | (0.001) | (0.001) | (0.001) | (0.001) | (0.001) |
| Hours | 0.103** | 0.098* | 0.111*** | 0.150* | 0.098 | 0.176** |
| | (0.040) | (0.059) | (0.038) | (0.078) | (0.063) | (0.077) |
| SAT | | | 0.035*** | 0.023 | 0.029** | 0.014 |
| | | | (0.009) | (0.018) | (0.015) | (0.018) |
| High school GPA | | | | | 11.305* | 5.265 |
| | | | | | (6.396) | (7.847) |
| High school GPA* | | | | | −1.767 | 0.817 |
| complementing | | | | | (8.271) | (10.147) |
| High school GPA* | | | | | −10.882 | −3.146 |
| flipping | | | | | (9.586) | (11.761) |
| Wald | 31.67*** | 24.79*** | 67.68*** | 21.15** | 24.22** | 26.86** |
| Observations | 178 | 178 | 147 | 147 | 126 | 126 |

Standard errors in parenthesis.
*Significant at 10%.
**Significant at 5%.
***Significant at 1%.

three measures of human capital are significant and positive. Students with higher SAT scores, high school GPAs and more college credits completed did significantly better on the final exam and common questions.

A Heckman selection model is also estimated to account for any bias resulting from students dropping the course (Table 3). A total of 6 (9%), 6 (10%), and 3 (6%) students from the traditional, complemented, and flipped courses, respectively, dropped the course after taking the first exam. Wald tests suggest that section bias exists, resulting in an overestimation of impacts of approximately one percentage point in almost all the models. Similar to the OLS estimations, these models suggest that students in the complemented and flipped classes performed significantly better on the final exam and common questions (from between 4 and 14 percentage points). Gender continues to be significant, but is positive: females did significantly better on the final and common questions according to the Heckman estimations. Minority students performed significantly worse on

**Table 5.** Student Evaluation of Usefulness of Course Components ($n = 51$)

| Variable | Mean | Std. | Min | Max |
|---|---|---|---|---|
| Online videos | 3.67 | 0.99 | 2 | 5 |
| Lectures | 3.49 | 1.10 | 1 | 5 |
| Homework assignments | 3.43 | 1.10 | 1 | 5 |
| In-class exercises | 3.34 | 1.21 | 1 | 5 |

Students were asked how useful each component was to their understanding of course material: 1 = not useful, 2 = somewhat useful, 3 = useful, 4 = very useful, and 5 = extremely useful.

the on the final, but not the common questions. Finally, all three measures of human capital are significant in models 5 and 6. Students with higher SAT scores and high school GPAs performed significantly better on the final exam and common questions, but the sign on college credit hours is negative in this model. Together these results suggest that the flipped classroom increased grades by approximately 8–13 percentage points with the complemented classroom increasing the grades by approximately 4–15 percentage points depending on the method of evaluation (i.e., the final exam or the group of common questions). The sample section model corrects for variances in impact identified for different student groups.

Impacts on these groups are investigated further with interactive terms (Table 4) to test if the treatments affected these groups differently. No such evidence is identified. This suggests that any gender, minority, or income effects on exams grades do not different significantly by teaching approach.

Evaluations administered in the last semester of the study (the complemented classroom) suggest that students perceived the benefits of the online videos to be significantly greater ($t$= 2.52) than the in-class exercises (Table 5). Students were asked to identify how useful the Khan Academy videos, mini lectures, homework assignments, and in-class exercises were to increasing understanding of course material using a Likert scale of one to five. Of the four options provided, the online videos were ranked the highest, the mini-lectures second and the in-class exercises ranked last. It is therefore most likely that much of the benefit of the flipped classroom (at least in the student's mind) is the ability to watch and re-watch videos on demand. In other words, the ability to have an online tutor who can keep pace with students, and is available when needed, can be incredibly useful.

## 4. Conclusion

The flipped classroom has been proposed as a teaching method that can enhance student learning by moving the "transmission of knowledge" from the classroom to an online environment, allowing more time for active learning approaches to take place during classroom hours (Wilson 2013). The motivation for this study was the noted difficultly students had with applying the economic theory taught in lectures to new and unique circumstances. It is not uncommon for instructors to note such difficulty when students are required to move up Bloom's taxonomy from comprehension to evaluation (Bloom 1984). This study suggests that the flipped classroom can assist, at least in part, with this process. Students scored between 4 and 14 percentage points higher than students in the traditional course on a set of common questions that had never been seen prior in the course.

Two different flipped course designs are evaluated in this study. The "complemented" approach combines traditional chalk-and-talk, "mini" lectures, and in-class exercises with video lectures assigned as homework. This alternative included more in class time for exercises than the traditional approach (the control), but less than a truly the flipped classroom and was adopted after student class preparation fell over the course of the (previous) semester. Mini lectures ensured students had the background necessary to complete the in-class exercises. However, analysis does not suggest that this lack of preparation hindered performance on exams.

Although the achievement gains identified in this study are similar to those found in the literature on active learning (Prince 2004; Durham, McKinnon, and Schulman 2007; Yamarik 2007) and the flipped class (Forsey, Low, and Glance 2013), there are several study design caveats that could lead to overestimation. First, although the study was designed to ensure the differences between the three experimental groups were only those studied (i.e., the use of online videos and increased use of active learning approaches), it is possible that unobserved differences to occur between the semesters of study could explain some or all of these estimated impacts. Furthermore, because the study uses a quasiexperimental design (and not a randomized control trial), it is also possible that unobserved student differences might partially explain these impacts. Finally, as the assessment was conducted by the author, there is the possibility that the instructor unconsciously impacted the results of the study by "teaching to the test."

Overall, these results suggest that the flipped class has positive impacts on student performance. Even so, some faculty may not find the costs of adoption to outweigh the benefits. For example, several instructors have found it difficult to adopt this different teaching paradigm that establishes the instructor as coach rather than the source of information. Still others have experimented with the method but have dropped it after being uncomfortable in the more informal classroom setting (Berrett 2012). Conversely, because most economics courses are analytical and problem intensive, it is likely that many instructors will find the adoption costs to be relatively low. These findings suggest that both the full adoption of the inverted class and the incremental adoption of these methods (by adding online video lectures to the course) can both lead to significant quantitative improvements in exam performance.

## Acknowledgments

This study was supported by a Franklin P. Perdue School of Business Summer Research Grant. I thank the Associate Provost, Melanie Perreault for her support and Kara Siegert in the Office of University Analysis, Reporting, and Assessment for her assistance with collecting the student data used in the analysis. Thanks also to John Whitehead for his request to serve on a panel on this topic. It was the preparation for this panel that elucidated the impact on student performance.

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