

Different cooperative learning grouping and problem-based instruction in promoting students' learning performance

Ruey-Gwo Chung†, Chieh-Ling Lo‡, Ting-Hao Hsieh†, Wan-Ling Chang* & Yang-Chih Hu**

Hsiuping Institute of Technology, Taichung, Taiwan†

Mingdao University, Changhua, Taiwan‡

Chaoyang University of Technology, Taichung, Taiwan*

National Sha-Lu Industrial Vocational High School, Taichung, Taiwan**

ABSTRACT: The aim of this study was to explore different cooperative learning grouping and problem-based instruction in the business administration department of a technology institute or university for enhancing students' learning performance, with the use of a marketing planning course as an example. Results of the study found that gender had an obvious effect on students' cooperative learning attitude. In addition, after being taught by cooperative learning and problem-based instruction, *homogeneous* groups showed obvious improvement in teamwork competence and learning achievement; after being taught by cooperative learning and problem-based instruction, the performance of *heterogeneous* groups was improved in terms of cooperative learning attitude, problem-solving attitude, teamwork competence and learning achievement.

INTRODUCTION

With the onset of the knowledge-based era, the business environment has become more complex, challenging and competitive. The education system is deeply affected by this trend. The traditional subject-based teaching method is teacher-centred, which mainly focuses on imparting knowledge and memorisation instead of training students to think independently, to collaborate with others, and to apply knowledge to solve real-life problems [1][2].

Therefore, for meeting the needs of the ever-changing environment, the purpose of teaching is not only to pass on knowledge, but also to cultivate in students their ability to cooperate, collect, analyse, aggregate, judge and apply the knowledge they learn to finding solutions to a problem [3][4]. To attain these goals, cooperative learning and problem-based learning are two of the most useful and popular methods.

Cooperative learning promotes students' teamwork competence; improves their learning effectiveness and cultivates their ability to improve the effectiveness of the education system [5]. Cooperative learning also enhances students' abilities to think, problem-solve and apply knowledge, as well as foster their socialisation skills [6][7].

On the other hand, problem-based learning is a learner-centred environment, which models a way in which humans learn throughout their lives, as well as through the application of knowledge and skills to the process of solving problems [3]. Barrows and Tamblyn defined problem-solving learning as one kind of learning, which works through the process of understanding and solving problems to obtain results [8].

Besides this, according to information released from a meeting for technology institutes or university presidents in Taiwan, it is known that the number of high school graduates from a technological and vocational programme is more than that from an academic programme [9].

Students who major in business administration should recognise that the business environment today has become buyer-dominated. Having a well-done marketing plan, as a result of team effort, is essential to business in earning good profits. Therefore, this study has taken the students' marketing planning course in a technology institute or university as an example and has focused on these objectives:

- Formulation of cooperative learning and problem-based instruction.
- Revision of the marketing planning course teaching material.
- Execution of experimental teaching and observation.
- Exploration of results regarding different cooperative learning grouping and problem-based instruction in promoting students' learning performance.

LITERATURE REVIEW

Cooperative Learning

Cooperative learning, which is a structural and systematic teaching strategy, is popular in Europe and America. It assigns students into different groups who work together, encourage each other, and develop their active learning attitude and, hence, improve learning effectiveness [10-13]. Researchers have found that cooperative learning is helpful in promoting students' curriculum achievement, learning motivation, and interpersonal relationships [14][15]. Up to now, many models have been developed for cooperative learning and the following are common characteristics [6][14]:

- Heterogeneous students. Students who have different abilities or different demographic variables, such as sex, race, and social status are assigned to the same group to help, direct and learn together.
- Individual accountability. Each member in the group knows that he/she has the responsibility to make the group successful.
- Group-processing. The group's performance is based on members' interaction, and it is important to give students enough time to evaluate the team operation and interpersonal skills used.
- Collaborative social interpersonal skills. Each member in the group has task work (professional knowledge) and team work (collaborative social interpersonal skills) to learn. The collaborative social interpersonal skills include leadership, decision-making, trust-building, communication, conflict management, and so on. These skills are crucial for group productivity.
- Face-to-face interaction. The teacher directs students to work together by providing assistance, exchanging resources and giving feedback to achieve group objectives.
- Positive interdependence. Each member in the group is collaborating to complete group tasks instead of competing with each other. Only group success is a real success.

In the current study, the Student Teams Achievement Divisions (STAD) model was used, which was developed by Slavin in 1978. The STAD model has five process factors [14][16][17], including:

- Class presentation. Before group activity begins, the teacher has to introduce some important concepts and declare the goals and meanings for each unit.
- Group learning. Based on students' prior learning performance and other personal characteristics (such as sex, race and social status), the teacher assigns 2-6 students to the same group in order to learn together and achieve learning objectives.
- Quizzes. Every couple of weeks, the teacher will hold an in-class test to evaluate each student's learning performance.
- Individual improvement scores. The more individual improvement, the more the group's performance is enhanced.
- Team recognition. The teacher praises the individual student, as well publicly praising the high performance groups.

Problem-Based Learning

Problem-based learning is learner-centred. Students who learn in the same group will explore the assigned problem actively and develop a plan to find solutions. The teacher instructs students to learn by themselves, instead of having a lecture or providing them with solutions. Barrows mentioned that there are some characteristics in student-centred problem-based learning and learning in small groups in that the teacher is a facilitator, a co-learner, a coach and a guide to learning [18]. Ill-structured problems are the key to stimulate students to learn. The problem is the vehicle to develop students' problem-solving skills and to acquire new knowledge through self-directed learning. The problem-based teaching model used in this study is adopted from Barrows [19]. It consists of five stages:

- Problem analysis stage. The teacher provides many questions to each group to clarify the problems it has to solve.
- Information gathering stage. Learners use the self-directed method to collect related information about the problem.
- Synthesis stage. Learners discuss with each other and evaluate the information they collect.
- Abstraction stage. Learners develop solutions to the problem and summarise their learning.
- Reflection stage. Learners self-evaluate and use the evaluation from colleagues, so as to evaluate their own learning process.

EXPERIMENT DESIGN

The quasi-experimental design was developed to evaluate the strategy of cooperative learning and problem-based teaching. Students were chosen for the study from two classes in the Department of Business Administration at the Overseas Chinese Institute of Technology, Taiwan. They took the same course but in two different class sessions in the same semester. Based on previous curriculum scores, one of the two classes of students was assigned into the *homogeneous* group, while those in the other class were labelled *heterogeneous*. Homogeneity means students in the same group had less variable curriculum scores. But heterogeneity means there are large curriculum score variability for students in the same group. There were 9 groups in each of the two classes, with 53 students in the homogeneous class and 46 students in the heterogeneous class.

The research design is shown in Table 1, where X represents the treatment variable, i.e. cooperative learning and problem-based teaching method. Variables O₁ to O₄ stand for students' learning performance in the marketing planning course, and include cooperative learning attitude, problem-solving attitude, teamwork competence and learning achievement, respectively. These two classes had the same teacher and the same teaching material. The experimental teaching continued for 10 weeks in one semester, with 100-minute class time per week. These two groups were both pre-tested, administered a treatment, and then post-tested. Finally, with regard to data analysis, ANCOVA, ANOVA, and *t*-test from the statistical software package SPSS 12.0 were mainly used.

Table 1: Design of the experimental teaching model.

Group	Pre-test	Treatment	Post-test
Homogeneous	O ₁	X	O ₂
Heterogeneous	O ₃	X	O ₄

Note: X - Cooperative learning or problem-based teaching method.

Tools for Collecting Data

Tools used to collect data were demographic sheets, cooperative learning attitude questionnaires, problem-solving attitude questionnaires, teamwork competence questionnaires and learning achievement tests.

Demographic Sheet

In this sheet, one part collected students' information, including sex, numbers attending cooperative learning, membership of associations, attendance at association's activities and the positions held in association. The other part was for evaluating students' personal characteristics, including extraversion, urgency, neuroticism, agreeability, conscientiousness and intellectual openness [20]. Results of the reliability analysis for personal characteristics types showed that the Cronbach α value in each dimension was higher than 0.7.

Cooperative Learning Attitude Questionnaire

There were two dimensions in the questionnaire. One was social skill learning attitude, which measured attitude toward keeping interpersonal relationships. The other was work-skill learning attitude, which assessed attitude to learning effectively [13]. The reliability analysis results of pre-test and post-test for cooperative learning attitude showed that Cronbach α in each dimension was higher than 0.7, and the value of Cronbach α in post-test was higher than pre-test.

Problem-Solving Attitude Questionnaire

This questionnaire determined the confidence in problem-solving, escape style (the tendency for facing or escaping when solving a problem), and personal control (the degree by which an individual controls his progress or behaviour) [13]. The Cronbach α value of each dimension in pre-test and post-test was higher than 0.7.

Teamwork Competence Questionnaire

The teamwork competence questionnaire had 7 dimensions with 46 items, where the dimensions contained interpersonal communication (8 items); the goal setting and performance management (7 items); planning and task coordination (8 items); conflict resolution (6 items); characteristics of team members (8 items); formation and execution of cooperative and innovative ideas (4 items); and team problem-solving (5 items) [16][17]. The Cronbach α value of each dimension was higher than 0.7.

Learning Achievement Test

Table 2 shows the two-way specification table for learning achievement tests. Based on knowledge, comprehension, application, analysis, synthesis and evaluation level, the teacher designed 40 items to assess students' understanding of marketing strategy, competitive environment strategy analysis, consumer behaviour, market segment/position, product strategy, price strategy, place introduction and promotion. The KR-20 analysis was used in this study to deal with the pre-test data. In KR-20 analysis, the main principles for deleting items include discrimination higher than 0.3, and difficulty between 0.4 and 0.8. After students' pre-test data were processed by the KR-20 analysis, 25 items were reserved and then revised for the post-test.

TEACHING AND OBSERVATION

The 10-week experimental teaching schedule included: product plan, movie, marketing environment, strategic analysis of the business environment, consumer behaviour, market segment, price strategy, place strategy, product promotion set, and budget and control strategy. Lecture methods, discussion, case study, practice and group activity were determined by the teacher. Teaching plans were prepared in advance to demonstrate how to use cooperative learning

and problem-based instruction in promoting students' cooperative learning attitude, problem-solving attitude, teamwork competence, and learning achievement.

Table 2: Two-way specification table of the learning achievement test.

	Knowledge	Comprehension	Application	Analysis	Synthesis	Evaluation	Total
Marketing Strategy	1	1	2	3	2	1	10
Competitive Environment Strategy Analysis	1	1	2	1	1	2	8
Consumer Behaviour			1		3		4
Market Segment /Position	1	1					2
Product Strategy		2	2	2	2	1	9
Price Strategy		1	1		1		3
Place Introduction	1	1					2
Promotion			1	1			2
Total	4	7	9	7	9	4	40

The 100-minute class consisted of explanation of the steps of cooperative learning and problem-based instruction, a lecture and discussion on concepts, practices and cases, as well as group activity at the end. Knowledge sheet, observation sheet, class activity sheet, homework assignment, notebook, Internet and PowerPoint software were the major teaching materials. In addition, the teacher filled in the observation sheet to reflect the teaching quality and students' learning in class in every unit. The observation sheet could help the teacher revise his/her teaching on the cooperative learning and problem-based principle.

During the experimental teaching period, each class was equipped with two research observers to record students' learning behaviours every week. Each observer focused on one of the different groups being observed. The observer also chose two members from the same group, one being the most active and the other being the least active, and wrote down their behavioural changes from beginning to end. From the results of the 10-week schedule, it was found that although team members were unfamiliar with each other at the beginning, after applying cooperative learning and problem-based instruction in class, more teamwork competence was shown in most of the group members. From the records of the 10-week observation sheet, it was found that both homogeneous and heterogeneous groups showed a gradual improvement in teamwork competence. On the other hand, the most active student in each group a bigger improvement in teamwork competence, but the least active also improved his/her personal interaction skills with others.

RESULTS AND DISCUSSION

ANOVA analysis was used to test whether students' demographic variables have significant effect on their learning performance. Results showed that only gender had a significant difference on cooperative learning attitude ($p < 0.05$), with female students performing better than male. On the other hand, using ANCOVA analysis, it was found that different grouping methods had no obvious effect on the post-test of cooperative learning attitude, problem-solving attitude, teamwork competence and learning achievement. Further, Table 3 presents the results of *t*-test between pre-test and post-test in four learning performance dimensions for homogeneous and heterogeneous groups. In cooperative learning attitude and problem-solving attitude, there were significant differences between pre-test and post-test scores in heterogeneous groups ($t = -2.198$; $t = -3.113$). On teamwork competence and learning achievement, there were significant differences between pre-test and post-test scores in both homogeneous ($t = -3.846$; $t = -14.107$) and heterogeneous ($t = -2.140$; $t = -12.913$) groups. Meanwhile, the mean scores for the post-test in both groups were higher than those for the pre-test. It means that after being taught by cooperative learning and problem-based instruction, obvious improvement on most learning performance could be found in both of the two groups.

CONCLUSIONS

In this study, the authors evaluated and revised the teaching materials for the marketing planning course in a technology institute or university, and amended the cooperative learning and problem-based learning methods to provide a reference for teachers. Moreover, questionnaires were used for pre-testing and post-testing, and observers were assigned to monitor the behavioural changes of groups or individuals, which made this study more complete in both quality and quantity.

Table 3: Differences of learning performance between pre-test and post-test in the same group.

Learning performance	Group	Test	No	Mean	SD	t-value
Cooperative Learning Attitude	Homogeneous	Pre	53	3.809	0.262	-0.573
		Post	53	3.836	0.344	
	Heterogeneous	Pre	46	3.764	0.322	-2.198*
		Post	46	3.878	0.287	
Problem-Solving Attitude	Homogeneous	Pre	53	3.369	0.272	-1.534
		Post	53	3.445	0.396	
	Heterogeneous	Pre	46	3.291	0.353	-3.113**
		Post	46	3.445	0.346	
Teamwork Competence	Homogeneous	Pre	53	3.478	0.313	-3.846***
		Post	53	3.672	0.344	
	Heterogeneous	Pre	46	3.451	0.376	-2.140*
		Post	46	3.559	0.340	
Learning Achievement	Homogeneous	Pre	53	47.564	10.602	-14.107***
		Post	53	74.415	9.962	
	Heterogeneous	Pre	46	47.200	10.925	-12.913*
		Post	46	71.800	12.956	

Note: * $p < 0.05$ ** $p < 0.01$ *** $p < 0.001$

Besides this, from the data analysis, it was found that different cooperative learning and problem-based instruction promote the students' learning performance; heterogeneous groups showed more improvement in cooperative learning attitudes, problem-solving attitudes, teamwork competencies and learning achievement. In addition, according to students' opinions after the course ended, most showed a positive attitude. Finally, the duration of this study is one of the key factors in ascertaining whether cooperative learning and problem-based instruction could effectively enhance students' learning performance. Therefore, it is recommended that future researchers should have suitable experimental teaching periods with sufficient time for observing the effect of the teaching experiment.

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