

## Abstract

Online education has expanded dramatically over the past two decades, yet significant learning challenges remain. This paper provides the first microeconomic analysis to examine how course design can enhance the quality of online university courses, addressing the twin needs of providing individualized support to students and keeping them engaged with online coursework. First I gather rich data covering over 3,500 undergraduates in an online introductory programming course at a large public university. The data allow me to monitor students' study time precisely and to characterize important dimensions of heterogeneity: their attentiveness and whether they are forward-looking. I then conduct two randomized informational interventions, which turn out to be successful in nudging inattentive students to utilize an online discussion board more fully and complete online assignments. I find that an additional 4.5 weeks of discussion board utilization and completing one extra online assignment (out of 10 in total) increase final exam grades by 0.07 SD and 0.18 SD, respectively. I then develop and estimate a behavioural model of student effort supply using the two field experiments to credibly identify the marginal benefits and costs of effort at each stage of the cumulative learning process. In contrast to the actual course grading scheme (with equal assignment weights), the simulated weights that maximize learning are decreasing across assignments, serving to increase effort by myopic students early in the course when they acquire foundational skills. The framework can accommodate other course structures, shedding light on how instructors can encourage effective effort allocation by heterogeneous students, both in other online and traditional course settings.