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Cooperative Learning in a Passive Learning Environment: A Replication and Extension

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Abstract

This study replicates Hwang et al. (2005) with a different cohort of accounting majors. This study also extends Hwang et al.'s (2005) article by exploring the effectiveness of employing cooperative learning pedagogy to enhance students' learning outcomes at both the application level and analysis level of knowledge (Bloom 1956). Different from the original paper, this study evaluates participants' learning outcomes using cases with supporting calculations, instead of multiple-choice questions. Overall, this study finds that cooperative learning is a more effective pedagogy than traditional lecture for students who were raised and educated in a passive learning environment. Limitations and possible directions for future research are also discussed.

Keywords

cooperative learning; passive; learning environment

INTRODUCTION

In passive learning environments, the traditional lecture method continues to dominate accounting education.[1] In such an environment, instructors verbalize information to passive students who are spectators, rather than participants, in the learning process. Conducting an experimental study, Hwang et al. (2005) found significant results regarding the effect of cooperative learning pedagogy on learning outcomes in Hong Kong, which is a typical passive learning environment. Because few studies reported in U.S. have been done in an educational environment outside of the U.S., it is warranted to replicate and extend Hwang et al/s (2005) study. Successful replication of the original study offers additional evidence to educators regarding the effectiveness of cooperative learning and will strengthen their confidence in implementing this teaching method in a passive environment. As Lindsay and Ehrenberg (1993) stated:

> Methodological authorities generally regard replication to be a crucial aspect of the scientific method. The right kind of repetition means that a previous result will have its scope extended. It leads to generalizable results, rather than merely to the isolated and

> uncertain things ... If the characteristic feature of scientific knowledge is that a result has to be repeatable, it must involve more than one set of data.

To replicate Hwang et al. (2005), we conducted this experiment in the same passive learning environment (Hong Kong) with a different cohort of accounting majors. We also experimented on the same accounting topic (earnings per share) and used the same investigation model, which was developed by Sharan and Hertz-Lazarowitz (1980). Different from the original paper, this study extends the original study in two aspects: (1) cross-examining the effectiveness of cooperative learning at both the analysis level and application level of Bloom's taxonomy of knowledge (Bloom 1956), and (2) using cases with supporting calculations, instead of multiple-choice questions, to assess the participants, learning outcomes.

This study replicates the findings reported in the Hwang et al. (2005). Specifically, empirical results indicate that participants who were taught using a cooperative learning approach are able to acquire more accounting knowledge at both the application level and analysis level than those taught using a traditional lecture method.

The remainder of this paper proceeds as follows. Research hypotheses are presented in the next section. In the third section, we discuss research methodologies. In the fourth section, we present empirical results. Finally, we conclude the study by discussing limitations and offering directions for future research.

HYPOTHESES DEVELOPMENT

The extant accounting literature has documented mixed results regarding the effect of cooperative learning pedagogy on students' learning outcomes (e.g., Ravenscroft et al. 1995; Hite 1996; Ciccotello et al. 1997; Ravenscroft et al. 1997; Ravenscroft et al. 1999; Lancaster and Strand 2001).[2] To offer additional insights to the literature, Hwang et al. (2005) examined the effectiveness of employing cooperative learning to teach accounting in a passive learning environment. Their study has shown that students who were raised and educated in such an environment could obtain more knowledge by using cooperative learning pedagogy than those who were taught using a lecture method. If such results can be replicated with a different cohort of accounting majors in the same environment, then we expect that:

> HI: Participants in the cooperative learning group will outperform those in the traditional lecture group based on their individual test scores.

In addition, this study expands Hwang et al. (2005) by cross-examining the effectiveness of

cooperative learning pedagogy on knowledge acquisition at both the application level and analysis level. According to Bloom (1956), application requires students to use abstractions in particular and concrete situations. The abstractions may be in the form of general ideas, rules of procedures, or generalized methods, and may also be technical principles, ideas, and theories that must be remembered and applied. Analysis, on the other hand, requires students to break down theoretical material into its constituent elements such that the relative hierarchy of ideas is made clear and the relations between the ideas expressed are made explicit. Moreover, analysis is intended to clarify the relationship, to indicate how the relationship is organized, and to describe the way in which the relationship manages to convey its effects. If cooperative learning is a more effective pedagogy than traditional lecture for students acquiring accounting knowledge in a passive learning environment, then we predict that:

> Hla: Participants in the cooperative learning group will outperform those in the traditional lecture group when they are required to apply knowledge to solve accounting problems.

Moreover:

> Hlb: Participants in the cooperative learning group will outperform those in the traditional lecture group when they are required to analyze accounting-related scenarios.

RESEARCH METHODOLOGY AND EMPIRICAL RESULTS

Research Methodology

In this study, we employed a 2 x 2 between-subjects experimental design with two independent variables: teaching methods (cooperative learning versus traditional lecture) and knowledge levels (application level versus analysis level). The experiment was conducted during the spring semester of 2005. Participants were accounting majors who attended a major university in Hong Kong at the time of the experiment. The topic used in the investigation was earnings per share (EPS). Two non-author instructors who were not aware of the study's research hypotheses conducted the experiment. Each instructor conducted one session by using cooperative learning pedagogy and the other session by employing the traditional lecture method.

All four sessions—two cooperative learning groups and two traditional lecture groups of the experiment took place on the same day.[3] Each instructor first conducted the cooperative learning session, followed by the traditional lecture session. Similar to what has been reported in the literature, participants, learning outcomes were assessed individually (e.g., Peek et al. 1995; Ravenscroft 1997; Hwang et al. 2005).[4] Such an arrangement mitigates the free-rider problem. Following Cottell and Millis (1993), instructors administered the assessment at the end of the experiment under a noncompetitive, criterion- referenced grading system.

Instructors randomly distributed two sets of outcome assessments to students in each experimental session. One set of assessments was designed to measure participants, application level of knowledge, while the other set of assessments was used to evaluate participants' analysis level of knowledge. Participants in all sessions answered questions immediately after the completion of the experiment based on the scenarios portrayed in the case. Upon completion of the assessment, participants worked on debriefing questions. As this study is a replication, we followed the research design and experimental procedures described in Hwang et al. (2005).

The outcome assessments were designed according to the knowledge levels defined by Bloom (1956). The application-level assessment included questions for which the participants had to apply knowledge learned in the subject directly to solve questions, while the analysis-level assessment required participants to solve the application-level questions first and then answer several additional questions by analyzing the accounting issues stated in the case. With reference to the examples of application-level and analysis-level questions in an accounting textbook,[5] we first designed the application-level case and questions and then added several questions to assess participants' analysis-level knowledge. Finally, we used a debriefing questionnaire to collect participants5 demographic information, such as gender and overall grade point average (GPA).

Ten accounting seniors who took the intermediate accounting course one year prior to the experiment were recruited to test the clarity of the research instrument. Based on their comments, we further modified the case scenarios and questions prior to the experiment.

As this study is a replication, we followed Hwang et al. (2005) by adopting the group investigation model developed by Sharan and Hertz-Lazarowitz (1980).[6] Prior to the experiment, the research team made several careful decisions, such as selecting non-author instructors for the experiments, choosing the topics of the study, determining the length of the experiment, and developing the handouts for the experiment.[7]

The instructors who conducted the experiment had five years' and three years' teaching experience, respectively, and had taught intermediate accounting during the previous three years. Participants received handouts with six subtopics in EPS,8 and the research team determined the amount of time for instructors to go over each subtopic. Also, the research team discussed the experimental procedures in detail with both instructors prior to the experiment. Participants in cooperative learning and traditional lecture went over the same subtopics with the exact same examples. All sessions of the experiment lasted for three hours with a ten-minute intermission.[9]

Participants were assigned randomly to either a cooperative learning or traditional lecture session.[10] For those in the cooperative learning sessions, the research team randomly assigned students to

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form small groups of four to six individuals.[11] There were 11 groups in the cooperative learning sessions. At the beginning of the experiment, all participants were informed that there would be an individual assessment at the end of the session.

Because the outcome assessment of the experiment was not part of a participant's grade, we used a monetary reward to motivate participants to remain focused during the assess¬ment.[12] Participants in the experiment were paid based on the score earned on the outcome assessment.[13] For each point earned, participants were paid HK$16, which is equivalent to U.S.$2. To ensure that the monetary incentive was effective, we asked each participant to rate, on an 11-point scale (1 = no difference, 11 = definitely more), whether the monetary incentive provided in the experiment had motivated him/her. The result indicated that the monetary incentive was moderately effective, and the difference between the traditional lecture group and the cooperative learning group was not significant ($t = 0.564$, $p < 0.574$).

Empirical Results

One hundred ten accounting students participated in the experiment. Seventy-four were female and 36 were male. The average overall GPA earned by the participants prior to the experiment of the traditional lecture group and cooperative learning group was 3.26 (standard deviation = 0.19) and 3.26 (standard deviation = 0.28), respectively. The difference in the overall GPA between the traditional lecture and cooperative learning groups was not significant ($t = 0.009$, $p < 0.993$). Moreover, we asked the participants to rate their level of attentiveness during the experiment on an 11-point scale (1 = not at all, 11 = totally). According to the ratings provided by the participants in the traditional lecture group and in the cooperative learning group, the difference in attentiveness between these two pedagogical groups was not statistically significant either ($t = 0.703$, $p < 0.484$). Descriptive statistics based on teaching methods (cooperative learning versus traditional lecture) and knowledge levels (application level versus analysis level) are presented in Table 1.

Analysis of Covariance (ANCOVA) results are presented in Table 2. The dependent variable of the ANCOVA model is a participant's individual score on the learning outcome assessment. The score could range from 0 (the minimum) to 10 (the maximum). Following the extant literature (e.g., Ravenscroft et al. 1997; Marcheggiani et al. 1999; Lancaster and Strand 2001; Hwang et al. 2005), we included the participant's overall GPA in the ANCOVA model as a covariate because GPA may affect the variances of a participant's learning outcome.

After controlling for a participant's overall GPA, both the teaching method (TM) and knowledge level (KL) are significant in explaining the participants' scores on the outcome assessment, with F-values of 23.392 ($p < 0.001$) and 9.597 ($p < 0.002$), respectively. Because two instructors conducted the experiment and each instructor had one cooperative learning session and one traditional lecture

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session, we examined the possible main effect of the Instructor (I) (e.g. Marcheggiani et al. 1999; Hwang et al. 2d○5). The ANCOVA results indicate that Instructor did not significantly affect the participants' scores (F-value =1.455, $p < 0.116$). In addition, Instructor did not significantly interact with either the teaching method (TM x I) or the knowledge level (KL x I).

TABLE 1
Descriptive Statistics

	Traditional Lecture			Cooperative Learning			
	Application	**Analysis**	**Total**	**Application**	**Analysis**	**Total**	**Overall**
Gender							
Female	19	19	38	24	12	36	74
Male	6	12	18	7	11	18	36
Total	25	31	56	31	23	54	110
Overall GPA							
Minimum	2.90	2.85	2.85	2.68	2.65	2.65	2.65
Maximum	3.52	3.67	3.67	3.66	3.77	3.77	3.77
Mean	3.25	3.27	3.26	3.22	3.31	3.26	3.26
Standard deviation	0.20	0.18	0.19	0.25	0.31	0.28	0.24
Attentiveness							
Minimum	5	2	2	5	3	3	2
Maximum	11	11	11	11	11	11	11
Mean	8.44	8.21	8.31	8.69	8.43	8.58	8.44
Standard deviation	1.69	2.58	2.20	1.47	1.86	1.63	1.94
Monetary incentive							
Minimum	1	1	1	1	3	1	1
Maximum	11	11	11	11	10	11	11
Mean	8.04	7.62	7.81	7.97	6.90	7.52	7.67
Standard deviation	2.73	2.97	2.84	2.50	2.39	2.49	2.67
Assessment score[a,b]							
Minimum	2.80	1.30	1.30	3.80	4.30	3.80	1.30
Maximum	10.00	9.30	10.00	10.00	10.00	10.00	10.00
Mean	7.35	5.76	6.47	8.72	8.01	8.42	7.43
Standard deviation	2.49	2.42	2.55	1.24	1.75	1.51	2.31

[a] The assessment score reported in this table is a raw, not a covariate-adjusted, score.
[b] The difference in the assessment scores between the traditional lecture and cooperative learning groups is significant ($t = 4.893$, $p < 0.001$).

Each participant's overall GPA was obtained from the registrar's office prior to the experiment (the maximum GPA is 4.0). At the end of the experiment, participants were asked to rate their level of attentiveness during the experiment (1 = not at all, 11 = totally). Using the same scale, participants also reported whether the monetary incentive motivated them to remain focused when answering questions (1 = not at all, 11 = totally). The assessment score could range from 0 (the minimum) to 10 (the maximum).

As HI predicted, participants in the cooperative learning groups outperformed those in the traditional lecture groups, measured by their scores on the outcome assessment. As presented in Table 1 and Table 3, the results demonstrate that participants in the cooperative learning group performed significantly better than those in the traditional lecture group. The difference in the average scores between the two groups of participants is statistically significant at a 1 percent level. Hence, HI is supported.

We examined the simple effect of the teaching method (traditional lecture versus cooperative learning) at each of the two knowledge acquisition levels (application and analysis). Given that a participant's overall GPA is a significant covariate in the ANCOVA model ($F = 6.487$, $p < 0.006$), we

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present the covariate-adjusted (marginal) mean scores between the two groups in Table 3. For those who answered the application level of questions, we found that the participants in the cooperative learning group outperformed those in the traditional lecture group. The difference between them is statistically significant ($p < 0.005$). Therefore, Hla is supported.

Hypothesis lb predicts that the participants in the cooperative learning group would outperform those in the traditional lecture group when they were asked to answer analysis level questions. The statistics reported in Table 3 confirm this prediction. The difference in scores on the outcome assessment between the two groups of participants is statistically significant ($p < 0.001$). This result suggests that cooperative learning enhances participants' ability to solve analysis level questions that require a higher level of understanding of the subject matter.

TABLE 2
Overall Result of ANCOVA Analysis

Dependent Variable: Score on Learning Outcome Assessment

Source of Variance	Sum of Square	d.f.	Mean Square	F-value	p-value
Main Effects					
Teaching method (TM)	90.498	1	90.498	23.392	0.001
Knowledge level (KL)	37.129	1	37.129	9.597	0.002
Instructor (I)	5.628	1	5.628	1.455	0.116
Covariates[a]					
GPA	25.096	1	25.096	6.487	0.006
Interaction Effects					
TM × KL	2.409	1	2.409	.623	0.216
TM × I	4.762	1	4.762	1.231	0.135
KL × I	5.894	1	5.894	1.523	0.110
TM × KL × I	9.911	1	9.911	2.562	0.057
Residual	390.743	101	3.869		

Adjusted $R^2 = .277$

[a] The covariate is the overall GPA of the participants before the experiment.

There are two teaching methods (cooperative learning and traditional lecture) and two knowledge levels (application and analysis) being considered in this study. Two non-author instructors conducted the experiments. Each instructor conducted one session of the experiment using cooperative learning pedagogy and the other session using a traditional lecture method.

TABLE 3
Comparison of Participants' Mean Test Scores[a]

Knowledge Level	Teaching Method: Traditional Lecture	Teaching Method: Cooperative Learning	Overall Average
Application	7.399 (25)	8.726 (31)	8.417[b]
Analysis	5.820 (31)	7.930 (23)	6.469[c]

[a] All of the figures reported in this table are marginal (covariate-adjusted) means and they have been rounded to three decimal places. The number of participants is listed in parentheses.

[b] For participants who took the application-level assessment, the mean difference in test scores between the traditional lecture and cooperative learning group is statistically significant ($p < 0.005$).

[c] For participants who took the analysis-level assessment, the mean difference in test scores between the traditional lecture and cooperative learning groups is statistically significant ($p < 0.001$).

Knowledge levels (application and analysis) are defined based on Bloom's (1956) taxonomy. Definitions of teaching methods (traditional lecture and cooperative learning) can be found in accounting and education literature. The participants' test scores ranged from 0 (minimum) to 10 (maximum).

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CONCLUSIONS

This study replicates Hwang et al. (2005) with a different cohort of accounting majors who were raised and educated in a passive learning environment.[14] With little change in the educational environment of the experimental site in the three years between data collection for the two studies, successful replication of Hwang et al. (2005) confirms our expectation that cooperative learning pedagogy can be more effective in enhancing students' ability to acquire accounting knowledge than a traditional lecture method in a passive learning environment. In addition, this study extends Hwang et al/s (2005) study by exploring the effectiveness of using cooperative learning at different levels of knowledge within Bloom's (1956) taxonomy. The positive findings of this replication and extension are important because they should strengthen the confidence of accounting educators who teach in a passive learning environment in implementing this pedagogy to deliver accounting topics that have become increasingly more complex over the past two decades.

Limitations

There are several limitations to this study. First，the experiment was conducted in a single university in Hong Kong. Therefore, it is beneficial to re-examine the research issue by conducting large-scale experiments at different sites with a broader range of participants. Second, this study investigated the same financial accounting topic (i.e., earnings per share [EPS]), as that of Hwang et al. (2005). To validate the effectiveness of cooperative learning pedagogy, it is essential to examine its effectiveness in teaching other accounting topics (e.g., cost accounting or auditing). Finally, as a replication, this study, like Hwang et al. (2005), evaluated the learning outcomes based on one lesson and immediately after the experiment. Therefore, it would be beneficial for researchers to assess participants' learning outcomes at various stages of the learning processes, such as at midterms or final examinations.

Directions for Future Research

Several areas deserve consideration in future research. First, the interdependency among group members could be a critical factor in influencing the empirical results of studies in this line of research. Since the incentive to cultivate group interdependency among college- age students is still unclear (Ravenscroft 1997), and because there are several theories to explain this interdependency (Ravenscroft et al. 1999), it is beneficial for researchers to explore the effect of this variable in future studies. Second, it is unclear whether and how an instructor's qualifications, such as teaching experience, personality, teaching style, and pedagogy-related trainings would affect a student's learning outcome when implementing cooperative learning in the classroom. Therefore, researchers may consider incorporating these factors in future studies. Finally, researchers could expand the scope of this study into a multiple-country study by explicitly considering the effect of national culture on learning outcomes.

FOOTNOTES

1. Passive learning can be defined based on the learning environment in the classroom. According to McManus (2001), students are assumed to enter the course with minds like empty vessels or sponges to be filled by knowledge in a passive learning environment.
2. For a detailed literature review and theories on cooperative learning, please refer to Ravenscroft et al. (1999).
3. Conducting all sessions on the same afternoon allowed us to control the potential information leakage of experimental contents from one session to another that could have led to favorable outcomes in the cooperative learning group.
4. For instance, Peek et al. (1995) and Ravenscroft (1997) contended that students who learned the course material in a group setting should be tested on an individual basis. A similar argument has been made by Hwang et al. (2005).
5. To develop the case scenarios and required questions for the experiment, we adapted items from Weygandt et al/s (2003) Financial Accounting textbook. The textbook has provided Bloom's taxonomy table and classified end-of-chapter problems and cases according to Bloom's taxonomy of learning skills and objectives (Weygandt et al. 2003, preface, p. xii).
6. This model includes the following steps: (1) the class is provided a general area of study; (2) students form groups (own choice or assigned); (3) groups are assigned a subset of a general area for analysis; (4) groups plan investigation (assigned tasks and independent work); (5) students first teach one another, followed by a group presentation; (6) students are required to learn all materials followed by a performance evaluation.
7. According to Peek et al. (1995), he instructor may have to develop materials specifically for the lesson. Also, it may be possible to use problems directly from a textbook or to make very simple modifications. The task has to be structured so that group members are positively interdependent. Moreover, there must be an element of individual accountability so that each individual member of the group is motivated to participate.
8. The handout covered theories, procedures and illustrative examples. The six subtopics of EPS learned by the groups were adopted from Hwang et al. (2005) study.
9. Since it takes time for the instructors to draw randomly the presentation team and for the team to determine the presenter, it took slightly more than three hours for the cooperative learning section to complete the experiment.
10. Prior to the experiment, participants were asked to draw a random number from 1 to 4. According to the number drawn, students were assigned to one of the experimental sessions.
11. Rau and Heyl (1990, 146) suggest that groups should range in size from four to eight students, depending on the size of the class.
12. At the experimental site, the factors to be considered in grade assignment are tightly controlled. Any assessment without pre-announcement to students cannot be included in grade computation. To prevent students from engaging in preparation before the experiment, which

could have confounded the results of this study, no announcement was made regarding the experiment or any assessment involved at the conclusion of the experiment. As a result of these constraints, the research team decided to use monetary rewards to motivate participants. The same mechanism was implemented in Hwang et al.'s (2005) study.

13. Using the monetary reward scheme in Hwang et al/s (2005) study, each participant in the traditional lecture sessions was paid based on the individual score he/she earned on the outcome assessment. For participants in the cooperative learning sessions, the monetary reward was calculated based on 70 percent of the individual score and 30 percent of the group average score.
14. The data used for the empirical results reported in Hwang et al. (2005) was collected during spring semester of 2002. Three years later, the authors conducted experiments during which data was collected for this study.

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