Exploring student study habits in a large, online, macroeconomics module in order to design effective interventions

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Overview:

The relationship between time and learning has long been an issue in pedagogy. However, there remains a lack of knowledge about how long students spend learning and what they do with their time; yet, understanding this is crucial if we are to design modules well and if we are to design effective interventions for those students that need them. This raises important questions, such as: what are the differences in the relationship between time and learning across the grade distribution and between students on different degree programmes? This paper aims to address these questions using data from a large-cohort introductory macroeconomics class. We use summary statistics and econometric analysis to analyse students' interaction with pre-recorded lectures, live whole-class feedback sessions, seminar attendance, and time spent reviewing videos. The analysis shows that there are diminishing returns to time spent watching videos and that interventions need to be carefully designed because students use resources in a heterogenous manner.

Motivation:

The availability of online learning tools has been growing in recent years, but the Covid-19 pandemic accelerated the shift to hybrid and fully online learning from spring 2020. The crucial role of time in the learning process can at least be traced back to Carroll (1963) and the subsequent work of Bloom (1974,1984). Bloom (1984) sought solutions to the 2-sigma problem and highlighted the ultimate goal of providing group tutoring as effective as one-to-one tutoring. Technology has opened new opportunities as highlighted by Khan (2011, 2015). Many papers provide empirical evidence to show the benefits of using instructional videos (see, for example, Exposito et al. 2020). However, recent studies also highlight our lack of deep understanding of the relationship between time and learning when interacting with online content and limited evidence of the efficacy of a flipped or online module design (see, for example, Meehan and McCallig, 2018; Roach, 2014; Weinert et al., 2020). In this paper, we analyse how students learn using mainly online tools in a large, introductory macroeconomics class. The module has been fully integrated into TopHat, the all-in-one online education platform. The vast majority of lecture content was delivered via pre-recorded videos and active learning was encouraged as each video was followed by at least one question to check understanding. During the semester students watched around 200 days of video content and submitted over 100,000 answers to formative questions asked during weekly learning modules and summative tests. The data from the module provides

unique information that would not normally be available when students learn in a traditional lecture and then at home, offline in their own time.

Data and Methodology:

TopHat provides real-time data on students' progress, and we used this to provide students' knowledge of their own real-time progress relative to their peers by sending bi-weekly progress reports. We can also use the real-time data to effectively identify those students that have not engaged with weekly content over successive weeks. We contacted disengaged students to inform them of their lack of progress. If there was no reaction from students after successive emails, then we also contacted their academic personal tutors. Overall, we have data on student engagement with video content, their attendance at seminars, the communication they received about their relative progress, and whether they were identified as disengaged. We use this data to compare summary statistics across the grade distribution and across degree programmes. We also use econometric analysis to help identify patterns of behaviour and patterns of engagement with module resources.

Results:

Our results show that there is a close correlation between final grades and the following factors: previous academic achievement, engagement with recorded videos, attendance at whole class online hours, and seminar attendance. However, there is not a simple linear relationship between final grades and engagement with recorded videos; there are diminishing returns to engagement with online content. We also find that regular and timely engagement with learning material is strongly correlated with final exam performance. We show that real-time module data showing student progress and engagement with online content is highly effective at identifying engaged and disengaged students even very early in the semester. This type of information opens up the possibility of designing more effective interventions and providing more effective student support in future.

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