

Active Learning in Economics: A Brief Survey for Japan's Educators

MORITA Tamaki* YAMAMOTO Kimika**

Abstract

Active learning (AL) in economics has begun to be applied in Japanese higher education but still in the trial and error phase. In other countries, especially in the United States, however, AL has recently been applied to economics courses and an overwhelming amount of statistical analyses on its effect has been accumulated. We review the literature and introduce these studies to Japan's economics educators who are seeking to adopt appropriate methods of AL in their courses. We found that collaborative learning is sometimes effective in helping students achieve higher grades, especially in small enrollment classes, and well-designed flipped learning works even in large enrollment class. We found other methods introduced here (experiments, online teaching, service learning, writing assignments, and just-in-time teaching) should be treated with care.

Key words: Active learning, Economics education.

1 Introduction

Active learning (AL) that let students learn by acting more than just listening to the lectures has begun to be adopted in Japanese higher education. Japan's traditional classes in higher education involve the instructor only giving lectures to students during class hours. Students merely passively listen to the lecture, neither expressing their opinions nor asking questions. Some instructors do not even welcome questions during class. The Ministry of Education, Culture, Sports, Science and Technology (MEXT) began allowing universities and colleges to introduce AL in 2012 to support students' vocational and social independence. Instead of traditional lectures, AL should be the essential tool for universities and colleges to enhance the quality of education and for students to learn more effectively (MEXT 2012). However, for most Japanese universities and colleges, AL is still in the trial-and-error phase.

Among the various disciplines in Japan's higher education, economics is one where instructors prefer the standard lecture-oriented "chalk-and-

talk" approach and only a few studies investigate the effect of AL methods. For instance, Tatsumi (2012) measured the effect of second-year undergraduate microeconomics and macroeconomics exercise courses and found that these courses are successful in increasing the students' understanding of microeconomics and macroeconomics.

However, in other countries, especially in the United States (US), AL has recently been applied to economics courses and an overwhelming amount of statistical analyses on its effect has been accumulated. This article focuses on introducing these studies and providing some suggestions for Japanese economics instructors to adopt AL effectively.

2 Active Learning in General

The definition of AL is not unique. Bonwell and Eison (1991) examined John Dewey's definition of learning as "something an individual does when he studies. It is an active, personally conducted affair" (Dewey, 1924, p. 390). The current concept of AL is summarized by Eison and Bonwell (1988) and Bonwell

* Department of Policy Studies, Yamanashi Prefectural University

** Faculty of Business Administration, Josai University

(2000) as “in the context of the college classroom, AL involves students in doing things and thinking about the things they are doing.” More precisely, according to the University of Michigan Center for Research on Learning and Teaching (2016), “Active learning is a process whereby students engage in activities, such as reading, writing, discussion, or problem solving that promote analysis, synthesis, and evaluation of class content. Cooperative learning, problem-based learning, and the use of case methods and simulations are some approaches that promote AL.”

Some disciplines utilize AL effectively. In language teaching, methods used in AL have been applied long before its name became popular. In science, McConnell (2003), through a literature survey, found the benefits of AL in improving students’ attitudes toward science and found increases in standardized test scores. A meta-analysis of 225 studies in the field of science, technology, engineering, and mathematics (STEM) by Freeman et al. (2014) suggested that AL is the preferred, empirically validated teaching practice in regular classrooms. They revealed that average examination scores improved by approximately 6% in AL sections and those students in classes with traditional lecturing were 1.5 times more likely to fail than those with AL. Across the STEM disciplines, AL increases scores on concept inventories more than on course examinations and it also appears effective across all class sizes.

In contrast, Oppenheimer (2003) warned that the tendency of using technology in education would diminish rather than enhance creativity. He describes students in lower and higher school as follows: “America’s students, as will be seen, have become a distracted lot. Their attention span—one of the most important intellectual capacities anyone can possess—shows numerous signs of diminishing. Their ability to reason, to listen, to feel empathy, among other things, is quite literally flickering” (p. xx). Focusing on the use of social networking software in higher education, Schroeder et al. (2010) stressed on the importance

of recognizing its drawbacks like high workload, the limited quality of interaction, as well as uncertainty about the ownership and assessment issues. It also poses threats, which include the difficulty of ensuring support and reliability of the applications and the implications of their illegitimate use.

What about the effect of AL in the discipline of economics? Is AL valuable for economics education?

3 Active Learning in Economics

We can find that the ratio of AL used in economics courses had been low until recently even in the US. In 1980, only 38% of the 538 colleges and universities in the US used one of these innovative teaching methods: computer-assisted methods (e.g., games and simulation), computer-managed instruction (or personalized system of instruction), self-paced instruction, programmed learning, case study method, or television or other audio-visual equipment (Sweeney et al., 1983). About fifteen years later, Benzing and Christ’s (1997) open-question survey with economics instructors indicated that some instructors had begun to change their teaching methods to include more faculty–student interaction. In the 2000s, the use of AL was recommended by, for instance, Hansen et al. (2002) who bemoaned the low economic literacy of American economics students. He advised economics instructors to lecture less, use active learning, and focus on problems, issues, and policies. Other consecutive surveys of mainly the members of the American Economic Association about teaching and assessment methods in various undergraduate economics courses were conducted in 1995, 2000, 2005, and 2010 in the US (Siegfried et al., 1996; Becker and Watts, 1996; Becker and Watts, 1999; Becker and Watts, 2001; Watts and Becker, 2008; Salemi and Walstad, 2010; Watts and Schaur, 2011). They all showed that most economics instructors choose to teach using the traditional chalk-and-talk style.

In recent times, Allgood et al. (2015) summarized the main research findings about teaching economics

to undergraduates by reviewing the literature since Becker's (1997) literature survey. In Chapter 5 of their review, "Alternative Teaching Methods and Practices," Allgood et al. introduced literature that describes how faculty members can use interactive teaching methods (e.g., Becker and Watts, 1998; Salemi and Hansen, 2005; Becker, Watts, and Becker, 2006). We investigate those and other studies to highlight lessons Japanese instructors can learn to provide effective AL in economics. Among the diverse AL methods, we focus on collaborative learning, experiments, online teaching, service learning, flipped learning, and two other methods.

3.1 Collaborative Learning

Some of the forms of AL are collaborative learning and cooperative learning. Collaborative learning is such that, by discussing and exploring problems with each other inside and outside of class, students can learn how to connect the concepts and their knowledge at a deeper level. Cooperative learning is a kind of collaborative learning, which is a structured form of group work where students pursue common goals while being assessed individually (Millis and Cottell, 1998). A supplementary method of collaborative learning is peer tutoring whose role is to encourage students' interaction, teaching each other, solving the problems themselves, and explaining the point to their peers.

In economics classes, the empirical results of the effect of collaborative learning and cooperative learning are negligible or positive depending on the method and outcome measured.

Huynh et al. (2010) explored the presence of a noticeable difference between students in a collaborative learning class and those in a non-collaborative learning class by conducting a quasi-randomized experiment. They concluded that there was strong positive connection between collaborative learning and academic performance, and reported that the use of collaborative learning in a principles course

with a grade incentive for voluntary participation increased a student's letter grade by one-third.

Some instructors adopted a collaborative learning lab component (CLL)ⁱ in their classes. Moore (1998) showed how most of the 176 CLL students found the CLL very worthwhile, enjoyable, and helpful, but there was no strong pattern between student responses and their final grade in the course. In the case of CLL, the effect depends on class size and small classes are reported to be better. Brooks and Khandker (2002) divided 95 enrollees in a microeconomics class into three groups: with large in-class CLL (48 students), with small in-class CLL (24 students), and without in-class CLL. The authors found that student attending a large in-class CLL got better test scores than those without an in-class CLL but significantly worse than those with a small in-class CLL students.

Johnston et al. (2000) took a collaborative, problem-solving (CPS) approach in the second semester of a second-year university macroeconomics course in 1995. Just like Moore's result, although students liked the collaborative activity, it did not increase exam grades or interest in economics.

There is a study that shows cooperative learning is valid for students' grade but not for attitudes. Yamarik (2007) compared the results of an intermediate macroeconomic course using cooperative learning and a traditional lecture. Controlling for the endogeneity of attendance, he found that students in the cooperative experimental group scored five to six points higher out of a possible 200 points but that there were no meaningful differences between the two groups on other outcomes such as attendance or student attitudes (interest, preparation, participation).

Marburger (2005) found that students who worked in cooperative learning groups did significantly better than those in a lecture class in their ability to analyze and apply economic theory to case studies, which requires deeper level learning ability. However, there was no difference between students in either type of class on a multiple-choice exam.

Bartlett (2006) found that a combination of lectures and the use of cooperative learning for introductory macroeconomics and microeconomics courses make students accountable to what they were learning.

Some evidence is available on how peer tutoring can be an effective way to increase student achievement. Munley, Garvey, and McConnell (2010) studied the effects of peer tutoring across different subjects, including economics, and found that participation in such a tutoring program increased grades by one-third of a letter grade if the student participated for ten to twenty hours over the course of a 14-week semester, which is something akin to one hour per week.

Other styles of collaborative learning include peer-assisted recitation classes that utilizes peer-tutoring. Stock et al. (2013) examined the impacts of enrollment in a voluntary one-credit recitation class for fundamental economics students. Undergraduate peer leaders with experience in upper-level microeconomics taught the recitation classes. Instead of being paid, the peer leaders enrolled in a three-credit course focused on examining research on economics pedagogy. The authors' estimates indicate that the recitation class students earned higher final grades than their counterparts in the same fundamental economics course did. In addition, those who enrolled in the recitation class were no more likely to drop the course than their counterparts who did not enroll in the recitation class.

In collaborative learning, group composition in a class seems to affect the students' performance, but a study shows it has no significant impact. Moore (2011) examined whether the characteristics of the small, semi-permanent team to which an introductory economics student was randomly assigned affected the student's performance on an identical final exam in eight sections of a principles course over three years, holding individual student characteristics the same. The results are encouraging in how they show that peer effects from such group characteristics have weak

effects and do not support the experts' general advice on how to form teams.

From these studies, it becomes evident that the causal relation between collaborative learning and academic performance is not always clear. Some find that a relationship exists while others do not. However, class-size is essential in collaborative learning. As Brooks and Khandker suggest, small class collaborative learning might have a positive effect on students' academic performance. Peer tutoring also affects the grade positively. Group composition does not seem to have much effects, and instructors do not have to worry about the way they form teams.

3.2 Experiments

Experiments in economics comprise of a variety of tools like games, case studies, simulation models, demonstration routines, and so on. These tools require students' active participation and stimulate their skills to adapt economic theory to real-world situations.

Students prefer experiments. Hawtrey (2007) showed that, among an Australian economics cohort of 500 third-year undergraduate finance students, sixty percent said experimental learning is important or very important. They not only prefer when experimental learning techniques are incorporated but also benefit through higher knowledge retention. Moreover, Emerson and Taylor (2004) mention that in the students' evaluations of instructors and courses, "assignments contributed to my understanding of the course content" are higher in the experiments group than in the non-experiments group.

Gremmen and Potters (1997) and Gramlich and Greenlee (1993) found a slight positive relationship between what students think they learn and their grade. While experiments do not improve test scores, they are found to improve other student attributes. Cartwright and Stepanova (2012) paid attention to students' attendance and/or writing reports. Students selected two topics out of ten and wrote a report. The course test they then took had all the 10 topics. The students

got 50% higher mark on topics on which they wrote a report.

Moreover, it seems that incentives play key roles in experiments but do not help augment students' performance. Dickie (2006) added incentives for those who participated in the games in the experiment classes; if he or she succeeded, they would earn five points on their grade. The result was that grade incentives had a negative influence on scores, i.e., the experiment group without incentives achieved higher grades in TUCE (the Test of Understanding in College Economicsⁱⁱ).

However, Emerson and Taylor (2004) insisted that their results proved experimental learning is useful for improving students' scores in TUCE. Cardell et al. (1996) also found students in experiment classes achieve higher TUCE scores. They compared students' scores before and after introduction of experimental learning in Denison University and Washington State University, where the experiment and non-experiment classes were prepared.

As described above, experimental learning might be preferred and accepted favorable among students, and have an effect on their attitude. However, as for their grade, the results differ among literature. As Gremmen and Potters and Gramlich and Greenlee pointed out, students' evaluation and their grade do not correspond. The efficacy of experiments should be explored further.

3.3 Online Teaching and Learning

The number of undergraduate students in the US taking online classes has increased significantly over the past decade. According to survey data for 2003–2004 from the US National Center for Education Statistics (NCES) (2015), 15.6% students were taking some distance or online classes and, in 2011–2012, the ratio rose to 32.0%. The trend of online classes in economics departments shows a similar trend. In this circumstance, online courses in economics have become an important part of student learning. Until

now, however, we have not seen markedly positive effects of online teaching.

Simkins (1999) introduced two cases suitable for independent learning: one was a simulation of the Federal Reserve Open Market Committee (FOMC) designed as a collaborative exerciseⁱⁱⁱ, and the other was a web-based financial market where students use real money accounts to buy and sell futures contracts^{iv}. In the former, Simkins found that using the web provides greater flexibility in implementing the activity, greatly increases the ease of obtaining information, and allows new opportunities for out-of-class student collaboration. In the latter, by integrating the web-based market into classroom discussion and course assignments throughout the course, students were able to analyze these price changes using demand/supply analysis. Unfortunately, he did not qualitatively analyze the effect of this learning.

Adding the supplemental materials such as web pages and supplemental online quizzes did not improve student performance on exams and out-of-class use of technology did not increase student scores in Harter and Harter (2004)^v. Duarte (2015) showed that students find blogging to be a useful learning tool and that blogs could be used effectively to support learning activities for longer than one semester based on the blog's visitor statistics and feedback. However, its ability to build and sustain a sense of community was not as strong as expected. Students were more positive about the use of the blog as an information and promotional tool to share marketing news and information and publicize the degree rather than for community building. Moreover, although the majority of students thought the system was helpful for sharing discipline-related knowledge and information, they were reluctant to participate in a regular and active way by posting. To increase the participation levels, the grading system should be tailored.

Two systems have been developed for online use. One is the Personal Response System (PRS)^{vi} and the other is the Wireless Interactive Teaching System

(WITS)^{vii}. Elliot (2003) discussed advantages and disadvantages of the PRS when used in group-teaching scenarios and showed the PRS was ineffective. She reported the results of a trial use of the technology in a second-year undergraduate microeconomics principles course. She suggested further study of PRS because it may be easily adopted as a teaching method for theoretical and quantitative material in economics, though she is not yet certain about its value in more discursive and contentious subjects. In contrast, WITS has strong effect to the student performance in Ball et al. (2006) who developed it. Ball et al. report the results of a controlled experiment to test the impact of WITS-facilitated AL exercises in an 80-person principles of microeconomics class. The impact on learning is strongly positive, with larger impacts on freshmen and on women, two of the groups that often struggle with introductory economics. In addition, students' evaluations on key questions were higher for the experimental class.

Some researchers statistically compared online instruction to other instructions. Staveley-O'Carroll (2015) compared the effects of lecture supplement of in-class pen-and-paper practice problems (the control group), in-class demonstrations, and online discussions. His findings were (1) in-class demonstrations have a positive effect on student learning, with the exception of African-American students; (2) female students perform better having participated in online discussions; and (3) traditional pen-and-paper recitation questions "teach to the test" but do not impart as much economic intuition as the two alternative pedagogical methods. This comparison reveals that online discussions positively affect only female students and in-class demonstrations seem to be superior to other methods.

Other studies indicate that hybrid classes do not surpass traditional lectures with regard to student performance. Joyce et al. (2014) divided approximately 750 students into two sections: the hybrid section where professors compressed their

lectures to fit the reduced class time for students to make more use of the lecture slides, online material, and faculty-produced videos, and the traditional section where these professors gave lectures for the entire duration of the class time. The principal differences between the two formats were the amount of contact that students had with their course professor and classmates, the tempo of learning required during the lectures, and the amount of class time available for questions. Through statistically robust experiments, Joyce et al. found that students in the traditional lecture format did modestly better than those in the hybrid version for an introductory microeconomics class. Brown and Liedholm (2002) also compared a macroeconomics live course that met face-to-face during class hours every week with that of a hybrid course that supplemented two class hours of face-to-face lectures per week with online materials. They also prepared a virtual course that consisted of videos, online materials, which was the same as hybrid course, and repeatable practice quizzes. They showed that students in the live course achieved significantly higher grades than those in the virtual class. With the rationale that was caused by the difference of time spent with instructors, they concluded that instructor and student interaction is important. Other relations, such as between the hybrid and virtual versions, were not significantly clear.

There is a study revealing that login time matters but login frequency does not affect students' grades in online courses in economics and finance (Calafiore and Damianov, 2011). They surveyed the determinants of students' online academic achievement^{viii}. Recognizing the limitation of the study that the login time is only a quantitative measure, not a qualitative one, Calafiore and Damianov concluded that the total time that a student spends in the course, rather than the number of times a student logs into the course, is a determinant of student performance.

From the literature, we have found limited evidence for the effectiveness of online learning thus

far. Only a few studies derived positive conclusions. We see that the numbers of online students are rapidly increasing in the US and posit that Japan will follow this trend. Universities and colleges should continue to explore ways to contribute to the students' learning if they adopt online education.

3.4 Service Learning

Service learning (SL) is said to originate from John Dewey's idea that the interaction of knowledge and skills with experience is key to learning (Ehrlich and Jacoby, 1996). In the context of economics, SL is a method of experiential learning that links the classroom with the local community, and it requires students to spend time in volunteer service and relate their experiences to the educational theories they learn in the classroom (McGoldrick, 1998). McGoldrick states that students, instructors, and community organizations all welcome SL in economics.

The drawbacks of SL are instances where either the student or the agency fail to live up to the expectations of the assignment, even with careful service contacts. McGoldrick et al. (2000) report the effectiveness of student-based instruction in SL. The example of student-based instruction presented in their study requires that economics students have a firm grounding in the material they are presenting to young children^{ix}. They must be able to anticipate questions and give examples in terms that their audience will understand and be able to pull examples of economic concepts from the most basic aspects of everyday life, reminding them of its universal relevance in decision-making.

Although there have not been many empirical studies on SL due to the difficulty in designing random experiments, Hébert and Hauf (2015) empirically showed the effects through a test–retest methodology^x. They measured academic development of course grades, an assignment that directly tested course-specific comprehension, and self-reported improvement. Although students who participated

in SL showed improvement in civic responsibility, interpersonal skills, and academic development, they only demonstrated better academic development in terms of concrete course concepts, showing no differences in final examination marks.

SL definitely suits economics and business studies; however, for now we cannot judge its effectiveness until further empirical research has been done.

3.5 Flipped Learning

Flipped learning is a relatively new method in AL. It is defined by the Flipped Learning Network (2014) as “a pedagogical approach in which direct instruction moves from the group learning space to the individual learning space, and the resulting group space is transformed into a dynamic, interactive learning environment where the educator guides students as they apply concepts and engage creatively in the subject matter.” In flipped learning, generally, students watch lecture materials outside classroom time and use their classroom time to do other activities.

So far, flipped learning is highly evaluated. Lage et al. (2000) discussed the benefits of “inverting” the economics classroom; students were expected to come to class prepared to discuss the relevant material provided as video-taped lectures and PowerPoint slides which was followed by in-class economic experiments. They found the strength of the flipped classroom lies in the opportunity for faculty–student interaction since students are able to clear any confusion immediately and instructors are able to monitor performance and comprehension. Roach (2014) documented the implementation of a “partially-flipped” class over one semester of a large enrollment microeconomics course and showed how students responded positively to flipped learning, which was also found to be a beneficial instructional design across student groups.

Unlike cooperative learning, flipped learning works in larger classes. Vazquez and Chiang (2015) reported on their experience “flipping” a large

enrollment (over 900 students) microeconomic principles classroom using a methodology enhanced over the course of several years. Students were assigned to watch multimedia pre-lectures that included embedded questions prior to attending each lecture. The materials promoted the understanding and retention of information by allowing visual connections to be made between images and concepts. Vazquez and Chiang concluded that pre-lecture videos could replace traditional chalk-and-talk style lectures and create more classroom time for active learning.

With the development of audio-visual equipment and increase of learning management offerings by major publishers in the US, flipped learning is becoming more effective for students and more cost-effective for instructors. The fact that flipped learning works for large classes is encouraging for Japanese universities that have large-enrollment introductory economics classes.

3.6 Other Methods

Among many other methods in AL, here we look at writing assignments and just-in-time teaching. Both of them are burdensome to instructors but may work well if designed appropriately.

3.6.1 Writing Assignments

Writing assignments, such as journals, can reach a broader array of students and can be assigned repeatedly in a low-stakes environment. Through the act of writing, the students must analyze and create. Greenlaw (1999) taught two sections of macroeconomic principles that were identical except that one included a series of writing assignments while the other did not. The examinations for both sections were the same. Greenlaw concluded from his experiment that the writing augmented section showed greater learning. Brewer and Jozefowicz (2006) designed short reflection papers and journal entries to connect the student's personal activities to classroom material, which permitted students to

reflect on how economics ties to their daily lives. Both worked well and the reflection papers seemed to be particularly successful based on the quality of the work submitted. Similarly, Dalton (2010) asked her students to conduct interviews of individuals who lived through the Great Depression and summarize their experiences with special focus on their economic difficulties. The interviewee tells his or her story and the new knowledge is used in story expansion as the student interviewer asks additional questions regarding the particulars of the interviewee's experiences. Dalton thought this approach could be useful for the study of economic expectations because the formation of individual expectations depends, in part, on individual experience. Aguilar and Soques (2013) proposed the use of a journal to enhance the study of macroeconomics. They equipped a pedagogical device, called the MacroJournal (MJ), which streamlines the process of incorporating current events into a macroeconomics course. By completing the assignment, students have an opportunity to become practitioners and link current events to classroom theory.

With writing assignments, students should be assessed using a well-established rubric such as that proposed by Aguilar and Soques: one point for his/her opinion with no justification whatsoever; two points for his/her opinion and an explanation that is incomplete, illogical, incorrectly uses the ideas developed in class, or is in some other way unsatisfactory; three points for complete and logical rationale for the change in assessment from the previous week, with the ideal answer incorporating items learned in class and a focus on the marginal contribution of the most recent events upon his/her assessment. Adequate rubrics also limit the instructors' costs of assessment and writing can be a way for students to learn actively.

3.6.2 Just-in-Time Teaching

Simkins and Maier (2004, 2010) introduce the use of Just-in-Time Teaching Technologies

(JiTT) in the principles of economics course. JiTT is defined by Novak et al. (1999) as “a teaching and learning strategy comprised of two elements: classroom activities that promote AL and web-based resources that are used to enhance the classroom component.” Between classes, students complete carefully constructed exercises focusing on material that will be covered in the next class and submit them electronically by a preassigned time a few hours before class using course management software or through a simple email. Once submitted, instructors review students’ JiTT responses a few hours prior to class and use the responses to organize and structure the upcoming classroom session. Simkins and Maier (2004) summarize the following benefits, though not by statistical way: (1) students are more likely to be prepared for class, (2) the use of student responses creates a positive feedback loop, (3) instructors become more aware of student thinking processes, and (4) JiTT pedagogy increases students’ cognitive learning.

There is no evident way to reduce instructors’ cost in this method, but if materials like rubrics for writing assignments are developed, JiTT may work well.

4 Conclusion

We surveyed the literature on how AL can be utilized in economics courses in higher education. We focused on mainly collaborative learning, experiments, online teaching, service learning, flipped learning, and two other methods in other countries, especially in the US. Japan’s economics educators can compare and contrast these results so as to apply AL.

We found some methods to be effective in economics courses. Collaborative learning is sometimes effective in helping students achieve higher grades, especially in small enrollment classes. It also has a positive peer effect on students’ other attributes, regardless of their group composition. Well-designed flipped learning works even in large enrollment class.

On the other hand, other methods did not show clear effects on augmenting students’ academic performance. As for experiments, evaluations from students are favorable, but these do not improve students’ grades. Online learning may have only slightly positive effect or even no effect if students spend time just sitting in front of the computer. Considering the increase of online undergraduate students and the use of supplementary tools for economic classes in the US, Japanese universities will soon have to provide more online materials or online courses. Improvement of the content and methods of the online tools is a pressing issue. Other methods, such as service learning, writing assignments, and just-in-time teaching, may advance the efficacy of learning but may triple the instructors’ burdens and their assessment should be treated with care.

Notes

- i) According to Moore, the collaborative learning lab is “where students, usually working in groups of three or four, take a series of short, written quizzes (called unit tests) that correspond to each of six units in the course. When the class has completed the material in a particular unit, students are urged to attempt one of these unit tests, which are taken outside of class at pre-arranged times. A unit test usually consists of about three or four questions or problems and takes approximately 20–30 minutes to complete.” (Moore 1998, p.321)
- ii) TUCE is a nationally recognized test that measures student learning in introductory economics courses in the US.
- iii) Simkins used an exercise based on the Federal Reserve’s Fed Challenge program, a national economics competition requiring teams of high school or college students to develop monetary policy recommendations and present them at simulated FOMC meetings.
- iv) Simkins used Iowa Electronic Markets (IEM), a set of Web-based financial markets, where contract payoffs are linked to political events, such as presidential and congressional elections. Students buy and sell contracts based on their expectation of election outcomes, in the process learning valuable lessons about market behavior and the forces determining that behavior.
- v) In Harter and Harter (2004), the instructor created a web

page that contained homework assignments, practice exams, answer keys, and interactive quizzes according to the chapters. The questions answered correctly were followed by a brief explanation about why they were correct, whereas those answered incorrectly were followed by more in-depth explanations about why the answers were not correct.

- vi) A Personal Response System (PRS) is a form of technology developed in UK that offers a lecturer/tutor the opportunity to ask a group of students multiple-choice questions to which they reply individually by selecting an answer on a hand-held wireless transmitter. Receivers connected to a computer pick up these answers. Computer software then aggregates the responses, and the students can see the results on a large screen using a standard projector.
- vii) The Wireless Interactive Teaching System (WITS) consists of Handspring Visors (a hand-held PDA) equipped with wireless capabilities, a laptop server, a wireless access point and projector, and proprietary software. WITS allows students to trade in markets, play standard economics games (prisoner's dilemma, public goods, 2 by 2 matrix, etc.), take multiple choice quizzes, and communicate with the instructor during class.
- viii) The authors use the online tracking feature in Blackboard (Campus Edition) to retrieve the real time that each student spent in the course for the entire semester.
- ix) The students prepared materials and went into elementary school classrooms to teach.
- x) The study used a test-retest methodology to control for the issue of self-selection and the potential differences between these students prior to their service learning experience.

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