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Contact details

Arlene Garces-Ozanne
Department of Economics
University of Otago
PO Box 56
Dunedin, New Zealand

Tel: 64 3 479 9079

Email: arlene.ozanne@otago.ac.nz

Phyll Esplin
Department of Economics
University of Otago
PO Box 56
Dunedin, New Zealand

Email: phyll.esplin@otago.ac.nz

Using Economic Classroom Experiments¹



Todd R. Kaplan and Dieter Balkenborg

Economic classroom experiments are an excellent way to increase student interest, but getting started may be difficult. We attempt to aid the newcomer by recommending which experiments to use and describing the current resources available.

Introduction

If you are reading this review in this special issue of the IREE, then you are probably interested in running economic experiments in your class but have little experience doing so. You may have heard about research on class experiments from colleagues, read a research article or two (or a pop-economics book), or even seen a demonstration. Still, it can be confusing knowing how to get started and the number of different resources available can be bewildering. We hope that this article will guide you through the possibilities, show you that the start-up costs are not too high, and convince you of the potential benefits.

In our experience, economic classroom experiments are a great way to introduce students to economic key concepts. They are fun for the students and for the teacher. While some charismatic teachers deliver lectures that appear near perfect, we believe that for most courses and lecturers, student interest in the material and student evaluations will improve with this technique.

Economics research has validated experimental methods and our teaching should reflect this development. The gradual acceptance of experimental methods culminated in 2002, when the Nobel Prize was awarded to Vernon Smith, who pioneered this revolution, and Daniel Kahneman. As evidenced by an article in this issue, Vernon Smith lets his teaching follow his research. Many of the researchers in the field also have followed suit. With the rise of the web, the cost of getting started has dropped significantly and the use of experiments has been adopted by many outside the field. With this in mind, using the words of Charles Holt (1999),

classroom experiments have become 'the most exciting new development in teaching economics'.

Why use economic classroom experiments?

Experiments are a fun way not only to learn, but also to teach. They can inspire students to learn more about a topic and provide an easy way to engage students in discussions. The teacher can use this experience in classroom discussions and guide the students towards understanding new theoretical concepts, which can then be used to analyse the data and other economic phenomena. For instance, students who have experienced cut-throat competition in an experiment based on the Bertrand model understand very well how zero profits arise in equilibrium.

This active learning experience will last well beyond the course – in quite a different way from just seeing the theoretical analysis of the model with the vague claim that it is applicable to many economic situations. Seeing theory work in action helps students believe in economics. This understanding is further enhanced since experiments are a great way to get students closer to current research.

Another advantage of experiments is that they work well for all levels of students (even those in sixth form/ high school). Experiments can introduce a topic in a comprehensible way to students from many different backgrounds and skills, in particular to those with low mathematical skills.

In addition to anecdotal evidence, several scientific studies document the benefits of using classroom experiments. The basic methodology of these studies is to keep the lecturer and module fixed, while randomly assigning students to two groups, one with experiments and one (a control) without experiments. Afterwards, the researcher compares the performance of the two groups.

Emerson and Taylor (2004) found that experiments boosted microeconomics students' scores on a standardised test for understanding college economics, TUCE.² They found that experiments increased the scores of both females and males but helped females close the gender gap. They also found that experiments benefited the weaker students (those with lower grades overall). Dickie (2006) also found an overall improvement in TUCE scores by using classroom experiments.

Ball, Eckel and Rojas (2006) ran wireless experiments in principles of economics and found that experiments improved the overall mark in the final examination. Again, the benefit was stronger for females than males. They found that the benefit was highest for first-year students. They also concluded that experiments significantly improved teaching evaluations of the lecturer and the degree to which students found the course stimulating.

Durham, McKinnon and Schulman (2007) and Emerson and Taylor (2004) find that experiments benefit different personality types differently, with read-write learners benefiting less than those that prefer learning by doing.

Finally, on this issue, Emerson and Taylor find that overall, the number of economics majors and students taking upper division economics are not affected by being exposed to classroom experiments. While somewhat disappointing, there is a positive spin to this result. Depending upon the student's background, they find that some students take more economics courses and some less – this is a strong indicator that experiments at least help students decide which areas they enjoy.

Which experiments to use

Now that you are convinced of the benefits of running an experiment in your class, the next step is to decide which experiments to use. The number of students, the time available and the school resources are the first factors to consider. For instance, in larger classes (60 and up), hand-run experiments are cost effective with regard to student time; teaching assistants and computer room bookings require careful preparation.

The most basic hand-run experiments can be as simple as asking for a show of hands (or electronic polling). You could ask, for example, who would co-operate and who would defect in a symmetric prisoners' dilemma. Simple experiments like the guessing game or the auctioning of a £1 coin are easy to implement. Two-by-two games can be played by having slips of paper in two different colours, one for each type of player.

A large selection of computerised experiments is available (see the next section). Most must be run in a computer room, but some can be assigned as homework. These can be either advanced individual choice experiments or situations in which a student plays against a fictitious player such as a robot playing a particular strategy, or against prior human players. We now present two cases where experiments have been successfully used in teaching.

Case 1: Intermediate Microeconomics (100 students)

This course is the easiest in which to introduce experiments. These can be done in groups of 20–30 (by recitation section) or in lectures by hand. While we have not yet tried to use an experiment to explain homotheticity, many topics in game theory or industrial organisation have many useful experiments designed for them. In addition, one experiment that is often used at the beginning of microeconomics is one of the classic experiments: a market experiment. Vernon Smith was one of

the first to make use of such experiments in both his research and teaching. In this issue, Jaworski et al. (2010) describe one way how this can be used in teaching.

In general, the market experiment comes in two popular forms: a pit market and a double auction market. The pit market is designed to be run by hand. For a computerised experiment that demonstrates the competitive solution, a double-auction market is the nearest equivalent. We prefer to conduct a market experiment immediately following the lecture on supply and demand and the competitive equilibrium, though some instructors may prefer to conduct the experiment before the lecture (indeed we prefer this order for most experiments). The primary benefit of a market experiment is to teach students the relevance and robustness of the competitive-equilibrium solution. Extensions allow for the demonstration of price floors and ceilings and the tax-liability-side equivalence theorem (see Ruffle, 2005).

Case 2: Third-Year Optional Course (30–40 students)

Another type of module can be constructed by designing each lecture around experiments. Each week an experiment is followed by a lecture based upon the experiment. The course we conducted had a diverse number of topics and was designed for economics students who had taken microeconomics without experiments. In our course, we focused on experiments on markets and market structure, including Bertrand Competition, Bertrand Complements (see Beckman, 2003), Vertical Markets, and Double Auction with Taxes. Experiments on multi-player simultaneous choice games included Bank Runs (see Balkenborg, Kaplan and Miller, 2009), and Network Externalities (see Bracht, 2009). For two-player sequential games, we included the Hold-Up Problem (see Balkenborg, Kaplan and Miller, 2010), Team Draft, Ultimatum Game, and Signalling. We also used individual choice experiments such as Price Discrimination, Lemons Game, Monty Hall and Search. Based upon student evaluations of individual experiments, the most popular experiment by average rank of learning and fun was the Bertrand Competition experiment (run on FEELE)³ which was first in fun and second in learning, followed by Team Draft (FEELE), Ultimatum game (Veconlab), Signalling (Veconlab) and Bank Runs (FEELE).

Resources

In this section, we will try to give you some guidance on where to start looking for experiments that you can run. Many resources are available via the web. A good starting point is a wikiversity site called 'economic classroom experiments' at http://en.wikiversity.org/wiki/Economic_Classroom_Experiments. This describes how to run many classroom experiments and has links to all the resources

mentioned here. You are invited to help to develop this website by adding missing links or reporting your experiences. The site is among a selected group of Wikiversity Featured Projects. Several review papers give tips for running experiments: Noussair and Walker (1998), Holt (1999), Dixit (2005), Hazlett (2006) and Balkenborg and Kaplan (2009).

Several sources describe hand-run experiments. An early source is Bergstrom and Miller, 2000, who provide materials and discussion questions for intermediate microeconomics. Charles Holt has a series of columns in the *Journal of Economic Perspectives* (these columns include Holt, 1996, Anderson and Holt, 1996, Ball and Holt, 1996, Holt and Laury, 1997, Holt and Sherman, 1999), and a textbook (2007) that provides materials to run each of its experiments by hand as well as by computer.

If you wish to run a computerised classroom experiment, the easiest site to get started is Veconlab, developed by Charlie Holt and connected to his aforementioned book. This site consists of almost all the basic economic classroom experiments, is very reliable and works anywhere you have a web browser. As opposed to hand-run experiments, one of us has successfully managed to 'wing it' with Veconlab, in particular, to run the experiment in this issue (Holt et al. (2010)), with only a cursory idea of what the experiment was about. Hopefully, now that there is an article, less people will try that.

Another site, FEELE, is one we developed as part of a grant from the Higher Education Funding Council for England. It mimics Holt's site and is meant to be a complement. Since there is KIOSK mode you may also want to start Veconlab experiments via the FEELE website. A variety of experiments where one can play against past data can be found on both Veconlab (Traveller's dilemma) and FEELE.

Econport, www.econport.org, has a beautifully written version of the double auction (Vernon Smith's basic market experiment). The site also offers an on-line handbook for micro economics and overall is well-documented. During the opening of a new finance centre at the University of Exeter, professionals from the finance industry were hooked playing it. On the downside, because of technical requirements, the system has to be tested in every room where you intend to use it (and based on experience even every computer needs to be tested).

For less technological demanding double auction experiment, you can use a computer assisted classroom experiment. Basic software is available (Jaworski et al. (2010)) or Ruffle (2003). We also provide an Excel spreadsheet to run a double auction and even a prediction market through the wikiversity site.

For a game theory or microeconomics course, go to Ariel Rubinstein's elegant website. He makes it fairly easy to design the module as a whole and track student responses. All the experiments are homework experiments on decision and game theory. For a macroeconomics course, Denise Hazlett has details of six of her macroeconomic experiments via her website <http://people.whitman.edu/~hazlett/econ/>.

Last but not least, plenty of resources and links are available on the webpage of the economics network <http://www.economicsnetwork.ac.uk/themes/games.htm> including experiments that involve physical activity (<http://www.bized.co.uk/educators/16-19/economics/firms/lesson/dimreturns.htm> or http://www.economicsnetwork.ac.uk/showcase/hedges_tennis.htm).

Concluding remarks

A major startup cost to the instructor of using experiments is the uncertainty of how they will work and the how much effort is required to introduce them. It may seem easier to just keep using the same old teaching materials. We hope this review (and issue overall) has reduced these and encouraged you to start using economic classroom experiments as a tool for active student learning. Even if you are not overly enthusiastic, we encourage you to adapt a small portion of your module in order to try out a single classroom experiment or a few short homework exercises to start with as even this is time well spent.

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Notes

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- ² The Test of Understanding in College Economics, TUCE, is a standardised, multiple choice test used in the United States at the undergraduate level, primarily targeting principles-level coursework. See <http://en.wikipedia.org/wiki/TUCE>.)
- ³ Found at <http://projects.exeter.ac.uk/feeel/> and described in detail below.

Contact details

Dr Todd Kaplan
Department of Economics
University of Exeter and University of Haifa
Email: Dr@ToddKaplan.com

Dieter Balkenborg
Department of Economics
University of Exeter
EX4 4PU
Email: d.g.balkenborg@exeter.ac.uk