**Learning to Do: Facilitating Practice in a Large Introductory Macroeconomics Class**

**Short Title: Learning to Do**


Anna Josephson*
Assistant Professor
Department of Ag. and Resource Economics
University of Arizona
aljosephson@email.arizona.edu

Dave Nelson
Associate Director
Center for Instructional Excellence
Purdue University
nelson8@purdue.edu

Larry DeBoer
Professor
Department of Agricultural Economics
Purdue University
ldeboer@purdue.edu

Angelika Zissimopoulos
Director for Initiatives in STEM Teaching and Learning
Chicago Center for Teaching
University of Chicago
zissimopoulos@uchicago.edu

*Josephson (aljosephson@email.arizona.edu) will serve as corresponding author.



The authors are grateful to the comments provided by three anonymous reviewers and to the editors for their assistance.

**Learning to Do: Facilitating Practice in a Large Introductory Macroeconomics Class**

**Short Title: Learning to Do**


## Abstract

Contemporary pedagogy encourages instructors to move away from memorization to teaching the ability to "do economics". In such an environment, students are taught to apply knowledge of economic measurement, the economic model, and economic policy to analyze current events and policies. In this paper, we build on existing literature describing independent activities to share a set of class exercises and assignments that comprise an entire course. The course discussed in this paper is a large enrollment introductory course and presents a novel approach to active learning, adapted to this often-challenging context. The course emphasizes engaging students by encouraging them to practice using macroeconomic tools.



**JEL Codes:** A10, A22, E00

**Keywords:** pedagogy, flipped classroom, active learning, economics instruction, macroeconomics

Suppose that the goal of an introductory macroeconomics course is to help students develop the ability to "do economics": to apply knowledge of economic measurement, the economic model, and the history of economic policy to examine current economic events and policies. To encourage students to develop an ability to apply and analyze information and to move beyond a simple recitation of terminology, instructors must promote an environment of active learning (Bonwell & Eison, 1991; Hettler, 2015). Active learning encourages students to practice applying macroeconomic tools and analyzing real-life events. In an active learning environment, lectures, at-home assignments, and in-class exercises all work to engage students in "doing" macroeconomics.

Active learning methods are well documented in the economic education literature (Truscott et al. 2000, Santos & Lavin 2004, Harmon & Lambrinos 2012), as well as flipped and inverted classrooms (Lage et al. 2000, Balaban et al. 2016). We contribute to the conversation in the literature by combining the strains of literature which describe the independent activities which could be a part of a flipped or active learning classroom environment (Truscott et al. 2000, Salemi 2009, Elmslie & Tebaldi 2010, Reece & Robins 2017) with the literature which describes such methods, perceptions, and outcomes in a course, at a broader scale (Santos & Lavin 2004, Lage et al. 2000, Harmon & Lambrinos 2012, Balaban et al. 2016). While much of the literature either describes a single independent activity or the broad outcomes of a course that used a series of activities, we aim in this paper to describe both: to provide a comprehensive course outline, combining the individual components used in an active learning environment, and the outcomes on student learning as a result of their use. To our knowledge, such assignments are still infrequently used in economics and thus few formal descriptions of them exist in the literature.

With this objective in mind, this paper outlines an introductory macroeconomics course at a large United States university which emphasizes "doing" instead of "knowing". The course focuses on engaging students, by encouraging them to practice using macroeconomic tools. We describe in this paper the assignments and exercises used to the teach students to "do economics" through active learning, using the five characteristics of the practice described by Bonwell & Eison (1991):

1. Students are involved in more than passive listening.
2. Students are engaged in activities.
3. Less emphasis is put on information transmission, while greater emphasis is put on developing skills.
4. Greater attention is given to exploring attitudes and values.
5. Students are involved in higher order thinking, including analysis and evaluation.

With the goal of sharing the components of an active learning environment, applied to a large course setting, we provide descriptions and examples of the main content of the course, as well as benefits and barriers to their integration in other courses. Further, in the interest of understanding the effect that these assignments have on students learning we also offer some brief evidence about their effectiveness on student exam performance, using the Fall Semester of 2016 as data for the evaluation. With this paper, we both provide a practical resource for instructors of large introductory courses, looking to integrate active learning techniques, which remain underused in much of economics instruction. We also contribute to the ongoing discussion within the economic education literature, by describing the implementation of a course designed to "learn to do", with both activities used and ultimate outcomes.

## COURSE CONTENT

The course of interest in this paper is an introductory macroeconomics course at a large land-grant university in the United States. Enrollment ranges from 220 to 400 students per semester.[1] A majority of students, 72% of those enrolled, are in their first or second years. Few students are economics or applied economics majors, and only half are enrolled in the college in which the course is housed. However, the course satisfies a social science requirement for most colleges at the university and the majority of enrolled students take the course to fulfill this requirement. Thus, by and large, this course is the first and only economics course which students take at the college-level. While some students will have taken economics previously in high school[2], few of the students will have taken economics before at the university-level.

The course layout follows a standard course format: the course meets twice weekly, for 75-minutes. Lectures, however, do not comprise the entirety of class-time. Course time is designed to both emphasize and reward in-class participation and is thus a hybrid of activities and traditional lecture. A number of course meetings (eight) are entirely comprised of guided and independent group work.

Course content is divided into four modules: module 1 covers macroeconomic measurement as well as demand and supply; module 2 covers the goods and money markets in the macroeconomic model; module 3 covers fiscal and monetary policy as well as the Great Depression; and finally module 4 covers the exchange market and the economy since the 1960s. The modules effectively break the class into quarters, each generally on a new topic. Modules are interrelated but present new information, while simultaneously building on previous

knowledge, gaining in complexity as the course progresses. Each module is comprised of a set of assignments and in-class exercises, including exams, quizzes, peer-review assignments (PRS assignment), in-class questions (CRS questions), and group work. The final grade is out of 1000 points, for which a breakdown in shown in Table 1.

[TABLE 1 ABOUT HERE]

In addition to active learning in the classroom environment, the course promotes a partially flipped classroom, encouraging students to take greater responsibility for their learning, outside of class. That is, in the partially flipped classroom context there is a change in where information is provided: some which instructional content is often delivered outside the classroom, and assignments which might have otherwise been considered homework, are delivered within the classroom. Two important tools for the former component goal are 1) the textbook and 2) a number of online videos. This content is not strictly required but is integral to success. First, the textbook follows the modules of the course. Reading is aligned with course progression and expected readings relevant for each lecture are discussed in class. Second, there are 51 video clips, which were edited from recordings of lectures made by the professor. The average video is seven minutes and 48 seconds in length. The shortest is just under one minute and the longest is almost 15 minutes. In the fall of 2016, videos were viewed 3,701 times, an average of 73% of the times the students visited the page (4,025 times). However, students did not watch the entirety of videos: on average, they viewed 74% of a video in a viewing.

In this section, to share details on the "learning to do" course, we provide a description of each assignment and exercise, as well as details about the instructor's experience using each. This section aims to provide guidance to other instructors hoping to make similar changes in

their own courses and to show the foundation of how each independent activity or assignment plays a role in overall course and its objectives of learning "to do" economics.

**Guided Study Quizzes**

The first component of the course is comprised of guided study quizzes, which are designed to promote practice. Practice is an important part of learning, as the adage "practice makes perfect" has long suggested. The literature generally agrees: Macnamara et al. (2014) conduct a systematic review on practice and find that, although practice may not make perfect, it does improve skills at what is being practiced. The authors further find no indication that practice "hurts". Additionally, practice not only improves the task one is performing: practice at a task can produce learning that generalizes to other tasks and can facilitate faster learning (Seitz 2017). Quizzes and practice have been found to have benefits in lecture and beyond: the use of mastery quizzes in fosters greater student engagement, allowing for a more active learning environment (Nevid & Mahon, 2009) and studies have demonstrated a positive correlation between online study quizzes and exam performance (Blumenfeld & Darr 1993, Orr & Foster 2013, Scrima 2009, Stewart et al., 2013).

Using this literature as guidance, guided study quizzes are designed to be low-stakes, low-stress tools that model and reward out-of-class studying that is expected of students in an flipped classroom environment. These quizzes allow students multiple attempts to recall material from the course, activating the testing effect (Roediger & Karpicke, 2006). In the course, each of the four modules has a series of five quizzes with five multiple choice questions, for a total of 25 questions over the course of a single module. A sample quiz (from module one, level four) is available in the Online Appendix, section $A^3$. Guided study quiz questions ask about basic

knowledge and skills derived from lectures, the textbook, and video clips. Quizzes draw questions randomly from a larger pool, a function that works well in Blackboard Learn.[4] All questions used in quizzes were written by the instructor. The average question pool includes 33 questions, with a range of between 16 and 68 questions. Students can take each quiz as many times as they like; however, they are unlikely to receive the same exact questions again, due to the size of the question pool. Practice is still encouraged in these exercises, though, as a student's grade is the maximum she achieved on any attempt.

During the 2016 Fall semester the 300 students in the course averaged 1,255 attempts per quiz, for an average of 4.2 attempts per student. The average student answered more than 20 questions on each quiz, trying for the full five points. During that semester students achieved the full 5 points on 69% of the 20 quizzes, and 91% achieved 4 or 5 points. Repeated attempts produced high scores. Of course, after many repeated attempts, pool questions may begin to repeat, so it is possible for a student to see most of the questions and the correct answers. It is possible for students to "game" the guided study quizzes. For example, on the fifth quiz in the fourth module in Fall 2016, one student called up 13 quizzes without answering any questions, then answered all five questions correctly on the 14$^{th}$ attempt. However, as there is an average of 33 questions in each pool, gaming quizzes requires substantial effort and thus such behavior appears to be rare.

The due dates for the guided study quizzes are also set with the objective of encouraging early practice: the quizzes are due halfway through each module, after three lectures. This deadline is before all other module assignments. This early deadline encourages students to master the basic skills in each module as preparation for more advanced assignments. This

structure of building knowledge through assignments scaffolds learning for students, preparing them to apply knowledge and understanding in upcoming assignments.

**Lectures with Real-Time Questions**

The second component of the course includes real-time questions, in the lecture environment, designed with the objective of overcoming the difficulties in interaction posed by a large classroom setting. In such an environment, real time interactions between instructor and students can be challenging. Engagement is particularly important in large-enrollment introductory courses, where it can facilitate students' understanding of how economists use economics to look at the world (Salemi 2009). To this end, instructors often seek methods to generate a small classroom environment in a large classroom setting. One popular method for creating this smaller classroom feeling is to provide immediate feedback to students during class time, a solution made easier with technology, often "clickers" (Goffe & Sosin 2005, Bergstrom 2009). Multiple studies have demonstrated the ability of classroom response systems like clickers to foster student attention and class participation (Caldwell 2007). These are also helpful tools in the large classroom environment, as demonstrated by Salemi (2009) who authored a seminal paper on this practice in economics, with applications in large-classroom environments. Clickers help to engage students during the entire class period, to gauge understanding of material presented, and to provide prompt feedback to student questions. They also allow for anonymous participation and a "game" aspect, both of which may increase student engagement (Martyn 2007).

Based on this literature and in order to realize the benefits in learning with clicker-tools while minimizing the purchasing cost to students (Kay & LeSage 2009), this course used a web-

based tool which allows questions to be asked and answered, and the results displayed in class.[5] This system is similar to clicker classroom response systems (CRSs), but allows students to use their own hand-held phones, laptops, or tablets to answer questions rather than a proprietary device. The instructor asks two, three, or four multiple choice questions during each lecture. A question asked at the start of class rewards attendance.

Typically, CRS questions ask students to apply economic methods that the instructor has just presented, as a method of employing practice immediately. Students are encouraged to conceptualize an answer, discuss it with their neighbors, and then submit through the CRS. This method is sometimes known as "think-pair-share" (Shapiro & Gordon 2012). When everyone in the class has answered, the quiz is closed and the screen shows a bar chart with the percentage of students offering each answer. Individual student answers are not revealed in class, but the CRS records student responses in a spreadsheet so grade points can be awarded for correct answers. By rewarding points for participation, CRS questions encourage and reward attendance, which is an important contributor to student success (Freeman et al. 2007, Crede et al. 2010, Lukkarian et al. 2016).

Total CRS points for the semester are capped at 40, though about 60 questions are asked. Thus, students who miss a class unavoidably, who forget their devices, or who have technical difficulties, can still receive the maximum points, without need for the instructor to judge the merits of each excuse. Fifty-four percent (54%) of students achieved the full 40 points during Fall 2016. The average student who earned the full 40 points attended 91% of classes and answered 73% of the questions correctly. Students who earned less than 40 points attended 63% of classes and answered 61% of questions correctly, on average. Most students who fail to earn

the full 40 points do not attend class regularly, though they may also answer fewer questions correctly.

The primary benefit of CRS questions for the instructor is that he can see immediately what percentage of the students have applied the economic concepts correctly. Mis-understandings can be explained and corrected immediately. Of course, as much literature demonstrates (Martyn 2007, Salemi 2009, among others), that similar interactions can be provided by clickers, but the CRS provides an additional benefit for students as it works with devices many students own anyway, so there is no need to buy an additional device. Students habitually carry their handheld devices so there is little problem with forgetting to bring them to class.[6] Additionally, CRSs discourages casual use of devices during class, by keeping them occupied for instructional purposes.[7]

**In-Class Group Projects**

The third component of the course is group work completed in class, part of the flipped classroom environment, bringing work that might otherwise be done at home into the classroom. By moving group work to the classroom, students are given the opportunity to engage in abstract thinking and in application, to express complicated ideas logically and fluently, and to engage with the professor throughout assignments. Although course lectures with real-time questions provide students with brief opportunities to practice using macroeconomic tools, more sustained interactions are also necessary to cultivate an understanding of how to apply macroeconomics. Group work poses a mechanism for improving these skills, particularly those based in communication (Johnston et al. 2000). Additionally, group work can facilitate peer teaching and learning as well as encourage students to make inferences that help students understand their

roles and strengths for application in future careers (Shulman 1987). Cooperative learning through group work is also found to positively influence students' performance on final exams (Yamarik 2007)

The in-class group projects offer ongoing opportunities to learn to do and take advantage of the beneficial outcomes of group work. The structure of these assignments is similar to that of the collaborative learning labor component, described by Moore (1998). Students work together in groups to take a series of short, written quizzes, working together following the jigsaw method to group work (Aronson et al. 1978; Lom 2012; Van Wyk 2015; Van Wyk 2016). The idea is that each student brings a piece of a jigsaw "puzzle" to solve an in-class group problem. Before class, students take a quiz to build knowledge for application in the group work. Each group member completes a different quiz, so members have each practiced some of the skills needed to answer the in-class questions. Although all group members have the tools to answer the questions, each group member becomes an "expert" on interpreting one of the data series that is used with the model to analyze the economy. A sample in-class group project is available in the Online Appendix, section B.[8]

These quizzes prepare students to contribute to the in-class group discussion. Quizzes are due the day before the first in-class group meeting. Each student has a responsibility to the group to complete the quiz and bring their knowledge to the group effort. Quiet students also may see their quiz expertise as permission to contribute to group discussions, encouraging participation in a comfortable context. Questions are designed to encourage collaboration and are written so that at least two students must apply their skills from the quiz to answer. For example, in the fourth module, each student reads news article excerpts and looks at data about a particular country. The quiz questions ask students to analyze the data and articles, for example describing the

monetary policy of each country's central bank. When students come together in class, a question asks for a comparison of the monetary policies of the various central banks of each nation. Each student can contribute knowledge of what each country is doing or the group must use the articles and data on each country to answer the question. Writing questions in this way takes some effort on the part of the instructor. However, questions that can be answered by only one student will be answered only by that student, with little group discussion (Basili et al. 1991).

In addition to students having different topics, different teams also have slightly different frames. For example, one team may look at the 1970s, while another would consider the 1980s. Group-level differentiation in activity is motivated by a desire for independent work on the pre-group work quizzes: as two friends are unlikely to have both the same decade and the same topic, students must work on their own to solve their quiz. However, ultimately, the topics covered in each team on the in-class assignment are the same. The decade of the assignment is trivial: students are learning the key skills that motivate the exercise, which are to practice interpreting data and to practice applying the model.[9]

Group projects are comprised of two meetings. The first in-class group meeting of each module is a "guided" group project. The instructor lectures about how to apply economic methods to analyze an issue, then asks a question of the groups designed to generate discussion. Information worksheets are provided. Groups discuss and agree on the answer and record it using the CRS. The instructor then shows the correct analysis, which leads to another question. Guided group classes include four to six discussion questions. The second in-class group meeting is an independent group project with 15 to 20 multiple choice questions. Group members discuss and agree on an answer to each question and record it on the question sheet. When they have

agreed on all the answers, each individual student obtains a Scantron bubble sheet to record the group's answers for grading at the instructional processing center.[10]

The instructor assigns students to groups randomly, with one set of groups for the first and second modules, and a new set of groups for the third and fourth modules. Groups are named after the classroom seat number where the group will gather, so students can find their group members quickly.[11] Group names are posted on Blackboard prior to class, and (after some difficulties during the first group meeting) students have little trouble finding their groups.

**Spreadsheet Assignments**

The fourth component of the course is a spreadsheet assignment, to encourage application of ideas and models through analyzing real data. Doing economics requires working with data, though this often poses a challenge for undergraduate students, particularly in introductory courses (Elmslie & Tebaldi 2010, Reece & Robins 2017). The spreadsheet assignments encourage students to practice working with data on the main economic indicators. Assignments are generally done in Microsoft Excel.[12] The instructor supplies students with an Excel file with annual data from 1960 to the most recent year. The file includes nominal GDP and its main components, the corresponding price deflators, Federal budget receipts and outlays, labor force, employment and unemployment, all-items and core consumer price indexes, selected interest rates and exchange rates, and other indicators relevant to the assignments. The spreadsheet assignment is designed to have students to "get their hands dirty" with actual economic indicators. These indicators are also incorporated into other areas of the course, including group projects, CRS questions, and exams.

Broadly, the spreadsheet assignments ask students to analyze the data presented. As an example: the first module's assignment introduces students to basic economic indicators. This first assignment introduces students to the basic economic indicators. By calculating the indicators themselves, and considering the derived statistics, students get a sense of what the numbers mean and their typical range. Calculations are completed with the spreadsheet and answers are subsequently entered into a Blackboard quiz. A complete spreadsheet assignment instruction set is available in the Online Appendix, section C.[13]

Assignments can be categorized into four types of procedures. First, there are those which require one operation, including deflating and calculating a variety of indicators inflation, money growth, unemployment rate, or interest rate spread. Next, there are those which require two or more operations, such as determining the minimum wage required to match the previous year's purchasing power, estimating the Taylor rule index, and calculating the real GDP growth rate, real interest rate, or budget balance percent. The final two procedures add complexity and require the interaction of indicators previously built. The third procedure includes determining correlations, such as those between real GDP growth and the change in the unemployment rate, the CPI core inflation rate and the BAA AAA interest rate spread, the real GDP growth rate and the interest rate spread, the core inflation rate and the unemployment rate, and many other similar relationships. Finally, the last procedure requires creation of diagrams and trendlines, including generating the Taylor Rule index, the Philips curve, and demonstrates Okun's Law. Knowledge obtained early in the semester is used as scaffolding for future knowledge, allowing students to build a base of information to use as the semester progresses.

However, the spreadsheet assignment poses more potential challenges to students than the module quizzes or group projects, though many of these concerns are related to formatting.

Students often are concerned about rounding fractional answers. Luckily, Blackboard allows a range around the correct answers, so rounding usually will not matter. Reminders about format are also integrated throughout assignments so as to assuage some of this anxiety. Each question includes instructions so data entry is consistent with Blackboard's conventions: not to use the symbols "$" or "%", to use one or two decimal places, to use periods instead of commas for decimal places, etc.

Further, while some students are familiar with Excel and spreadsheets before they begin the course, many are not. As a result, for some students more effort goes into learning spreadsheet software than mastering the economic measurement concepts. Assignments are designed to accommodate this and step-by-step instructions are provided.

**Peer Reviewed Assignments**

The final component of the course is a combination of reading and writing, through a structured, peer-evaluation writing assignment. To our knowledge, we are one of the first to describe calibrated peer review in the literature of economics education. Although not often the main goal of economics courses, writing is an essential part of doing economics (Schmeiser 2017). Writing is an essential part of learning, more broadly, and also encourages critical thinking, evaluation, and communication. Writing offers also an opportunity for peer engagement, peer review, and peer evaluation. The benefits of peer review are well documented in the literature and are also employed commonly by academics in their own work (Lundstrom & Baker 2009; Ware 2008; Boud et al. 2014). Peer reviews can provide some of the most thoughtful feedback and help to develop stronger work. Further, as students, upon graduation, will most frequently interact with their peers rather than experts, and so communicating effectively to peers is an essential skill.

The course employs a calibrated peer review software (PRS) and a PRS assignment serves as the capstone to each module.[14] Media reports, including video, newspaper, and social media sources, are likely to be students' main source of economic information after they complete the course. This information does not arrive in discrete multiple-choice units, but as messy text written or spoken by journalists, pundits, politicians, or analysts. PRS assignments provide practice using course tools to analyze this noisy and potentially disordered information. Assignments are structured similar to the rhetorical cases, described by Palmini (1996) so that assignments serve as effective practice for writing clear and accurate economic analyses. However, much of each assignment is practice for critical reading. Each student evaluates seven essays, including their own. The overall objective of the assignment is to encourage students to read, think, write, and respond critically.

PRS essay topics in the course are based on the material covered in the previous module, as they are intended as capstones to that module's materials. Each PRS essay encompasses more topics and requires more complex thought. The first module's essay is a low-stakes 60-word "elevator speech" for practice with using the software. The second module's essay is about a demand-supply example from media reports, which requires analysis using tools from the first module. The third and fourth modules' essays use excerpts from Congressional Budget Office analyses of the economy and fiscal policy. PRS requires knowledge of the macroeconomics learned in the previous module, but also familiarity with current events. A sample PRS assignment, with instructions, is available in the Online Appendix, section D.[15]

The structure of the PRS assignment is straightforward: students read excerpts of a media report or government document and write short essays applying the economic model to analyze the information in the report. Essays are limited to a maximum of 225 words. The assignment

provides a rubric describing four questions or topics that a good essay would cover. Essays must be submitted to the PRS by a mid-module deadline. The software then distributes each student's essays to three fellow students for peer review. Before the peer review, however, students grade three "calibration" essays written by the instructor. Grading includes answering four multiple-choice questions based on the rubric and giving the essay a score between 1 and 10. Students must answer three of four questions correct and assign a score within 2 points of the correct score to receive credit for the calibration for each essay. Students have three chances to pass each calibration. For the three full PRS assignments during Fall 2016, 51% of students passed all three calibrations, and another 32% passed two of three.

After submitting their own essay and completing the calibration, students then grade three of their fellow students' essays with a 1 to 10 score. This is the peer review. Students receive credit for their scores if they match the scores given by the other two students grading that essay, within a range set by the instructor. The average of these three scores becomes the grade the student receives for their essay. PRS weighs the average score based on each reviewer's calibration result. Reviewers who could distinguish a good essay from a bad essay in the calibration have their peer review scores weighted more heavily than those who were unable to identify good from bad. For the peer review section, 68% of students received the full score on all three student reviews, meaning the grades they gave to the peer-written essays matched the grades given by the other reviewers, within a range of two points. Reviewers gave an average score of 7.3, on the 1 to 10 scale.

After grading three calibration essays written by the instructor, and three essays written by fellow students, the student grades their own essay. For the self-evaluation, students receive credit if their score matches the average given by the peer reviewers, within a range set by the

instructor. The range for credit on the self-evaluation is set generously, and 89% of students received full credit for evaluating their own essays. Self-evaluation uses a wider range so as not to penalize "modest" students who are overly critical of their own good work. Of course, this also benefits students who fail to recognize their own inferior essays.

Students sometimes express consternation that their essays are graded by their fellow students, who are not experts about economics or the essay topic. The instructor responds that PRS is more like their post-college lives than are most assignments. A memo to the boss usually is not an attempt to demonstrate mastery to someone who already knows the answer, but an effort to explain a topic to someone who wants to know more about an unfamiliar subject. Similarly, a letter to the editor is an effort to inform and persuade fellow readers, not to address or influence experts.

## SOME EVIDENCE ON EFFECTIVENESS: FINAL EXAM SCORES

An important question emerges when considering the assignments and coursework of any course: what actually works and what assignments contribute to students' success? To examine the effectiveness of the assignments described in this paper, we consider the impact of the various course materials on several final exam outcomes.

In our analysis, for assignments we include: (1) CRS questions, in which the total number of points are without the 40-point cap, but a maximum of 61; (2) guided study quizzes from each module, measured by total scores on the five quizzes; (3) spreadsheet assignments, which are the sum of the scores from all four modules; (4) PRS assignments, which are the sum of the scores from all four modules; (5) group assignments, which include the pre-meeting quiz score, as well as the in-class group scores, summed across all four modules; (6) extra credit assignments, which

are available in each module and so the sum is summed across the four modules; (7) whether the student attempted the practice exam; and (8) the practice exam score. We also include the semester of the student, which is coded 1-2 for first years, 3-4 for second years, etc.

The practice exam components require further explanation. A practice exam is made available before each exam; for the practice exam before the final, 50 multiple choice questions are drawn from a pool of 364 questions, taken from guided study quizzes and past exams. The exam can be attempted as many times as a student may like. In Fall 2016, the exam was attempted at least once by 177 of 228 face-to-face students. It was tried 682 times, an average of 3.9 times for each student who attempted it. "Tried Practice Exam" is a 0-1 dummy variable, equal to 1 if the student tried the practice exam. "Practice Exam Last Grade" is measured as the score out of 50 that the student achieved on their last attempt of the practice exam.

Table 2 presents the results from three regressions. The first column presents final exam score, overall. The second column presents final exam score on data questions, only. The third column presents final exam score on history and policy questions, only. The ability to apply the model and data to questions of policy and history are integral parts of the active learning environment in the course, and so, with these outcomes, we measure how students both performed overall, as well as on the specific outcomes of interest. Regressions are OLS, with errors clustered at the student-level. Only the face-to-face students are included, for a total of 228 observations.[16] This is not a test of causality, so no inferences can be made about the direct effectiveness of these assignments.

Considering the results for overall exam score: these suggest that PRS assignments, CRS questions, and group assignment coefficients are positive and significant. Class attendance and

engagement, as measured by the group assignment and CRS, are also correlated with higher scores for students.

[TABLE 2 ABOUT HERE]

Insignificant coefficients are also instructive. None of the guided study quiz coefficients were significant. This is unsurprising as almost all students achieve 4 or 5 on almost all the quizzes and it is perhaps the case that there is not enough variation in these variables to test correlation. However, this insignificance signals that the assignment is working as intended: students work to obtain high marks on this low-stakes, study-tool assignment. Additionally, neither the extra credit assignments nor the spreadsheet assignments are significant. There are several possible explanations for this. It is likely that the most successful students do not bother with the extra credit assignments, as their grades are already high. Students with lower exam scores might have the higher extra credit scores as a result, using extra credit to compensate for lower exam performance. Next, and worthy of more consideration, is the insignificant coefficient on the spreadsheet assignments. The reason for this insignificance is unclear; it may be that the struggle to use the spreadsheet software obscures the economic measurement concepts that are tested by the exam. Revisions of this assignment may be appropriate in order to achieve the goals of this particular course.

## LIMITATIONS

It is essential to discuss the limitations associated with changing a classroom from a standard lecture environment to this type of active learning environment. Across disciplines, evidence suggests that varied teaching styles have positive effects on students (Bonwell & Eison 1991, Lage et al. 2000, Prince 2004, Freeman et al. 2014) and thus the movement in instruction is

towards one of greater interaction and engagement between teacher and student. In this conversation, in addition to a talking about classroom instruction priorities and methods, forwardness about the challenges and potential difficulties instructors may face must be discussed. These concerns may make adaptation challenging, but must not be eschewed in this conversation. In the context of adapting a large macroeconomics course from knowing to doing, the primary issues are related to time, the available technology, and the course population.

First, addressing perhaps the most important issue: time. Creating this course took a non-negligible amount of time as most active learning adaptations seem to (Lage et al. 2000). The course was designed during a 6-month sabbatical and the summer months before the Fall semester of 2013, totaling approximately nine months of time. In addition to being a significant investment of hours, it was also a great deal of work. Other research and extension tasks were set aside in the interest of modifying the class. Such effort might deter others looking to make similar revisions. Indeed, Goffe and Kauper (2014) find in a survey of 340 principles instructors that a third of professors acknowledge that lecture is not the best way for students to learn, though it is the most cost effective.

Next, technology available proved to be influential in implementing the course. In the large classroom context, technology is used to replicate the educational ideal of small class sizes with one-to-one discussions and graded writing assignments, while still acknowledging that large university environment. In big universities, including the one in which the course of interest in this paper is conducted, large introductory classes are commonplace. Technological tools like CRSs and PRSs create a virtual small classroom in a large lecture hall. Without the technology, less would be possible. While the availability of technology influenced many of the assignments and practices undertaken in the course, others may be dissuaded if such technologies were not

available or were cost prohibitive. We have attempted to mitigate technological difficulties and limitations by providing examples of open-source software similar to the tools employed through this course.[17] However, we acknowledge that technological constraints may pose challenges for some instructors looking to adapt the methods described here.

Finally, the population of this specific course was of particular consideration and the effects of the change on learning outcomes indicate that demographics are an important factor. For almost all of these students, the course described here is the only economics course they will ever take in college. For this population, it was less appropriate to emphasize (for example) the finer points of GDP accounting or price index construction, and more appropriate to focus on meaning and interpretation of the real GDP growth rate and consumer price inflation rate. These are the economics numbers which non-economists are likely to see each month, which can be useful for personal planning, and which are endlessly cited by politicians and pundits. Were this a first course to be taken by economics majors, however, more emphasis on foundational material might be appropriate and/or necessary. However, this concern is perhaps one more easily addressed by instructors: with some imagination, engaging techniques can be developed for any material and student population.

## CONCLUSION

In most economics courses, course objectives are achieved by simply covering the content in a textbook. However, with the proliferation and popularization of active learning, as instructors, we can undertake a different goal: instead focusing on "learning to do." Students learn how to apply the tools of macroeconomics to analyze economic issues that arise throughout their lives, beyond the classroom and university. In this paper, we have described an entire course, including

classroom activities, assignments, and evaluations, all of which were designed with this goal in mind. Such assignments are still underused in economics instruction and we provide one of the first formal descriptions of them in the literature.

Learning to do requires practice. Active learning, flipped classrooms, and the methods and technologies introduced in this paper, were chosen to provide opportunities to practice the application of macroeconomic tools to analyze data, policies, and events. Low-stakes quizzes encourage study of the text and video clips. In-class real-time questions ask students to practice using tools as they are introduced. Group projects provide opportunities for more in-depth application and analysis. Spreadsheet assignments require students to analyze macroeconomic data and familiarize students with data and indicators used in other elements of the course. The calibrated peer review essays offer practice for analyzing information as it appears in media articles and agency reports. Analysis shows that these course components succeed in achieving the goal of providing improved learning: students who perform well on course materials were rewarded with higher grades on the exam.

A classroom with active learning and communication between students is an attractive one and thus, hopefully, will become increasingly common across universities. In such a context, the instructor's voice is not the only one heard and students try out the tools that have been introduced, analyzing the policy or events which have been described: they learn in real time. The classroom erupts with talk as students exchange impressions and ideas – taking responsibility for their own learning. Feedback is exchanged, the lecture moves forward, and the process begins again. A straightforward lecture seems flat by comparison.

[TABLE 3 ABOUT HERE]

## REFERENCES


Aronson, E. et al. 1978. The jigsaw classroom. Oxford, England: Sage.

Balaban, Rita A., Donna B. Gilleskie, and Uyen Tran. (2016). A quantitative evaluation of the flipped classroom in a large lecture principles of economics course. *Journal of Economic Education* 46(4): 269-287.

Basili, P.A. and J.P. Sandord. 1991. "Conceptual Change Strategies and Collaborative Group Work in Chemistry." *Journal of Research in Science Teaching* 28 (4): 293-304.

Bergstrom, Theodore C. (2009). Teaching Economics Principles Interactively: A Cannibal's Dinner Party. *Journal of Economic Education* 40 (4): 366 – 384.

Blumenfeld, Gerald J. and Ralph F. Darr Jr. (1993). Relative effects of CMI and non-CMI practice quizzes on subsequent test performance. *Journal of Research in Computing Education* 5 (4).

Bonwell, C.C. and J.A. Eison. 1991. Active Learning: Creating Excitement in the Classroom. ASHEERIC Higher Education Report, Number 1: George Washington University, Washington D.C.

Boud, David, Ruth Cohen, and Jane Sampson (2001). Peer Learning in Higher Education. Routledge.

Caldwell, J. E. (2007). Clickers in the large classroom: Current research and best-practice tips. *CBE-Life Sciences Education* 6 (1), 9-20.

Crede, Marcus, Sylvia G. Roch, and Urszula M. Kieszczynka (2010). Class Attendance in College: A Meta-Analytic Review of the Relationship of Class Attendance with Grades and Student Characteristics. *Review of Educational Research* 80 (2): 272 – 295.

Elmslie, Bruce T. and Edinaldo Tebaldi. (2010). Teaching Economic Growth Theory with Data. *Journal of Economic Education* 41(2): 110 – 124.

Freeman, Scott, Eileen O'Connor, John W. Parks, Matthew Cunningham, David Hurley, David Haak, Clarissa Dirks, and Mary Pat Wenderoth (2007). Prescribed active learning increases performance in introductory biology. *CBE – Life Sciences Education* 6: 132-139.

Freeman, S., S.L. Eddy, M. McDonough, M.K. Smith, N. Okorafor, H. Jordt, and M.P. Wenderoth. 2014. Active learning increases student performance in science, engineering, and mathematics. *PNAS* 111 (23): 8410–8415.

Goffe, William L. and Kim Sosin (2005). Teaching with Technology: May you Live in Interesting Times. *Journal of Economic Education* 36 (3): 278-291.

Goffe, William and David Kauper. (2014). A Survey of Principles Instructors: Why Lecture Prevails. *Journal of Economic Education* 45 (4): 360-375.

Harmon, Oskar R. and James Lambrinos (2012). Active-Learning Exercises for Principles of Economics Course. *Journal of Economic Education* 43 (2): 221-221.

Hettler, P.L. (2015). Active Learning in Economics: Increasing Student Engagement, Excitement, and Success. *Int Adv Econ Res* 21: 357.

Imazeki (2014). Bring-Your-Own-Device: Turning Cell Phones into Forces for Good. *Journal of Economic Education* 45 (3): 240-250.

Johnston, Carol G., Richard H. James, Jenny N. Lye, and Ian M. McDonald (2000). An Evaluation of Collaborative Problem Solving for Learning Economics. *Journal of Economic Education* 31 (1): 13-29.

Kay, R. H., & LeSage, A. (2009). Examining the benefits and challenges of using audience response systems: A review of the literature. *Computers & Education*, *53*(3): 819-827.

Lage, Maureen J., Glenn J. Platt, and Michael Treglia. (2000). Inverting the Classroom: A Gateway to Creating an Inclusive Learning Environment. *Journal of Economic Education* 21 (1): 30-43.

Lukkarinen, Anna, Paula Koivukangas, and Tomi Seppala (2016). "Relationship between Class Attendance and Student Performance" *Procedia – Social and Behavioral Sciences* 228 (July): 341 – 347.

Lom, Barbara (2012). "Classroom Activities: Simple Strategies to Incorporate Student-Centered Activities within Undergraduate Science Lectures" Journal of Undergraduate Neuroscience Education 11: 1, 64-71.

Lundstrom, Kristi and Wendy Baker (2009). To Give is Better than to Receive: The Benefits of Peer Review to the Reviewer's Own Writing. *Journal of Second Language Writing* 18 (1): 30 – 43.

Macnamara, B.N., D.Z. Hambrick, and F.L. Oswald, (2014). Deliberate practice and performance in music, games, sports, education, and professions: A meta-analysis. *Psychological Science* 25: 1608-2618.

Martyn, Margle. (2007). Clickers in the Classroom: An Active Learning Approach. *Educause Quaterly* 2: 71-74.

Moore, Robert L. (1998). Teaching Introductory Economics with a Collaborative Learning Lab Component. *Journal of Economic Education* 29 (4): 321 – 329.

Nevid, J. S., & Mahon, K. (2009). Mastery quizzing as a signaling device to cue attention to lecture material. *Teaching of Psychology*, *36*(1), 29-32.

Orr, R., & Foster, S. (2013). Increasing student success using online quizzing in introductory (majors) biology. *CBE-Life Sciences Education* 12(3): 509-514.

Palmini, Dennis J. (1996). Using Rhetorical Cases to Teach Writing Skills and Enhance Economic Learning. *Journal of Economic Education* 27 (3): 205-216.

Prince, M. 2004. Does Active Learning Word? A Review of the Research. *Journal of Engineering Education* July: 223–231.

Reece, William A. Jr. and Russel P. Robins (2017). Performing an event study: An exercise for finance students. *Journal of Economic Education* 48 (3): 206 – 215.

Roediger III, H. L., & Karpicke, J. D. (2006). Test-enhanced learning: Taking memory tests improves long-term retention. *Psychological Science* 17(3): 249-255.

Salemi, Michael K. (2009). Clickenomics: Using a Classroom Response System to Increase Student Engagement in a Large-Enrollment Principles of Economics Course. *Journal of Economic Education* 40(4): 385-404.

Santos, Joseph and Angeline M. Lavin (2004). Do as I Do, Not as I Say: Assessing Outcomes When Students Think Like Economists. *Journal of Economic Education* 35 (2): 148 – 161.

Schmeiser, Katherine. (2007). Teaching writing in economics. *Journal of Economic Education* 48 (4): 254-264.

Shulman, Lawrence. (1987). The Hidden Group in the Classroom: The Use of Group Process in Teaching Group Work Practice. *Journal of Teaching in Social Work* 1 (2): 3-31.

Scrima, A. E. (2009). Implementing a mastery model through self quizzing in an online learning environment. Western Michigan University.

Seitz, Aaron R., (2017). Generalizable Learning: Practice Makes Perfect – But at What? *Current Biology* 27: R218-R241.

Shapiro, A.M. and L.T. Gordon. 2012. "A Controlled Study of Clicker-Assisted Memory Enhancement in College Classrooms." *Applied Cognitive Psychology* 26 (4): 635 – 643.

Stewart, D., Panus, P., Hagemeier, N., Thigpen, J., & Brooks, L. (2014). Pharmacy student self-testing as a predictor of examination performance. *American Journal of Pharmaceutical Education 78*(2): 32.

Truscott, Michael H., Hemant Rustogi, and Corrine B. Young. (2000). Enhancing the Macroeconomics Course: An Experiential Learning Approach. *Journal of Economic Education* 31 (1): 60-65.

Van Wyk, Michael M. (2016). "Jigsaw Pedagogy in Enhancing Economics Teachers' Learning in Free State Secondary Schools" *International Journal of Educational Sciences* 13: 3, 349-355.

Van Wyk, Michael M. (2015). "Using the Jigsaw Teaching Strategy for the Advance of Economics Teachers' Acquisition of Knowledge" *International Journal of Educational Sciences* 10 : 2 , 338-346.

Ware, Mark (2008). Peer Review: Benefits, Perceptions, and Alternatives. Publishing Research Consortium.

Yamarik, Steven. (2007). Does Cooperative Learning Improve Student Learning Outcomes? *Journal of Economic Education* 38 (3): 259-277.

**Table 1.** Student Evaluation Point Breakdown

| Assignment | Number per Module | Total Number | Points | Total Value |
|---|---|---|---|---|
| *In-Semester Exam* | 1 | 3 | 100 | 300 |
| *Final Exam*[*] | 1 | 1 | 200 | 200 |
| *Guided Study Quizzes* | 5 quizzes, with 5 questions each | 4 | 1 each | 100 |
| *PRS Assignment* | 1 | 4 | 10 points for the first module, 30 for remaining the 3 | 100 |
| *Spreadsheet* | 1 | 4 | 30 | 120 |
| *CRS Questions* | varies – no set amount | | 1 | 40 |
| *Group-Related Quiz* | 1 | 4 | 10 | 40 |
| *Group Assignment* | 1 | 4 | 25 | 100 |

[*]The final exam serves as the fourth module in-semester exam, as well as a comprehensive final.

**Table 2.** Regression Results – Final Exam Score

| | |
|---|---|
| *Semester* | 0.286<br>(0.205) |
| *CRS Questions* | 0.146**<br>(0.011) |
| *Guided Study Quizzes, Module 1* | 0.034<br>(0.803) |
| *Guided Study Quizzes, Module 2* | -0.258<br>(0.196) |
| *Guided Study Quizzes, Module 3* | -0.014<br>(0.903) |
| *Guided Study Quizzes, Module 4* | 0.086<br>(0.436) |
| *Spreadsheet Assignments* | 0.021<br>(0.440) |
| *PRS Assignments* | 0.127***<br>(0.002) |
| *Group Assignments* | 0.109***<br>(0.005) |
| *Extra Credit Assignments* | -0.097<br>(0.190) |
| *Tried Practice Exam* | -3.831***<br>(0.005) |
| *Last Score of Practice Exam* | 0.153***<br>(0.000) |
| *intercept* | 12.116***<br>(0.007) |
| Observations | 228 |
| R-Squared | 0.422 |

* significant at the 90% level, ** significant at the 95% level, *** significant at the 99% level

**Table 3.** Description of Resources in Online Appendix

| Title | Description | Location |
|---|---|---|
| *Full Appendix* | Complete Appendix, including all four components described below. | https://repository.arizona.edu/handle/10150/631439 |
| *oA. Guided Study Quiz* | Includes guided study quiz. Five questions are presented in a quiz, randomly drawn from a pool. | https://repository.arizona.edu/handle/10150/631442 |
| *B. In-Class Group Project* | Includes quiz questions, which are prepared in advance of class, as well as the project assignment. | https://repository.arizona.edu/handle/10150/631441 |
| *C. Spreadsheet Assignment* | Includes sample spreadsheet assignment, with full instructions and questions. | https://repository.arizona.edu/handle/10150/631440 |
| *D. Peer Reviewed Assignment* | Includes article which students analyze, as well as instructions and calibration questions. | https://repository.arizona.edu/handle/10150/631443 |

## NOTES

[1] Each semester, about three-quarters of enrolled students are in the face-to-face section of the class, and about one-quarter take the course through an online section. Most students who take the course online live on-campus but have scheduling conflicts or extracurricular commitments which make a flexible online learning environment more conducive.

[2] The state in which the college is located requires that students take economics in high school.

[3] Online appendix available at the University of Arizona Campus Repository, including Part A. Contact the authors for more information.

[4] While Blackboard Learn and similar learning management systems are increasingly common, we recognize that not all instructors have access. Moodle is a free, open-source, version of the software which could be used by instructors whose universities do not provide a similar system.

[5] Although the software used in this class is proprietary to the university at which the course is taught, a similar free version of the software, called Poll Everywhere, exists and could be used by instructors whose universities do not provide a similar system.

[6] A Pew survey from 2017 found that 100 percent of people between the ages of 18 and 29 have some type of cell phone. In the experience of this particular course, considering three semesters with a total of 788 in-class students, only two did not have a cell phone, laptop or tablet. These students turned in their answers on paper and were on their honor to submit their answers unchanged after the correct answer was revealed.

[7] Imazeki (2014) finds that bring-your-own-device response systems turn these potential distractions into a pedagogical tool that can enhance learning.

[8] Online appendix available at the University of Arizona Campus Repository, including Part B. Contact the authors for more information.

[9] Most important, regarding the different decades used for assignments, students are not penalized nor do they benefit, from having one decade over another. The instructor is careful to avoid such possibilities, for example, by focusing on alternative decades on exams. So, even if application of data or model considered is similar or the same as a previous group assignment, the time period is not. On a recent exam, students were asked to analyze materials and data from the recession and recovery of 1957-1959, which is not the subject of a group work assignment. Thanks to an anonymous reviewer who raised this concern.

[10] Groups are told that all members must submit the same answers. However, students may not actually do this. The individual submission of Scantron sheets is rooted in university capacity limitations and large class size. Due to the size of the course, assignments are processed using scantrons. The scantrons are filled out individually because the university's data processing center is unable to handle group submissions. As a result, all grades are tabulated individually. With that being said, the instructor is able to see if groups are submitting different individual answers and penalize them. This is made clear in class. As a result, deviations from the group decision are rarely observed, and students collaborate to find a single group solution. Thanks to the reviewer who pointed this out.

[11] In a class of two hundred or more people meeting in a classroom designed to seat five hundred people, a straightforward system such as this provides dramatic time savings.

[12] For students who do not have access to Microsoft Office, Google Sheets provide a free spreadsheet tool in which to complete the assignment.

[13] Online appendix available at the University of Arizona Campus Repository, including Part C. Contact the authors for more information.

[14] Although the PRS used in this classroom is a proprietary software provided through the university where the course is taught, a similar free version, called Calibrated Peer Review, exists.

[15] Online appendix available at the University of Arizona Campus Repository, including Part D. Contact the authors for more information.

[16] Although there were 98 online students, assignments for these pupils did not include in-class PRS assignments or group projects, we cannot test correlations with final exams scores.

[17] Thanks to the anonymous reviewer who encouraged us to do so.