

Teaching Methods that Help Economics Students to be Effective Problem Solvers

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ABSTRACT

A traditional teaching method, “chalk and talk”, may not help students to develop their ability to think logically and therefore students cannot be effective problem solvers. This paper examines the effect of a combination of two teaching methods: cooperative learning with a think-pair-share technique and a context rich problem on students’ learning. These teaching methods were applied to the author’s Principles of Economics course. This paper obtained several findings. First, students’ more active involvement in the class activity was observed. Second, students’ questions to the instructor changed and they were no longer “How to solve it.” Third, Students’ performance of the course improved. These findings indicate that these teaching methods help students to stand at and walk on the right path to become effective problem solvers, which will enhance their motivation to study and engagement in learning, and the methods are effective.

Keywords: Teaching method, Cooperative learning, Context rich problem, Think-pair-share technique, effective problem solver

1. INTRODUCTION

The improvement of students’ performance in economics courses always draws economics instructors’ attention. Franklin College has three expectations for students in liberal arts education. First, students obtain a methodology through understanding a theory. Second, students are able to explain the essence of problems. Third, students become effective problem solvers so that they make appropriate judgments and identify solutions to problems. Unfortunately, only a few students have met these expectations. It appears that many students in Franklin College cannot consider problem solving (the second and the third expectations) to be linked to the methodology or theory being taught (the first). In other words, they cannot apply methodology or theory to an actual economic problem. They often say, “I understand the material I learned. But I just cannot solve the problem” (Heller, Keith and Anderson 1992a, 627). A traditional teaching methodology giving a lecture of theory to students, often called “chalk and talk”, may have created this phenomenon. Some researchers have pointed out that it is still a dominant teaching method (Salemi and Siegfried 1999; Hansen, Salemi and Siegfried 2002; Wattes and Becker 2008). I consider that students need to be involved in a class activity that helps them to understand a link between problem solving and theory, and that develops their ability of logical thinking like economists do so that they can become effective problem solvers. This helps motivate me to incorporate teaching methods into my economics courses that I learned about at the Teaching Innovation Program (TIP) workshop in 2009 (TIP 2009): a combination of two teaching methods - cooperative learning with a think-pair-share technique and a context rich problem. Cooperative learning has been demonstrated to be

an effective teaching method (Heller et al 1992a, Heller, Keith and Anderson 1992b; Robertson, Davidson and Dees 1994; Sherman 1994; Bartlett 1995; TIP 2009). The purpose of cooperative learning is to ensure that every individual within a group develops her or his academic and social skills to the maximum (Bartlett 1995). The think-pair-share technique is an effective technique in the cooperative learning environment when students derive solutions and their underlying concepts (Mills and Cottell 2003). A context rich problem is designed to focus students' attention on the need to use their conceptual knowledge to qualitatively analyze a problem (Heller et al 1992a) and is widely known as one of the most effective teaching methods (Heller et al 1992; Heller et al 1992b; TIP 2009). This paper examines the effect of a combination of two teaching methods; cooperative learning with a think-pair-share technique and a context rich problem, on students' learning of economics. These methods help students to apply a theory to real economic problem and to think logically so that they become effective problem solvers. I have applied these teaching methods to my Principles of Economics courses over the past four semesters (two academic years). There are usually about 20-25 students in my class, many of whom are freshmen and plan to major in Economics, Business or Accounting. These students were divided into several four-member groups and given an assignment of a context rich problem. Then, students were instructed to use the think-share-pair technique to solve the problem. First, students were asked to individually consider the topic, then they were paired to discuss problems and finally they developed a single answer for a group. Some evidence was collected during and after implementing these methods to measure the effectiveness. First, students' behavior in the classroom changed, that is, more active involvement in the class activity was observed. Second, the questions that students asked me changed. Third, four key elements, which will be discussed later, were implemented nicely. Students played their roles in line with four key elements as one of group members. Fourth, students understood the problem better and their performance of the assignment improved in the quiz held one week after the activity. These findings indicate that the teaching methods help students (i) to change their learning style in the classroom from listening and taking notes given by a traditional "chalk and talk" to an activity where they pay more attention and get more involved, (ii) to learn that a problem solving is linked to a theory (for example, connect two points - price and revenue corresponding to quantity demanded - and make a line through a theory - elasticity). (iii) to learn thinking logically and explaining their ideas, thoughts and solutions logically to enhance their ability, (iv) to learn applying an economic theory to an actual economic problem, (v) to learn from other students and to enhance motivation to study, (vi) to learn to have fun in economics, and (vii) to reach Franklin College's three expectations. This paper indicates that the teaching methods that I used are effective, and that they help students to stand at and walk on the right path to become effective problem solvers, which enhance students' motivation to study and their engagement in learning further.

The next section describes methodology including character of the course, implementation, and evidence collected. The third section gives results. Some concluding thoughts are provided in the final section.

2. METHODOLOGY

TIP 2009 introduced many of the recent advances in active teaching strategies and teaching methods such as context rich problems, class room experiments, cooperative learning, case studies, assessment, discussion, large enrollment course and many others¹, which can provide students with more effective learning styles to meet various purposes. Some researchers suggested to instructors that they should incorporate such

¹ See "Starting Point: Teaching and Learning Economics" at "<http://serc.carleton.edu/econ/index.html>" for more details about teaching methods.

teaching methods into the traditional lecture style called “chalk and talk.” For example, Salemi and Siegfried (1999) suggested that economics faculty should learn non-lecture teaching techniques. Hansen, Salemi and Siegfried (2002) advised that economics faculty should shift away from “chalk and talk” and toward strategies that require students to work with economic concepts. Watts and Becker (2008) pointed out that despite recent attention given to cooperative and active-learning methods and to alternative classroom assessment techniques, economics educators still use these practices in economics courses relatively infrequently and cooperative learning and small group assignments are rarely used in all kinds of courses.

2.1. Two Teaching methods

I consider that a traditional teaching method “chalk and talk” may not help students to develop their ability to think logically and therefore students cannot be effective problem solvers. This helps motivate me to incorporate teaching methods into my economics courses that I learned in TIP 2009. That is, a combination of two teaching methods: cooperative learning with a think-pair-share technique and a context rich problem. I applied these teaching methods into my Principles of Economics course. I expected that these methods would help students to obtain development of strategies, understanding of application, and critical analysis of solutions (TIP 2009) so that students could understand a link between problem solving and theory, and develop their ability of logical thinking like economists do for becoming effective problem solvers.

Cooperative learning is defined as structured, systematic instructional strategy in which small groups work together to produce a common product (Copper 2003). There are several reasons that cooperative learning is incorporated into my Principles of Economics courses. First, cooperative learning ensures every individual within a group develops her or his academic and social skills to the maximum (Bartlett 1995). Second, cooperative learning is an effective teaching method that has been shown by many researchers. Cooperative learning can provide students to learn more effectively (Bartlett 1995). The cooperative-group learning problem solving is a viable alternative to traditional recitation sections (Heller et al 1992a). Cooperative grouping is an effective means of teaching problem solving in a university introductory course (Heller et al 1992b). Cooperative learning is a viable and effective instructional methodology for teaching and learning because it helps make a subject exciting and enjoyable for both students and instructors; even the shy student finds it easy to be involved; and many students maintain a high level of interest in activities (Robertson, Davidson and Dees 1994). Students can share ideas in the team and the utilization of teamwork allows the science educator to achieve a variety of academic and social goals in the classroom setting so that students can discover the adventure of science (Sherman 1994).

The think-pair-share technique is probably the best-known and the most widely used for cooperative learning structure (Millis and Cottell 2003). In a think-pair-share activity, each student is asked individually to consider a problem first; then, students discuss the problem in pairs; finally each group develops a single answer. There are some reasons that this technique is used for cooperative learning. First, it is effective technique in cooperative learning environment when students derive solutions and their underlying concepts in cooperative learning environment (Mills and Cottell 2003). Second, Sherman (1994) showed in chemistry classes that think-pair-share is an appropriate method. Third, it is easy to learn and easy to use, and it easily creates a more relaxed atmosphere than calling on individual (Millis and Cottell 2003). Fourth, students have valuable time to think through questions before any discussion begins (Sherman 1994; Millis and Cottell 2003). I expected that cooperative learning with a think-pair-share technique would allow students to benefit from others and change their learning style from just attending classes and listening to instructor’s lecture to

participating more in class activities. Through this technique, students are expected to have a better understanding of class materials and be more motivated to study. I also expected that the think-pair-share technique would help students to be able to think critically because guided peer questioning²², which is very similar technique to think-pair-share, is so effective in enhancing critical thinking (King 2003).

A context rich problem is widely known as one of the most effective teaching methods (Heller et al 1992a; Heller et al 1992b; TIP 2009). There are some unique characteristics in the context rich problem. It is essentially a short story that includes a reason for asking questions about a real object or event. The problem statement does not always explicitly identify the unknown variable. More information may be available than is needed to solve the problem. Information may be missing but can easily be estimated or is common knowledge. Reasonable assumptions may be needed to be made to solve the problem (Heller et al 1992a; Heller et al 1992b). There are a few reasons that I use a context rich problem in cooperative learning with a think-pair-share technique. First, it is designed to focus students' attention on the need to use their conceptual knowledge to qualitatively analyze a problem (Heller et al 1992a). Second, it encourages students to practice using the prescribed problem-solving strategy (Heller et al 1992a; Heller et al 1992b). I expected it would help students to apply economic theory to actual economic problems more practically and to develop their ability to think logically.

When a cooperative learning method is conducted in a class, four key elements must be in place for students to work and learn effectively: positive interdependent, individual accountability, equal participation and simultaneous interaction (Kagan 2003; TIP 2009). Table 1 explains a brief description of each key element. The Results section describes how effectively all of the four key elements are in place in the cooperative learning structure. Also, it is pointed out that there are always free-riders: students who do not participate to the best of their ability in group work (Bartlett 1995). Bartlett (1995) offers a solution that adding an element of chance: a flip of the coin or a roll of the die to cooperative learning will be an effective method to eliminate free-rider problem. Since individual accountability includes an individual test in the method, this free-rider problem is avoided and the idea of Bartlett (1995) will not be applied to the teaching method used in this paper.

2.2. Characteristics of the Course

I have used this methodology in my Principles of Economics over the last four semesters. There is no prerequisite for this course. Many of the students are freshmen, among which many of students plan to major in Economics, Business or Accounting. Others will major in different fields and they take this course to satisfy the requirement of social science field in the liberal arts core curriculum. Class size ranges from 20 to 25 students. There is no specific classroom restriction. Each student has a desk and a chair, which are movable.

2.3. Implementation

Based on the cooperative learning method, the class was divided into several four-member groups (6-7 groups). Then, each group was assigned a context rich problem, and was instructed to use the think-pair-share technique and to work together for the assignment. Table 2 shows the context-rich problem that I used for this experiment.

To begin this experiment, the purpose must be clearly explained to students before the activity starts. I provided students with written instructions first, which explained objectives, description of the exercise (worksheet), and how the assignment was implemented. I gave them 1-2 minutes to read it before I started

² See King 2004 for detailed description and explanation about guided peer questioning.

explaining the task. Then, I explained (i) objectives - I want to help them develop a logical thinking through taking step-by-step process by explaining how they arrive at their conclusion so that they become effective problem solvers, (ii) group formation, (iii) how they worked on the worksheet in the group assigned in line with a think-pair-share technique, (iv) students were asked to show and to explain all steps that they needed to follow to arrive at each answer when they reported out solutions derived from the group analysis, (v) working in group helps them understand the problem well by allowing them to benefit from others, (vi) each group had the same context-rich problem, (vii) I walked around the room and observed each group and listened in on their conversations to monitor progress on the task and how the group was working together while they worked on their problems, and (viii) their problems were similar to one they would see on the next quiz as a final evaluation.

After I demonstrated the entire process of the assignment, the students broke into their groups. Groups were formed consisting of four members using colored (four: red, blue, green and yellow) and numbered (1 through 6) stickers that students chose out of a box (students did not see inside the box) upon entering the class. Members of a group had the same number but different colors. I believe that this color and number combination allows for multiple ways of setting up groups so that students cannot manipulate the draw and end up in the same group of friends for this exercise.

The group work was implemented as described below. After forming the group, each group was given three worksheets containing a context rich problem (two for group activity and one for submission). Students then started the think-pair-share process. Before making a pair in a group, each student was asked to work on the assignment by thinking about the problem individually to answer the question. Then, students with red and green stickers (subset 1) paired in a same number group and kept one worksheet while students with blue and yellow stickers (subset 2) in a same number group paired using another worksheet. Each pair discussed their work and considered necessary corrections if any. Next, a pair (subset 1) exchanged its thinking process and solutions with the other pair (subset 2) in the same group for feedback. Third, subset 1 and subset 2 formed a group to discuss their thinking and solutions, and make necessary corrections if any. Finally, all group solutions were given on the third worksheet in each group. About 20 minutes was given for this exercise; about 5 minutes for thinking individually, about 10 minutes for pair discussions, and remaining minutes for group discussions and developing a single answer for a group. This assignment was given to students about one week after the material in question was covered in the class.

While students worked on their assignments, I walked around the classroom to observe and monitor each group to ensure that everyone was participating in line with the four key elements for cooperative learning. I ensured that each group was getting everyone's input on key information in the problem, swapping roles of calculating and recording, and sharing parts of the answer to reach a final result. I listened in on their conversations to monitor progress on the task and how the group was working.

To end the group work activity, I turned off the ceiling lights in the classroom for the quiet signal. The third worksheet with group members' names was submitted by each group to me at the end of the group activity for an evaluation. Reporting out began by randomly chosen individual (color and number) in each group. Reporters were required to come to the chalkboard to present his/her answer to the problem including a process. They were also asked to identify where they got stuck in the problem and how they could overcome the impasse. Final evaluation was given on the next quiz using a different context rich problem. I handed out a sample answer of the worksheet to students at the end of the class or in the next class period for students' review.

2.4. Evidence Collected

Four types of evidence were collected, during and after the experiment, in order to analyze the effectiveness of the teaching methods on students' learning of economics; (i) I evaluated each student especially during the group discussion (think-pair-share) whether he or she could explain a process to arrive at group's answer, (ii) I reviewed each group's worksheet to judge if it includes the necessary steps to answer each question, (iii) To evaluate their work, I set the total point of 15 for the worksheet consisting of 3 parts with 5 points each, "What data are necessary", "Step-by step Process" and "Conclusion", and (iv) I gave students a quiz with a similar question for a final evaluation to see if students were able to solve, show necessary steps on the right path and got the right answers. I used the same point system for the quiz.

3. RESULTS

As students worked on the problem, I walked around the classroom and observed each group. The following evidence was typically obtained during the activities for the past four semesters.

During the period of "think" individually, the classroom was usually very calm and it seemed that students were confused about this new type of assignment and the class activity that they first faced. There was no specific and remarkable result observed. When a "pair-share" time came, everybody generally looked relieved because they could work with the pair or the group member to tackle the problem. I listened in on their conversations to monitor progress on the task and how the pair and the group were working together. During the initial period of "pair-share" time, they did not actively discuss with their pair about the problem and rather they asked me questions in general. Most of the questions I usually received initially were "What should I do?", "What is the question asking for?", "What formula should I use?", "I don't know how to do it", and "I am confused." It appears that these questions are typical technical questions and shows that they still stay with an idea just to solve a numerical question using a formula. I, rather than answering questions, tried to redirect the pair and the group in ways to find the answer by them. Most of the group usually did not recognize that this was a question about elasticity despite my hinting about elasticity and revenue in the class (a week ago). In the middle of "pair-share" time, a change of students' behavior to solve the problem in the group activity could be typically observed. That is, students were no longer shy in the discussion. They started participating in the activity positively. They spoke and listened to their partner or other group members, discussed the problem and played their role regardless if they were on the right track or not. A change of question that students asked me during the activity could also be usually observed. Now they asked me "Look at my work" and "Is our way of thinking on the problem on the right path or not?" This indicates that they started thinking logically by taking step-by-step process. Finally, some groups (usually 2-3 groups) generally recognized that it was a question asking elasticity. They found that the quantity demanded changed a lot and therefore the corresponding revenue changed a lot in case the demand was relatively more elastic. Other groups generally continued to be uncertain. At the end of the activity, I collected their worksheets. The average performance for each question of the context-rich problem for the past the four semesters was about 60% for "What data is necessary", about 55% for "Step-by-Step Process", and about 60% for "Conclusion."

One group, who could take step-by-step process and explain it logically, made a very impressive comment to me about the question of "Step-by-Step": "Requirement of a 'two-page-recommendation' actually forced us to take a step-by step process to explain their answers. If we were asked to just 'explain' like in the traditional question, it would not have encouraged us to explain logically." This comments suggests that two-page-recommendation in the context-rich problem is a key to achieve the purpose.

The other observation was that the four elements were nicely implemented in every class activity. Since there were only three copies of the worksheet for four people (one each for working in pair, the other one for submitting), a single answer was generated by a group, and each student took on a variety of roles (such as recorder, reporter and summarizer etc), positive interdependence was incorporated. Individual accountability was involved because each student was asked to take a “think-pair-share” process, he or she was randomly chosen from a group to report out a final answer, and a follow up quiz was taken individually. Equal participation was incorporated as each student participated in the same variety of tasks and he or she was asked to take a “think-pair-share” process in this exercise. Finally, given that each group worked for a problem simultaneously, shared parts of answer and generated a final answer for the worksheet, simultaneous interaction was also incorporated. Successful incorporation of these four key elements in the cooperative learning helped students’ further involvement into the class activity.

A week later, a quiz was given to each student. The quiz had a similar context rich problem but not identical. The purpose of the quiz was to see whether students could transfer their understanding of a core concept to a real economic problem practicably before applying traditional disciplinary tools and whether they were getting familiar with the “step-by-step” process. Average students’ performance improved in every activity: Average score for “What data is necessary” rose to about 85%, “Step-by Step” rose to about 80%, and “Conclusion” rose to “85%.” Any significant difference of average scores among the four semesters was not observed. This result shows some improvements in students’ understanding, thinking logically and applying economic theory to actual economic problem.

4. CONCLUSION

A traditional teaching method called “chalk and talk” may not help students to develop their ability to think logically and therefore students cannot be effective problem solvers. This paper examines the effect of a combination of two teaching methods: cooperative learning with a think-pair-share technique and a context rich problem on students’ learning economics. These teaching methods were applied to my Principles of Economics courses in the past four semesters to develop students’ ability to think logically so that they could become effective problem solvers. As shown in the previous section, some positive effectiveness of these teaching methods were found and observed. First, students’ behavior in the classroom changed, that is, students’ active involvement in the class activity was observed. Once students paired and formed a group, they positively participated in the activity. They were no longer shy in the discussion: They spoke and listened to their partners or other group members, and discussed the problem. Second, the questions that students asked me changed. Their questions are no longer “How to solve it?” Third, four key elements were implemented nicely. Students played their roles in line with four key elements as one of group members. This helped students to get involved in the activity. Fourth, students understood the problem better and their performance of the assignment improved in the quiz held one week after the activity. One major reason for this fact is an engagement in a think-pair-share activity, which allowed students to benefit from other group members. These findings indicate that the teaching methods help students (i) to change their learning style in the classroom from listening and taking notes given by a traditional “chalk and talk” to an activity where they pay more attention and get more involved, (ii) to learn that problem solving is linked to a theory (for example, connect two points - price and revenue corresponding to quantity demanded - and make a line through a theory - elasticity). (iii) to learn thinking logically and explaining their idea, thoughts and solutions logically to enhance their ability, (iv) to learn applying an economic theory to an actual economic problem, (v) to learn from other students and to

enhance them to be motivated to study, (vi) to learn having fun in economics, and (vii) to reach Franklin College's three expectations. This paper indicates that the teaching methods that I used help students to stand at and walk on the right path to become effective problem solvers, which enhance students' motivation to study and their engagement in learning further, and that the teaching methods are effective. This encourages me to continue incorporating these teaching methods into my economics courses and to use other teaching methods in the same course and other economics courses to develop students' ability. Although the effectiveness of a combination of cooperative learning with a think-pair-share technique and a context-rich problem is shown in this paper, one question always remains: There are always some weaker students left behind. How can we help them? This will be my future task.

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Table 1. Four Key Elements

Key Element	Description
Positive Interdependent:	<ul style="list-style-type: none"> • Students develop a sense that they are responsible for one another's learning in the group (Cooper 2003), that is, it can be structured by having a common goal, shared resources, shared rewards, and complementary roles and a student's success is dependent on the success of other students in the group (Bartlett 1995). • Also, no student alone can complete the task (Kagan 2003). • Therefore, two individuals are mutually positively interdependent if the gain of either helps the other (Kagan and Kagan 1994).
Individual Accountability:	<ul style="list-style-type: none"> • Each student is required to perform in front of a peer in the group (Kagan 2003). • It makes each member accountable for his or her own learning or contribution (Kagan and Kagan 1994). • Students are assessed individually concerning their mastery of course content and virtually, student's course grade should be based on individually-completed tests, papers and other assignments (Cooper 2003).
Equal Participation:	<ul style="list-style-type: none"> • Each student performs for about the same amount of time (Kagan 2003). • A series of individual share with partner, having students alternate and each in turn describing one event, should be done, that is, all students in a group are doing the same thing or elements that ensure that each student gets his or her turn (Kagan and Kagan 1994).
Simultaneous Interaction:	<ul style="list-style-type: none"> • It occurs in a classroom when there is more than one active participant at a time, and it increases the number of students actively involved at any one moment and thus the amount of active participation time per student (Kagan and Kagan 1994).

Table 2. Context Rich Problem

You are an economic consultant in the sales department of Indianapolis Colts' Stadium which has an exclusive right to sell soft drinks at Colts' games. One day, your boss (general manager of the department), who is well educated but has not taken any economics courses, has asked you to write two-page-recommendation about how to increase sales revenue of soft drinks at the games. The boss mentioned to you "I am thinking how to increase the sales revenue from selling soft drinks as much as possible." He continues "Should I raise the price to increase the revenue or should I lower the price to increase revenue?" Explain what data you need to collect and how you use it for this purpose. Then, write two-page-recommendation to your boss.