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Economics Works! Experiments in High School Classrooms

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Economics Works! Experiments in High School Classrooms

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Abstract

Economic experiments are a unique form of active learning. Students apply the scientific method by testing hypotheses and discovering for themselves how markets work. The authors conducted teacher training courses in experimental economics over a three-year period and conducted surveys to track teachers' adoption of classroom experiments. This paper discusses the survey results and describes how the training was revised accordingly. The primary conclusion of this article is that classroom experiments must be compatible with the school environment; that is, they should emphasize non-monetary incentives and hand-run experiments as well as be explicitly tied to school curricula.

I. Introduction

By the time that Vernon Smith, who pioneered the use of experiments in economics, was awarded the Nobel Memorial Prize in Economics in 2002, experiments had become a familiar part of instruction in college economics courses. A substantial literature describes the use of economic experiments for instructional purposes in college classrooms. (Holt, 2007) provides a good reference, and numerous articles describing experiments in college classrooms have been published recently, including experiments in price discrimination (Michael et al., 2005), public goods theory (Pickhardt, 2005), money demand and risk (Ewing, Kruse and Thompson, 2004) and rationing "free" goods (Alden, 2006).

Experiments are a form of active learning that economic educators have been advocating for decades (Becker, 2000; Becker and Watts, 1995; and Brock and Lopus, 2006). Students in college microeconomics course sections with an experimental emphasis have experienced added gains in achievement on the *Test of Understanding College Economics* (Emerson and Taylor, 2004; and Dickie, 2006), and have outscored students in control classes on final exams (Ball, Eckel, and Rojas, 2006).

II. Economics Works!

Experiments are a unique form of active learning. Students apply the scientific method by testing hypotheses and discovering for themselves how markets work and how people respond to incentives. This was brought home to one of the authors after running Smith's classic double auction experiment with a high school Advanced Placement Economics class. After opening an envelope containing the predicted market equilibrium price and showing the class that the prediction exactly matched the actual price of the last trade in the experiment, one student exclaimed (in apparent surprise), "Economics works!" Experiments are an effective pedagogical antidote to the view, expressed by John Kenneth Galbraith, that economics may be seen, not as science, but as a mere "system of belief" (Galbraith, 1970), and that economists are, as characterized by Karl Marx, "the scientific representatives of the bourgeois class" (Marx, 1976).

III. Professional Development Course on Teaching with Experimental Economics

In light of the evidence regarding the potential for experimental teaching techniques to improve economics instruction, the Center for Economic Education at the University of Alaska, Anchorage (UAA) developed a professional development course on "Teaching with Experimental Economics," funded by private sector sources. This was presented as a week-long college credit course to a total of 42 teachers during the summers of 2004 and 2005. Since most experimental research is conducted using computers and cash incentive payments, (Friedman and Sunder, 1994) course instructors utilized these same protocols.

During each day of the course, teachers served as subjects in experiments conducted by the instructors under controlled

conditions with monetary incentives. The cash incentives were not trivial – at the end of the week, a teacher could have ‘earned’ as much as \$100, contingent on his or her experimental performance. The experiments included auctions as well as public goods, asset market, and game theory investigations.

Following each experiment, teachers were led through a discussion of their experience. They also worked on a group economics assignment based on the economic concepts demonstrated by the experiment. The final day of the course ended with a discussion of classroom implementation, including appropriate teaching strategies, incorporation into the curriculum, and experimental materials. Experiments were linked to the matching National Council on Economic Education’s (NCEE) *Voluntary National Content Standards in Economics* (2000).

IV. Experience of the 2004 and 2005 Cohorts

Immediately following the 2004 and 2005 courses, participating teachers expressed great enthusiasm for teaching with experiments. In response to a question on the course evaluation survey asking “What was your impression of the experimental approach to teaching economics?” most teachers answered with statements like “Great! Super! The Best,” and “I think it’s way cool, mostly because, as a teaching tool, students are more willing to learn when actively engaged.”

Teachers said that what they liked best about the use of classroom experiments was the fact that they actively engaged students, and that they utilized a technology that students enjoy (computers). Some teachers did, however, express reservations. Several said that they did not have the necessary access to computers, one feared that she could not afford to provide funds for incentive payments, and another thought that the systematic use of experiments would take “more time than a public high school teacher has to design, construct, and administer.”

V. Spring 2006 Survey

To obtain feedback regarding the adoption of experiments in the classroom, the same teachers were mailed a survey in Spring 2006. All 42 completed and returned it. Only 13 (31%) had conducted one or more experiments. Of the 73 experimental sessions reported, just three teachers accounted for 53 of them; two of these teachers were

at the same school. Forty-one of the 73 experiments were some version of a demand and supply/double oral auction experiment.

Table 1: Barriers to Adoption 2006
Rank-Ordered by Importance of Barrier (n=34)

		Major Barrier	Minor Barrier	Not A Barrier
1.	No money for incentive payments.	13	14	6
2.	Not aware of experiments that match exactly the needs of my course(s).	12	13	9
3.	No access to projector.	11	7	16
4.	No access to computer lab.	9	7	17
5.	No access to suitable computer.	8	14	10
6.	Experiments are too complicated.	7	18	7
7.	I don't feel technically able.	4	11	18
8.	Insufficient room in the curriculum to add experiments.	4	19	11
9.	Class periods are too short.	1	9	23
10.	I can teach economic concepts better using other teaching techniques.	1	6	22

That 13 participants had adopted experiments was encouraging. But for the group as a whole, we had underestimated the barriers to the adoption of experiments. A follow-up survey asked teachers (34 responded) to rank ten potential barriers to using experiments as: "major barrier," "minor barrier," or "not a barrier." Table 1 presents the results (rank ordered according to "major barrier"). (Because

some teachers had been assigned classes in business or non-economics social sciences, some questions were not applicable to all teachers, and those questions had fewer than 34 responses).

The largest barrier to adoption reported by teachers was “No money for incentive payments.” Our reliance on monetary incentives during the courses, rather than alternatives such as extra credit points or candy, may have affected teachers’ views on this issue. Identifying experiments that fit teachers’ curricula was the second biggest barrier, followed by technology issues, including access to projectors to display experimental results and access to computers.

VI. 2007 Revised Course

In an attempt to overcome these barriers to adoption, we offered a subsequent summer course in 2007, which enrolled many of the teachers that had participated in prior courses. This time instructors relied more, but not exclusively, on non-cash incentive payments, including grade points, candy, and special “currency” redeemable for classroom privileges. Instructors also required teachers to develop and present their own classroom experiments using fellow teachers as subjects, which included identifying the specific Anchorage School District curriculum standards in economics that their experiments addressed. They also utilized fewer computerized and more “hand run” experiments in their instruction. The experiments were variations of the classic classroom experiments: the “double oral auction” (also called a “pit market”); the “ultimatum game” and the “dictator game” (testing for altruism); a “common resource game” (demonstrating the tragedy of the commons problem); and a “public goods game” (demonstrating the free rider problem when soliciting contributions to provision of a public good). Following the 2007 course, teachers received the same survey as in 2006.

As shown in Table 2, “No money for incentive payments” was still the largest barrier to adoption, but a smaller proportion of teachers now considered it a “major barrier.” The most dramatic change was that “Not aware of experiments that match exactly the needs of my course” fell from second to fifth place, and not a single teacher considered this a major barrier. Apparently, having teachers conduct their own experiments tied to their school district’s guidelines had a positive effect. More than half of the teachers (55 percent) now considered this “not a barrier,” as opposed to 26 percent in 2006.

In a follow-up discussion regarding the use of cash payouts, the teachers stated that if they received grant funding for such purposes, or even if they were willing to use their own funds, they could “get away with” using cash only on a limited number of occasions during the school year. Even then, the use of monetary incentives would require “high-level administrative approval.”

Table 2: Barriers to Adoption 2007
Rank-Ordered by Importance of Barrier (n=20)

		Major Barrier	Minor Barrier	Not A Barrier
1.	No money for incentive payments.	4	12	4
2.	No access to computer lab.	4	7	9
3.	Insufficient room in the curriculum to add experiments.	2	7	11
4.	Class periods are too short.	0	9	11
5.	Not aware of experiments that match exactly the needs of my course (s).	0	9	11
6.	No access to suitable computer.	5	3	12
7.	I don't feel technically able.	1	7	12
8.	Experiments are too complicated.	2	5	13
9.	I can teach economic concepts better using other teaching techniques.	0	6	14
10.	No access to Proxima projector.	1	3	16

The final discussion covered sources of hand-run experiment materials. For the double oral auction, the recommended source was

the Charles Holt text, *Markets, Games, and Strategic Behavior* (2007), and for the ultimatum game, the Foundation for Teaching Economics website (www.fte.org/capitalism/activities/ultimatum/index.html). Experiments dealing with the tragedy of the commons and public goods may be found at the website:

http://www.econport.org/econport/request?page=man_pg_classroom_mexperiments

VII. Conclusion

Economic experiments put students directly into real economic situations where they make choices based on specific incentives. These experiments provide a powerful connection between economic theory and direct experience. Teachers are enthusiastic about using experiments in the classroom, but they must be prepared with training that is compatible with the school environment and learning objectives. Specifically, teacher training in experimental economics should (1) stress the creative use of non-monetary incentives; (2) emphasize hand-run, rather than computerized, experiments; and (3) utilize experiments that are tied directly and explicitly to school curricula.

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