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Effects of flipping the principles of microeconomics class: Does scheduling matter?

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ABSTRACT

Flipping the principles of microeconomics classroom significantly improves student-learning outcomes compared to traditionally taught lectures; however, it remains unclear as to if the effect differs depending upon the spacing and scheduling of class meetings. This paper investigates if the quantitative effects of flipping on student outcomes differ by scheduling. It further evaluates if student perceptions about flipping vary depending on the spacing of class meetings. This paper shows that students in flipped classes scored significantly higher on final exams compared to those in a traditional setting, and the effect of flipping did not vary with class spacing. Students in the flipped class setting reported significantly more active learning and were significantly more likely to recommend the professor to other students than those in a traditional setting; however, those in the flipped class that met twice a week for 80 min reported significantly less active learning and were significantly less likely to recommend the professor than those in the traditional setting. The results documented in this study suggest that while the effects of flipping on student learning do not vary with class spacing, student satisfaction does differ with spacing. Therefore, when considering the scheduling of a flipped course, instructors need not worry about the impact of flipping on learning outcomes, but they should consider the importance of student satisfaction.

1. Introduction

As colleges and universities face mounting pressure to improve student learning and increase retention rates, instructors and professors find themselves constantly implementing new teaching techniques in an effort to increase active learning, engage students, and improve their retention of material. One of the more popular techniques being adopted is inverting or flipping the classroom. Flipping the classroom entails reversing the order in which activities of a course take place. That is, traditionally, students are first exposed to course material during class, often in a lecture format, and they work on problems and applications outside of the classroom. In a flipped classroom setting, students first receive the lecture material outside of the classroom, typically either through readings or videos, while during class time, they engage in active and hands-on learning (Bergman and Sams, 2012; Hughes, 2012).

As flipping has gained popularity, research has attempted to quantify the benefits of flipping. A scoping review of early studies on flipping from a variety of disciplines found generally positive effects of flipping on student and faculty satisfaction and weak or indirect evidence of the effect on student learning outcomes. Furthermore, the effectiveness of flipping may depend on the methods used, pedagogy involved in the design of the flip, and details of the flip itself (O'Flaherty and Phillips, 2015). Until recently, most research documented gains in student learning outcomes in STEM disciplines (see, for example, Larson and Yamamoto, 2013; Moravec et al., 2010; Pierce and Fox, 2012). These studies did not include control variables and implemented simple difference in

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means *t*-testing, leaving them unable to assign causality to flipping.

Researchers in economics have attempted to expand upon these to document how flipping affects student outcomes in principles classes. Calimeris and Sauer (2015) implement a treatment-control experiment and document that after a negative adjustment period, students in a fully flipped classroom score roughly 0.5–0.6 standard deviations, or two-thirds to an entire letter grade, higher on midterm and final exams. Similarly, Balaban et al. (2016) find that students in a flipped principles of microeconomics classroom in a large class in a university setting scored 0.2–0.7 standard deviations higher on a final exam than those in a traditionally taught class. They also find evidence of increased student effort during the semester, which may be a mechanism through which flipping is effective. This finding corresponds with Green's (2014) finding that the effectiveness of active learning through an extensive, semester-long simulation is dependent upon students' participation and effort.¹ Caviglia-Harris (2016) documents that students in partially- or fully-flipped courses scored significantly higher on a final exam than did those in a traditional course. Olitsky and Cosgrove (2016) use a differences-in-differences approach and find that students in a flipped-blended learning environment learned significantly more over the course of a semester than those in a traditional course.

Therefore, recent literature has established that over the course of a semester, flipping the principles of microeconomics classroom significantly improves end-of-term student learning outcomes. Questions remain however, as to if the effectiveness of flipping differs depending on class spacing, or the frequency and duration of class meetings, as well as class size. Typically, colleges and universities offer students in introductory microeconomics courses the option to take classes that meet either three times per week for roughly 50–55 min or classes that meet twice a week for 75–80 min. Both options have their costs and benefits with respect to flipping. Meeting less frequently for longer periods may enable students to fully complete activities in class, though they have more to accomplish in each class meeting and between classes. Meanwhile, when meeting more frequently for shorter periods, activities may not wrap up in one class period, breaking up the flow of the activity; however, students have less material to review between classes, and revisiting material from unfinished activities may reinforce concepts and the activities in students' minds.

The "spacing effect" is defined in the cognitive psychological literature as "the finding that for a given amount of study time, spaced presentations yield substantially better learning than do massed presentations" (Dempster, 1988). That is, learning is improved when material is presented in shorter, more frequent sessions versus longer, more infrequent sessions. The spacing effect, therefore, would suggest flipping to be more effective in the Monday/Wednesday/Friday classes compared to the Tuesday/Thursday classes.

Interestingly, the educational research on class spacing yields no clear consensus. A number of studies generally find that students in compressed courses or courses meeting only once per week generally do not score worse than those in traditional courses (see, for example, Daniel, 2000; Scott and Conrad, 1991). Meanwhile, other studies confirm the spacing effect in education. In particular, in a financial management course, students who enrolled in classes meeting 3 times per week for 50 min had higher pass rates than those enrolled in a class that met once per week (Henebry, 1997). Similar effects were found in college algebra, with students enrolling in one-day-per-week classes scoring significantly lower than those meeting two or three days per week (Gallo and Odu, 2009). More recently, Miyamoto and Coleman (2015) find that students who increase session counts in MOOCs, holding constant total time, are significantly more likely to complete their certification. Carrington and Houston (2010) find that in intermediate accounting courses, there were no significant differences in grades across four different schedules (one, two, and three days-per-week, or an intensive condensed summer course); however, students those who met three days-per-week received significantly more failing grades or dropped out compared to those in the other schedules. The authors surmise that meeting for too short of a period does not enable students to absorb the information or instructors to effectively communicate the material. To this study's knowledge, the effect of flipping with respect to spacing has yet to be investigated.

Additionally, questions remain as to how the effects of flipping may differ with respect to class size. Research has illustrated that increases in class sizes are associated with decreases in student outcomes in college-level economics courses (Arias and Walker, 2004; Diette and Raghav, 2015) and business courses (Monks and Schmidt, 2011). However, there may be such a thing as too small of a class in the flipped classroom setting. That is, since the flipped classroom involves active learning, often in pairs or groups, classes that are too small may not allow for enough groups, for different sized groups, for big enough groups, or for switching groups.

In addition to determining if flipping affects student learning outcomes, researchers have also investigated student attitudes towards the flipped classroom and have generally found students to respond favorably to the flipped classroom format (Calimeris and Sauer, 2015; Lage et al., 2000; Roach, 2014). Student attitudes towards class are important as they may encourage or discourage students from applying themselves, impacting student learning. Furthermore, untenured professors and instructors have an incentive to satisfy students' needs, wants, and desires as course evaluations often factor into tenure or contract renewal decisions. Therefore, in addition to determining if the effects of flipping differ by course schedule, it is also informative to determine if perceptions of and satisfaction with flipping, as measured by course evaluations, differ by schedule.

This study fills a gap in the literature by investigating the effects of flipping by course spacing. First, this paper establishes an effect of flipping on student test scores similar to that in the previously published literature using five semesters of data for seven classes. Next, this paper discerns if there are differences in the effect of flipping on student outcomes by class meeting duration and frequency, as well as class size. Subsequently, this paper determines how flipping and spacing may impact an instructor's course evaluations.

¹ Green also presents evidence in support of a traditional lecture class as he documents that students in hybrid/online classes or in experimental classes which incorporated an "extensive class simulation" scored significantly lower than those in a traditional lecture/discussion course in principles of macroeconomics; however, Green does not investigate the effectiveness of flipping itself, but rather he examines the effectiveness of different components of a flipped class, not a flip as a whole.

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