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Student-crafted experiments “from the ground up”

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A B S T R A C T

If experiential learning activities support engagement and deeper student learning, student-owned experiments constructed “from the ground up” might have benefits that exceed pre-designed classroom experiences. This paper provides a framework for embedding a custom experiment project within an existing course. Students manage every aspect of the process, from experimental design to analysis. Two example implementations are described. Undergraduate behavioral economics students created original experiments, exploring anchoring and adjustment in the context of pyramid scheme pitches (in spring 2013) and reciprocity in attraction (in fall 2014). Perceived benefits and potential pitfalls are explored. While this paper does not represent a controlled study of student learning or engagement, both student reflection and instructor observation support the continued use of this pedagogical approach.

1. Introduction

Experiential learning encompasses a spectrum of teaching techniques, all seeking to convert the passive listener into the active and engaged participant (Hawtrey, 2007). One such technique, the pre-designed classroom experiment, has been found to improve student engagement, attitudes toward economics, knowledge retention and, in some cases, short-term test performance (e.g., Durham et al., 2007). From the instructor perspective, classroom experiments can make teaching more interactive and bring the worlds of research and teaching closer together (Kaplan and Balkenborg, 2010). Such experiences are often short (i.e., one class period or less) classic experiments, but can also take the form of longer-term, student-directed, original projects.

The purpose of a short, pre-designed experiment – one where roles, rules, incentives and calculation sheets are fixed and provided at the outset – is typically to teach or enhance student understanding of a particular economic concept. Given the wide availability of examples and classroom materials, this is a relatively low cost pedagogical approach, often understood to be “at least as good as” traditional lectures (Cartwright and Stepanova, 2012). While past research has identified benefits of such experiments for students and instructors, it has also revealed limitations. Cartwright and Stepanova found that learning is not significantly improved by pre-designed experiment participation unless the experience is followed by assessment, typically in the form of reflection and data analysis. Experiment type also affects outcomes, with greater benefits found when experiments are more involved, taking a significant amount of class time and requiring multiple decisions (Durham et al., 2007). Students who participate in pre-designed classroom experiments remain passive in many ways, given that they cannot design or change the rules and may not make personal connections between the overall curriculum and the experiment (Egbert and Mertins, 2010). Such experiments typically ask students to operate individually, rather than emphasizing team-oriented skills useful in future academic and professional experiences.

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Table 1
Sample schedule of experiment activities (time out of 180 contact min/week).

Week	Activity
1	20 min: discuss experiment learning objectives, team responsibilities, and initial student interests (based on pre-class student interest inventory, sent via email)
2	20 min: discuss primary interest areas and possible corresponding research questions
3	60 min: vote on final interest area, identify 3–4 possible research questions in this area with corresponding behavioral theory and description of possible experimental approach
	Outside of class: (1) use shared document to make list of lessons from course readings on experimental economics and (2) use rank vote to identify preferred experimental idea and team assignments
4	20 min: announce winning idea (research question and connected behavioral theory with draft design) and team assignments, with short initial team meetings
5	60 min: discuss supplemental experimental/theoretical readings (chosen due to relevance to experimental idea) and implications for experiment design
6	30 min: finalize experimental design in shared document and answer team questions
7	Outside of class: IRB Team posts draft consent forms and IRB proposal for peer/instructor comment, other teams post ideas/documents as applicable
8	No activities—midterm exam
9	5–20 min: team updates as needed
10	5–20 min: team updates as needed
11	20 min: Debrief Team presents to class
	Outside of class: test experiment with small group of recruited subjects
12	5–20 min: team updates as needed
13	Outside of class: experiment conducted outside of class (evening), resulting data posted to class site, analysis team evaluates data and prepares presentation
14	45 min: discussion of results and reflection on findings, lessons, improvements
15	Outside of class: self/peer assessment of team contributions and anonymous learning objectives reflection or essay
16	No activities—final exam

In contrast, custom experimental projects seek to enhance engagement by giving students control over experimental design, implementation, and analysis. Such projects emphasize teamwork and critical thinking as students must work together through the full process, from identification of the research question to analysis of experiment results. While this pedagogical approach aims to strengthen the students' understanding of experiments as a methodology in economics, it can simultaneously seek to enhance understanding of the economic concept(s) at the heart of the experiment (Egbert and Mertins, 2010). This paper will not provide quantitative evidence of enhanced conceptual learning,[1] but will argue that both methodology and theory are best studied together, challenging students to understand the "what we know" and "how we know it" in tandem. If a course incorporates pre-designed experiments and a custom experiment project, students have the experience of being both subjects and creators. This provides exposure to multiple perspectives, enriching both learning experiences.

While custom experimentation is less conducive to ready-to-print handouts and resources, this paper provides a framework for a term-long experiential project, set within an undergraduate behavioral economics course. Rather than creating a variation of an existing experiment (as in Egbert and Mertins, 2010), students design a custom economic experiment "from the ground up." Two examples of such projects are described, as are perceived benefits and potential pitfalls. The pedagogical approach outlined within builds on existing literature by emphasizing the aspects of experiments that seem most important: significant involvement (i.e., complexity of engagement), connected assessment, student-directed learning, and perceived relevance.

2. Learning objectives and course structure

In terms of specific learning objectives, students who participate in the "ground up" experiment will: (1) demonstrate knowledge of a behavioral economic theory, connect that theory to an authentic problem, and design a research question intended to test that theory, (2) apply knowledge of experimental economics by designing and implementing an experiment that investigates the defined research question, (3) connect theory to practice by comparing subject behavior to theoretical expectations, (4) articulate the knowledge gained and clearly identify limitations, identifying experimental improvements, and (5) demonstrate commitment to this shared, student-owned learning experience.

The learning objectives for the embedded experiment fit within the larger learning objectives of the course. The example implementations described in this paper are set within an undergraduate behavioral economics course at a small, private liberal arts university. This is an elective course, suitable for both economics minors and majors. Prerequisites include principles of microeconomics and macroeconomics, statistics, and calculus or business analytics. The average class size has

[1] Formal pre/post capture of conceptual knowledge is suggested for future iterations.