International Journal of Managerial Studies and Research (IJMSR)
Volume 2, Issue 10, November 2014, PP 166-172
ISSN 2349-0330 (Print) & ISSN 2349-0349 (Online)
www.arcjournals.org

Application of the Jigsaw Cooperative Learning Method in Economics Course

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Abstract: *The aim of this paper is to investigate the impact of Jigsaw cooperative learning method on students' learning performance in Economics. Data of 127 students enrolled from two classes are collected in spring semester in 2014. Empirical findings support that Jigsaw cooperative learning method benefits students' academic achievement and knowledge retention in terms of the increase in mean scores and the decrease in standard deviation of scores.*

Keywords: *Jigsaw Learning Method, Cooperative Learning, Economics Course*.

1. INTRODUCTION

In recent years, teaching methods and techniques have gradually changed from teacher centered teaching methods toward modern student centered teaching methods. Therefore, studies involving cooperative learning have emerged as an internationally important area of social science research among researchers (Slavin, 2011). Cooperative learning is one kind of student-centered approach different from traditional pedagogy centered on teachers.

Cooperative learning methods are proven to benefit students' learning in many ways. For instance, cooperative learning approaches have been found to positively impact the cognitive and affective outcomes, academic achievement and knowledge retention (Tran & Lewis, 2012; Johnson & Johnson, 2009, and Tran, 2014). As Johnson and Johnson (1989) mentions, the goal of cooperative learning seeks to develop positive interdependence, face-to-face interaction, individual accountability, social skills and autonomous group processing. Bratt (2008) figures out that cooperative groups enhance students' social competence, foremost their ability to collaborate with peers. Lazarowitz, Hertz-Lazarowitz, and Baird (1994) suggest that cooperative learning methods improve academic achievement among students. Aronson and Patnoe (1997) support that students will develop more empathy, in particular towards weaker students as a result of cooperation learning. Manuel et al. (2011) provide empirical evidence that the cooperative learning methodology provides some improvement in the teaching of statistical courses.

Different kinds of cooperative learning techniques have been conducted in different settings of education. Such techniques contain Jigsaw grouping, learning together, teams-games-tournaments, group investigation, student team achievement division, and team accelerated instruction. Among them, Jigsaw learning method breaks away from the traditional structure based on memorization. It introduces students to the logic of scientific research, as well as developing their capacity for continuing learning. It is hence expected that Jigsaw learning method facilitates students' learning.

Our course is Economics. The content of Economics is generally regarded by students as difficult. For the subject of Economics, traditional teacher-centered instruction is generally utilized. However, in comparison with cooperative learning techniques, Tran (2014) states that lecture-based teaching tends to be less effective to the demands of high rates of cognitive and affective outcomes (Slavin, 2011). In addition, more and more studies support the advantages of cooperative learning. Accordingly, we attempt to apply one of the cooperative learning models called Jigsaw learning method in Economics course and investigate the impact of Jigsaw learning

method on students' academic achievement. We expect to offer gains for students' learning in Economics by employing different pedagogy.

Data of 127 students form two classes enrolled in Economics in 2014 spring semester are collected. These students are divided into two matched groups of 51 for the control group using lecture-based teaching and 76 for the experimental group employing Jigsaw cooperative learning. All students under study are taught by the same lecturer.

The results show that pretest outcomes are identical between the experimental group and the control group. However, after Jigsaw learning method is utilized, students who are instructed using cooperative learning achieve significantly higher scores of post tests on the achievement as well as knowledge retention than do students who are instructed using lecture-based teaching. In addition, students of the experimental group exhibit smaller variation of scores than those of the control group. Our study hence supports the effectiveness of Jigsaw cooperative learning in Economics learning.

2. METHODS

2.1 Steps to Create a Jigsaw Classroom[1]

Jigsaw grouping is one type of cooperative learning comprising instructional methods in which instructors divide students into small groups and they then work together to help one another learn academic content (Slavin, 2011).

We adopt the following steps to conduct Jigsaw cooperative learning method. First, based on gender, background in senior high school and pretest scores, we diverse the group and divide students into 4-person Jigsaw teams. Hence, each student becomes a team member. The member with the highest pretest scores within the team is appointed as the team leader. Then, the assignment drawn from each chapter is segmented into 4 parts and each team member is assigned to be responsible for one segment.

Second, each team member has to preview quite well to become familiar with his/her assigned segment before an arranged teaching assistant session. Third, in the teaching assistant session before the class, one member from each Jigsaw team join other members assigned to the same segment to form temporary expert groups. An expert-group leader is chosen in terms of ability. Each expert group discusses the main points of their segment and to rehearse the presentations. After expert-group discussion, each member go back to his/her Jigsaw team and present the assigned part to the group. The rest members propose questions for clarification. A well-trained teaching assistant floats from group to group and observes the process. He/She makes an appropriate intervention only when any expert group or team is having trouble. Most of the time, the group/team leader handles this task.

Finally, at the end of the TA session, each team should write down summary of their assignment and a quiz on the material is given. Students' performance shown on the summary and the quiz generate individual as well as team scores and they really count.

2.2 Experimental Design

Our experimental study investigates the effects of Jigsaw cooperative learning method on students' performance over two months of instruction toward Economics subject. The sample includes 127 students from business school at Chung Yuan Christian University.

Students are randomly assigned into two groups. The first group follows the Jigsaw method while the second one employ a traditional methodology. The former is the experimental group while the latter belongs to the control group.

All students under consideration are taught by the same lecturer. As such, we control the potential bias that could have been introduced when different teachers teach different classes. The Economics course is taught primarily in lecture format with discussions. It is a three-credit course.

[1] As for how to manage a Jigsaw classroom, we refer to http://www.Jigsaw.org/steps.htm.

The course material, the lecture, the textbook, course schedule, tests, and discussions are controlled to be identical for students both in the experimental group and the control group.

The adoption of Jigsaw cooperative learning method is announced at the beginning of the semester. This emphasizes the importance of announcement at the start of the course and sticking to it. Failing to do so will increase student anxiety and lead to the impression that the pedagogy is capricious.

2.3 Null Hypotheses

Jigsaw cooperative learning method is expected to help students achieve greater academic benefits due to the following reasons.

First, according to the design and steps conducting Jigsaw cooperative learning method, team members are required to work together as a cohesive group to achieve shared learning objectives. Jigsaw method works as a problem-based learning approach. The first step is about task assignment. In class, the students organize themselves with four members into learning teams, termed as basic team. The instructor will provide the problem set with the operating principles, the goals to be met (rubrics) and the basic information structured in segments. Each member of the basic team must choose a segment and, using the materials posted on our specific website, called I-learning platform at Chung Yuan Christian University, and the materials from context book, organize his/her own learning, seeking additional information, laying out his/her subject area and structuring his/her presentation of the segment.

A team member must be responsible for their own learning and for the success of other team members' learning. Hence, they are teams with positive interdependence and it results in reciprocal interaction among individuals and promotes each group member's productivity and achievement (Yager, 2000; Slavin, 2011).

Second, since performance of the summary summarized by the team and the quiz given at the end of discussion session are counted, team members rationally respond to the evaluation incentive and will make efforts to accomplish the team's goal of obtaining high scores. This stimulates team members to interact verbally with one another on learning tasks (Johnson & Johnson, 2009), exchange opinions, explain things, teach others and present their understanding (Johnson, 2009). The promotive interaction benefits students' learning.

The third and fourth reasons supporting the advantages of Jigsaw for students' learning are related to self-learning and peer learning. About self-learning, each member acts as an expert. Each expert is encouraged to understand and gather all the information on the subject area and segment assigned. This facilitates further development of the self-learning process and a higher degree of organization in the information prepared by each member. About transmission and peer learning, each expert transmits information on his/her particular subject area to the other members. Thus he/she is responsible for facilitating learning by the rest of the team. Each member in turn receives structured information on the other subject areas, studied in the same way as his/her own. The objective of this step, in addition to summarizing and presentation skills, is for the team to learn to cooperate and to arrive at a reasonable level of understanding of each subject area and segment and a grasp of the subject as a whole. We state the third and fourth reasons in details as below.

Third, after expert-group discussion, each member is asked to go back to his/her team to present and teach the rest members his/her responsible part, individual accountability is hence enforced. It avoids the situation where one or two team members may do all the work while others do nothing. In addition, since the achievement of the team (summary task or quiz) depends on the individual learning of each team member, then team members suffer peer pressure to study hard in order not to become the black sheep within the team. They are also motivated to ensure that all team members master the material being studied (Slavin, 1996).

Fourth, Jigsaw cooperative learning method asks each member to teach others and elaborate ideas. As some researchers support, students retain more knowledge when they offer more explanation and elaboration to others (Zakaria, Chin, & Daud, 2010; Webb, 2008; Johnson & Johnson, 1989).

In a nutshell, in addition to enhancing academic achievement caused by the first three reasons, Jigsaw learning method improves knowledge retention supported by the fourth reason. A series of studies support the aforementioned corollary. Improvement of academic achievement could be shown on the difference, between the experimental group and the control group, in the mean of scores of chapter quiz held after the corresponding course with shorter time lag. Moreover, it could also be shown on the difference in variance of scores. Improvement of knowledge retention could be exhibited by comparing, between the experimental group and the control group, the mean or variance of scores of quiz held after the corresponding course with longer time lag. According to literature supporting and the aforementioned inference, we build up two types of tested hypotheses for the empirical work. The first type hypothesizes that Jigsaw cooperative learning method has no impact on students' academic achievement. The second type hypothesizes that Jigsaw cooperative learning method has no impact on students' knowledge retention. Each type is tested by mean difference as well as by variance difference in quiz scores. We hence formulate four null hypotheses.

H_0^{1a}: Between the experimental and control groups, the mean difference in scores of chapter quizzes held after course with shorter time lag is zero.

H_0^{1b}: Between the experimental and control groups, the variance difference in scores of chapter quizzes held after course with shorter time lag is zero.

H_0^{2a}: Between the experimental and control groups, the mean difference in scores of chapter quizzes held after course with longer time lag is zero.

H_0^{2b}: Between the experimental and control groups, the variance difference in scores of chapter quizzes held after course with longer time lag is zero.

2.4 Measurement of Learning Performance

In order to analyze the performance of Jigsaw learning method in Economics course, we work with quantitative analyses. By comparing students' scores between the experimental group and the control group, we would obtain quantitative evidence of the outcome of Jigsaw learning method. The quantitative outcome is captured by students' academic performance.

Before measuring students' academic performance, we held a pretest at the beginning of the course to control for prior knowledge that different students might have before entering a class. The score of this pretest plays an essential part of the common scores; hence, students are asked to take the test seriously.

Two specifications are used to measure a student's academic performance. The first one is the achievement which measures learning performance by each student's exam scores obtained one week later after the lecture is delivered. An alternative specification measures knowledge retention which utilizes the exam scores one month later after the lecture is delivered. We conduct two posttests to obtain scores for the first measurement and one posttest for the second.

2.5 Data

We collect data from 127 students who enrolled in the Economics course. These students are composed of two classes in spring semester in 2014. It is the first time for all of the students in these two classes to take Economics course at university. Based on pretests, the average scores students possess in these two classes are identical. We hence randomly assign one of them as the control group adopting traditional method without cooperative learning and the other as the experimental group adopting Jigsaw cooperative learning. There are 51 students in the control group and 76 students belong to the experimental group.

3. RESULTS AND DISCUSSION

Table 1 and 2 separately tabulate mean and variance comparison between the experimental group and the control group across tests.

Table 1. *Mean comparison between the experimental group and the control group across tests*

Tests	Group	Obs	Mean	t	Pr(|T| > |t|)*
Pretest	Non-Jigsaw	51	24.5098	0.4327	0.8655
Pretest	Jigsaw	76	24.15789	0.4327	0.8655
Posttest 1	Non-Jigsaw	51	59.92157	0.9997	0.0007
Posttest 1	Jigsaw	76	69.35526	0.9997	0.0007
Posttest 2	Non-Jigsaw	51	25.80392	0.9986	0.0029
Posttest 2	Jigsaw	76	30.5	0.9986	0.0029
Posttest 3	Non-Jigsaw	51	23.5098	0.9964	0.0071
Posttest 3	Jigsaw	76	28.15789	0.9964	0.0071

*Note: Ho: diff = 0 and Ha: diff ≠ 0

Table 2. *Variance comparison between the experimental group and the control group across tests*

Tests	Group	Obs	Std. Dev.	f	Pr(F > f)*
Pretest	Non-Jigsaw	51	11.08219	0.8983	0.6536
Pretest	Jigsaw	76	11.69279	0.8983	0.6536
Posttest 1	Non-Jigsaw	51	14.82544	0.9746	0.5326
Posttest 1	Jigsaw	76	15.01706	0.9746	0.5326
Posttest 2	Non-Jigsaw	51	9.353116	1.3915	0.0963
Posttest 2	Jigsaw	76	7.92885	1.3915	0.0963
Posttest 3	Non-Jigsaw	51	10.66091	1.5992	0.0322
Posttest 3	Jigsaw	76	8.430188	1.5992	0.0322

*Ho: ratio = 1 and Ha: ratio > 1

Pretest is held at the beginning of the semester when no experiment starts. Posttest 1 and posttest 2 individually test students' learning of the first topic and the second topic of the course materials delivered this semester. Posttest 1 is held one week later than the date when the first topic is instructed. Posttest 2 is held one week later than the date when the second topic is instructed. The results of posttest 1 and posttest 2 reveal students' academic achievement. Posttest 3 aggregately test students' learning of the first and the second topics. Posttest 3 is held around two months later than the date when the instruction of the first and second topics is accomplished. The results of posttest 3 captures students' knowledge retention.

The average points scored of Pretest for Jigsaw group is 24.5098 and that for control group is 24.15789. The standard deviation of scores of Pretest for experimental group is 11.08219 and that for control group is 11.69279. Based on t-test and f-test, the findings indicate that students in these two groups do not statistically perform differently in Economics course in terms of mean and variance before the application of the Jigsaw and traditional learning techniques. The reason for exhibiting the similar qualifications of students can be originated from having the similar potential or capability while being admitted to Chung Yuan Christian University.

After Jigsaw and traditional learning programs are applied, findings of posttests are different from those of pretest. The academic achievement in Economics course has been compared in terms of Posttest 1 and 2. According to the results, the average point average of the experimental group where Jigsaw technique used in cooperative learning is greater than that of the control group. It is 69.35526 versus 59.92157 for Posttest 1 and 30.5 versus 25.80392 for Posttest 1. In addition, the difference is significant at a significance level of 1%.

We also investigate the difference in standard deviation of scores. For Posttest 1, there is no significant difference between the control group and the experimental group. However, the variance difference on the posttest becomes significant for Posttest 2. Students under Jigsaw cooperative learning possess less variation in quiz scores of Posttest 2. The standard deviation is 7.92885 for the experimental group while it is 9.353116 for the control group. The difference in standard deviation of Posttest 2 is significant at a significance level of 10%. It seems that students more uniformly converge to a specific level of performance through the cooperation learning process.

Posttest 3 represents knowledge retention since it is held about two months after the related topics had been taught. The mean is 23.5098 for the control group while it is 28.15789 for the experimental group. The standard deviation is 10.66091 for the control group while it is 8.430188

for the experimental group. A statistically meaningful difference in mean and variance of scores of Posttest 3 between experimental and control groups is found. According to these findings, average success in knowledge retention of the experimental group is found to be higher than that of the control group.

The findings of this study is in agreement with other studies concluding that Jigsaw technique used in cooperative learning is found to be effective. The reason for the experimental group to have a higher success than the control group in Economics course can be said to be due to the fact that students, having lived through the learning processes themselves, have formed real learning experiences since they applied the Jigsaw technique themselves, researching and discussing the topics in depth (Kilic, 2008).

4. CONCLUSION

Students gradually change from passive learning toward active learning and one of the purpose of the modern education practices is to help students acquire critical and creative thinking. Following this trend, cooperative learning in one practical method which is used to increase motivation and progress in classes. It also increases self-confidence, improves communication skills and increases active participation in the education process.

In Jigsaw classroom, students develop active learning by helping each other learn. Jigsaw technique has been proven to be effective in the development of critical thinking process of the students and in the learning process of the theoretical courses such as general chemistry laboratory course (Mark et al., 1991). However, Economics is generally delivered by traditional method which is difficult to stimulate active learning. This paper hence attempts to adopt Jigsaw cooperative learning to benefit students' learning.

Our empirical findings support that we reach the goal. It was observed that before the related sections were taught, the pretest average scores and the standard deviation of scores of the control and Jigsaw groups are close to each other. However, once Jigsaw cooperative learning is conducted, students through the experiment show better academic achievement and knowledge retention measured by three Posttests in terms of mean and standard deviation.

We expect that our attempt could produce some advantages for students listed below. First, the use of the Jigsaw method allows students to gain in terms quantitative measurements. Second, the adoption of a problem-based learning approach facilitates meaningful learning in which students progressively build solutions on the basis of the basic tools learned previously. Third, Jigsaw learning method represents a challenge for students, who have to undertake a guided search for information, assimilate that information and organize it for their classmates. The need to cooperate with classmates and peer learning increase flexibility and student involvement in the learning process. Our empirical work support the first advantage and further work is needed to clarify the rest two advantages of Jigsaw cooperative learning.

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