



Does classroom time matter?



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ARTICLE INFO

Article history:

Received 19 November 2014

Revised 16 February 2015

Accepted 23 February 2015

Available online 9 March 2015

JEL classification:

I20

I23

Keywords:

Classroom time

Microeconomics

Randomization

Student performance

ABSTRACT

Little experimental evidence exists on the causal impact of class time on academic performance when students have access to extensive course material online. We randomized 725 college students into traditional twice-per-week and compressed once-per-week lecture formats in introductory microeconomics. Students in the traditional format scored 3.2 out of 100 points higher (0.21 standard deviations) on the midterm than those in the compressed format but a statistically insignificant 1.6 points higher (0.11 standard deviations) on the final. There were no differences in non-cognitive outcomes. Students in the middle tercile of predicted test scores performed worst in the compressed format relative to those in the traditional format but there was little difference in test scores by format in the top tercile of predicted performance. While the compressed format offers clear savings in classroom space and professors' time, these savings come at some cost to student performance.

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James A. Garfield, twentieth president of the United States and a graduate of Williams College, is reputed once to have said of renowned Williams educator Mark Hopkins: "the ideal college is Mark Hopkins on one end of a log and a student on the other" (Rudolf, 1956, p. vii). Garfield's epigram embodies the notion that the best learning takes place in a dialogue between student and professor, in which students take an active role in the learning process and professors can easily gauge a student's comprehension through verbal and non-verbal cues. This ideal remains at the core of American higher education despite the enormous changes in instructional tech-

nology that have occurred since the mid-19th century when Garfield was educated. In the mid 1950s, television was the first technology to capture the imagination of university administrators keen to reach a larger student population and, most importantly, hold the costs of instruction down (Eurich, 1958; Macmitchell, 1955). More recently, the Internet and various modes of online instruction have captured the imaginations of university administrators anxious to cut costs. Online learning in some form will surely be an increasingly important component of university education, even potentially improving on the kind of instruction Mark Hopkins might have offered to his students (Bowen, 2013).

To what extent does the opportunity to interact with a professor and other students matter in an environment rich in online materials? Recently, Figlio, Rush, and Yin (2013) compared students who took introductory economics online versus in a traditional lecture format at a major research university. Bowen et al. (2014) examined the performance of students in an introductory statistics class held on six

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public university campuses, contrasting the performance of students attending a traditional class with two weekly meetings with those whose class material was delivered online supplemented by one weekly class meeting. Both studies reported no overall difference in performance as measured by test grades between formats.¹ Participation rates in both studies were less than 25%, however, highlighting one difficulty of undertaking a classroom-based, semester-long randomized trial in a university setting.²

To gauge better the importance of classroom time in a typical “online rich” learning environment, we randomly assigned 725 students into “compressed” and traditional formats of introductory microeconomics at a large, urban, public university. We examine whether students who were offered class once a week for 75 minutes over a 14-week semester performed as well as students who were offered class twice per week, each for 75 minutes. Two experienced professors (the first two authors) taught four sections, one of each format. Students in the two formats had access to the same lecture slides, online material, and faculty-produced videos, which eliminated substitution bias as a source of attenuation since classroom time was the only difference between formats. Because research on student learning suggests that frequent assessments with immediate feedback improve performance (Pennebaker, Gosling, & Ferrell, 2013), we required students in both formats to take the online quizzes both before and after lectures using a sophisticated interactive web application (Aplia) to deliver and grade them.

We find that students in the traditional format performed 3.2 percentage points (p -value of 0.005) better on the midterm on a 100-point scale but a statistically insignificant 1.6 percentage points (p -value of 0.138) better on the final – differences of 0.21 and 0.11 standard deviations, respectively. Students in the lower tercile of predicted test scores performed worst in the compressed format on the midterm relative to those in the traditional format but students in the middle tercile performed worse in the compressed format overall. There was little difference by format in test scores in the top tercile of predicted performance. Students in both formats attended the same proportion of classes, and there were no differences in withdrawal rates. We also find no difference in hours logged into Aplia. Students in the compressed format watched 2.5 more videos than those in the traditional format relative to an overall mean of 8.5, while students whose professor was in the videos watched the videos

8.6 more videos than those whose professor was not in the videos.

Our results have meaningful pedagogical and administrative implications for undergraduate education. The fundamental difference in treatment between the traditional and compressed formats is the amount of time spent in the classroom, with students in the compressed sections having only half the amount of formal class time as those in the traditional sections. Differences in test scores by format were twice as large for the midterm relative to the final, suggesting that students in the compressed format adjusted to the demands of less class time. Nevertheless, reduced class time appears to diminish cognitive performance for most students in a large introductory economics class at a public university in which the vast majority of students commute.

1. The experiment

1.1. Setting

The study took place at Baruch College, part of the City University of New York and one of the most diverse campuses in the country. As of the 2013–2014 academic year, the Baruch student body claimed 163 nationalities and spoke 110 languages.³ Baruch’s Zicklin School of Business is the largest accredited collegiate school of business in the country with 12,000 undergraduates. Almost all students commute to campus and most attend full-time.

Principles of Microeconomics (ECO 1001) is a required course for all students applying to the business program at Zicklin. It also fulfills a social science requirement for non-business majors. Nearly 1000 students take ECO 1001 each fall. Four sections with seats for a total of 776 students were part of our study, which accounted for 95% of the daytime non-honors seats available for the course.⁴ Students could register for class on Mondays and Wednesdays in the morning or Tuesdays and Thursdays in the late afternoon. Classes were listed as taught by the first two authors of the study. Both are full-time, tenured faculty members who have taught the class for the past six years and both have strong teaching evaluations.⁵ Registration for the fall classes began in April of 2013 and continued through August. Students currently enrolled in Baruch could register in April and May while transfer students from community colleges or other four-year colleges could not begin registration until June.

¹ Figlio, Rush, and Yin (2013) did, however, find that Hispanic students and those with a grade point average below the median did less well in the online class.

² In addition to low participation rates, both studies encountered other difficulties. For example, Figlio, Rush, and Yin (2013) present results showing no mean differences in test scores between formats unadjusted for covariates but statistically significant differences of between 2 and 3 percentage points on a 100-point scale when adjusted. Students in the “live” format scored 3 percentage points higher on the final exam (p -value < 0.05) and 2.5 percentage points higher (p -value < 0.01) on the average of all three exams than students restricted to the video-taped lectures. See Table 3 in Figlio, Rush, and Yin (2013). The statistics experiment conducted by Bowen et al. (2014) encountered difficulty coordinating test and grading across campuses and faculty – not all campuses used a common set of questions on the final and faculty, aware they were part of an experiment, may have graded more leniently in order to reduce failure rates.

³ Statistics about Baruch’s student population are available from the authors upon request.

⁴ Twenty-one seats went unfilled in the sections of the course in this study. Just over 100 students took ECO 1001 in the evening, most of whom were part-time students. Of the remaining students who were not part of our study, one section of 25 students was reserved for honors students only, and another daytime section of 40 students was taught by an adjunct faculty member.

⁵ In student course evaluations for the fall semesters of 2010–2012, both professors averaged 4.4 on the 6 questions that assessed the quality of the course organization and delivery. Copies of the full teaching evaluations for each professor are in the Appendix. In addition, each professor has a rating of 4.3 based on a 1–5 scale of teaching ECO 1001. See <http://www.ratemyprofessors.com> (last accessed November 3, 2014).

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