

# When Creative Problem Solving Strategy Meets Web-Based Cooperative Learning Environment in Accounting Education

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## Abstract

*Background:* Facing highly competitive and changing environment, cultivating citizens with problem-solving attitudes is one critical vision of education. In brief, the importance of education is to cultivate students with practical abilities. Realizing the advantages of web-based cooperative learning (web-based CL) and creative problem solving (CPS) for learners in various aspects, many scholars have dedicated themselves to the study of CPS and Web-based CL. However, from a review of relevant literatures, it can be discovered that only a few of studies focus on the integration of CPS and Web-based CL. Thus, this study tried to integrate CPS and Web-based CL to the subject of accounting and explore the effects of this innovative teaching instruction on students' problem-solving attitudes.

*Aims:* The study aimed to explore the effect of applying an innovative teaching strategy - creative problem solving strategy on web-based cooperative learning environment in accounting course to promote students' problem-solving attitudes.

*Sample:* Students in three classes of the 4-year hotel management program were selected as research subjects. One class was assigned to the experimental group 1 (EG1), which was treated with 'creative problem solving (CPS) strategy on web-based cooperative learning (Web-based CL) method; another was assigned to the experimental group 2 (EG2), with 'Web-based CL' adopted; and the other was assigned to the control group (CG), with 'traditional lecturing' method adopted.

*Method:* The quasi-experimental method was conducted, and the collected data was analyzed by quantitative methods.

*Results:* The major results showed that the differences among the three classes reached the significant levels, and the problem-solving attitudes of the EG1 were significantly better than that of the EG2 and CG.

*Conclusion:* Before the experimental teaching, students in the three groups had significant differences in their problem solving attitudes. After the experimental teaching, the post-test results revealed that the difference among three groups in problem solving attitudes reached significant level. EG1 had the highest performance. Moreover, EG1 had significantly outperformed EG2 and CG. However, no significant difference was observed between EG2 and CG.

**Keywords:** web-based cooperative learning, creative problem solving, accounting

## 在會計教育下當創造性問題解決法遇見網路合作學習環境

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### 摘要

**背景：**面臨高度競爭的環境，培育學生具備問題解決的態度是教育的重要課題。簡單地說，教育的重點是在培養學生具有實務能力。當理解網路合作學習法及創造性問題解決法的優點之後，許多學者紛紛在此兩方面的研究多所著墨。然而，從近幾年的文獻來看，整合創造性問題解決法及網路合作學習環境的研究卻相當缺乏，因此，本研究試著在會計課程上整合創造性問題解決法及網路合作學習環境，並測試其對於學生問題解決態度的效果。

**目標：**本研究旨在探討整合創造性問題解決法及網路合作學習環境於會計課程中，對於學生問題解決態度的效果。

**樣本：**四年級制旅館管理系的三個班級被選為研究樣本。第一個班級被分派為實驗組一，在網路合作學習環境下採用創造性問題解決法；第二個班級被分派為實驗組二，採用網路合作學習環境，第三個班級則為控制組，採用傳統的講述式教學法。

**方法：**本研究係採準實驗設計法，並運用量化統計方法求知研究結果。

**結果：**統計分析結果顯示三組學生達到顯著差異，實驗組一的問題解決態度顯著優於實驗組二及控制組。

**結論：**在實驗教學前，三組學生於問題解決態度上便有顯著的差異。而在實驗教學後，研究結果顯示，實驗組一在問題解決態度的表現上顯著優於實驗組二及控制組，但實驗組二及控制組間便無顯著差異。

**關鍵字：**網路合作學習、創造性問題解決法、會計

## Introduction

Huang and Lin (2000) pointed out that education can be delivered through three main methods, including cooperative learning (CL), competitive learning, and individual learning. CL refers to joint construction of knowledge by a group of people with a shared commitment to a common goal (Sharan, 1980; Bouton & Garth, 1983). Within a CL setting, the modules, which are available through a learning platform, systematically instruct students to learn more effectively by completing different tasks (Barbara, Wagner, Reimann, & Spiel, 2008). Moreover, in recent years, due to the advancement of Internet technology, the virtual environment constructed on the Internet has allowed the implementation of CL to be no longer confined to traditional classrooms. With the flexibility, interactivity, and boundlessness of the Internet, the conventional linear learning methods can be subverted. Students can not only learn at individual pace but also cross the boundaries of time and space to take part in group discussions. Therefore, many scholars have promoted the Internet as an ideal medium for CL, and web-based CL was originated in such background. Hoskins & van Hooff (2005) indicated that particularly university courses (such as lectures) within the curriculum of degree programs with large student number could benefit from introducing e-learning methods in a lasting manner and result in an improved quality of teaching. So far, many empirical studies have shown that web-based CL can effectively enhance students' learning effectiveness (Clinton & Kohlmeyer, 2005; Gabbin & Wood, 2008).

Creative Problem Solving (CPS) is a teaching strategy developed on the basis of problem solving abilities. CPS emphasizes that students' active

learning and problem-solving process can help develop critical thinking, allowing them to solve problems in a more efficient manner (Isaksen, Puccio, & Treffinger, 1993). If this strategy can be properly applied in school education, students' learning response, creativity, and problem-solving attitude can be benefited.

Facing highly competitive and changing environment, cultivating citizens with problem-solving attitudes is one critical vision of education. In brief, the importance of education is to cultivate students with practical abilities. Realizing the advantages of web-based CL and CPS for learners in various aspects, many scholars have dedicated themselves to the study of web-based CL and CPS. However, from a review of relevant literatures, it can be discovered that only a few of studies focus on the integration of web-based CL and CPS. Thus, this study aimed to integrate web-based CL and CPS to the subject of accounting and explore the effects of an innovative teaching instruction, CPS on web-based CL environment, on students' problem-solving attitudes.

## Literature Review

### Web-based Cooperative Learning (Web-based CL)

#### Cooperative learning (CL).

Boyce (2009) indicated that teachers should pay close attention to the type of instructional environment they implement, because it will convey what they value and it will have motivational consequences for their students. Nattiv (1994) described CL as a teaching method that allows students to be interdependent in learning, working, and role-playing when dealing with a shared goal and assigned task. Kagan (1994) identified six key concepts of CL. These concepts include teams, cooperative management, will to cooperate, skill to cooperate,

basic principles, and structures. The four Kagan basic principles could be identified with the acronym “PIES.” PIES stands for Positive Interdependence, Individual Accountability, Equal Participation, and Simultaneous Interaction (Kagan, 1994). Johnson and Johnson (1999) identified five criteria that delineate true cooperative learning groups. They specified the decisive factors for cooperative learning as positive interdependence, individual accountability, engaging interaction, group processing, and development of small-group interpersonal skills. Emphasis is placed on group processing, or reflection of the team’s ability to function, and the development of small-group interpersonal skills. Gabbin & Wood (2008) denoted that studies involving CL techniques have produced mixed results on the effectiveness of using group incentives in the classroom to improve the academic achievement of accounting students. It can be discovered that CL is a systematic and structured teaching strategy, which can improve the drawback of conventional competitive learning and individual learning methods in which the training of cooperative and social skills is usually neglected.

According to the theory of CL, the major strategies include Student’s Team Achievement Division (STAD), Learning Together (LT), Teams-Games-Tournament (TGT), Group Investigation (GI), and Kagan’s six categories of cooperative structures: classbuilding, teambuilding, communication skills, thinking skills, information sharing, and mastery. Among these strategies, STAD is most commonly carried out and also adopted in this study. STAD was first developed by Slavin in 1979, including 5 instructional stages: class presentation, group, quizzes, individual improvement scores and team recognition (Slavin, 1995).

### **Web-based cooperative learning (web-based CL).**

Due to the Internet has become more prevalent currently, the implementation of CL is no longer confined to traditional classrooms. Tomlinson & Henderson (1995) pointed out that when two or more than two learners use different computers with the aid of an application system to perform information sharing and exchange and achieve the goal of CL, this learning process can be considered as web-based CL. Nowadays, web-based CL has become a hot topic in the study of learning environment and a tendency in instructional design (Strijbos, Kirschner, & Martens, 2004; Weinberger & Fischer, 2005; Naidu & Järvelä, 2006).

Many studies have empirically verified that CL can enhance students’ learning effectiveness (Sharan & Shachar, 1988; Roth & Roychoudhury, 1993; Johnson, Johnson, & Smith, 1995). Hite (1996) further found that CL techniques had a significant effect on the academic achievement of accounting majors. However, Ravenscroft & Buckless (1997) compared the exam results of students with different team-work schemes and different group incentives and indicated that these variables had no significant effect on exam results. Marcheggiani, Davis & Sander (1999) studied the effect of the group-Socratic teaching method and interactive lecture style on students’ exam performance and attitudes in an introductory accounting course. Their results showed no significant difference in either exam scores or attitudes of the students who were in group-Socratic teaching as compared with those in the traditional teaching environment. In another study, Lancaster & Strand (2001) compared the academic performance of students in a managerial accounting course using cooperative versus traditional learning. They found that academic performance and student attitudes did not differ significantly. It’s clear there’s no consensus

on the effects of cooperative learning in accounting education. In addition, only a few scientifically founded and evaluated (e.g. pre-post-tests and comparison of groups) e-learning concepts exist in the context of university education (Keeton, 2004; Stokes, 2000). This study thus tried to apply web-based CL in accounting education to the experimental teaching.

### **Creative Problem Solving (CPS) Process**

Development of creative problem solving (CPS) is attributed to the common belief that creativity can be nurtured (Foster, 1971; Candy, 1999). In the past, creativity was usually considered as nature not nurture, and a well-designed method was not available for cultivating creativity. However, after Parnes's (1987) proposition, researchers started to use some specific methods or procedures to stimulate activities in the incubation stage, so as to incite inspirations.

Osborn (1953) proposed seven stages of creativity, including problem orientation, preparation, analysis, hypothesis, incubation, synthesis, and verification. Following Osborn, Parnes developed the well-known creative problem-solving process in 1961: (1) Fact-finding; (2) Problem-finding; (3) Idea-finding; (4) Solution-finding; (5) Acceptance-finding (Isaksen, Puccio, & Treffinger, 1993). This five-stage CPS process mainly starts with divergent thinking and gradually end with convergent thinking. Divergent thinking helps one produce multiple opinions and ideas for a practical problem, while convergent thinking is to evaluate, clarify, and focus the attention on the produced opinions and ideas, in preparation for the next step.

In 1985, Isaken & Parnes modified the five stages again as follows: (1) A new stage, Mess-Finding, was added; (2) Fact-Finding was redefined as Data-Finding. It was asserted that effective

problem solving depends not only on fact but also on reading of data; (3) A guideline and techniques were developed for convergent thinking to balance the already available steps of divergent thinking. Treffinger, Isaken & Dorva (1994) further made another revision to propose three components and six stages of CPS process, where the three components are (1) understanding the problem, (2) generating ideas, and (3) planning for action, and the six stages are (1) Objective-Finding (OF): To discover the objective from experience, role, and the context, and manage to solve the problem in a systematic manner; (2) Data-Finding (DF): To collect data, consider the context from various perspectives, impressions, and feeling, and find out the most important data and fact; (3) Problem-Finding (PF): To brainstorm out all possible problems and sub-problems and find a definite description of the problem; (4) Idea-Finding (IF): To develop all possible ideas for the problem and select the most interesting and promising one; (5) Solution-Finding (SF): To find all possible evaluation standards and use them to evaluate the ideas and derive the best solution; (6) Acceptance-Finding (AF): To find all possible executable steps and the most promising solution to form a substantive plan and verify the effect of the solution (Treffinger et al., 1994). Because of the detailed process above, the three components and six stages of creative problem solving process proposed by Treffinger, Isaksen & Dorval (1994) were adopted to design the content and activities of this experimental teaching.

### **Problem Solving Attitudes**

Heppner & Peterson (1982) mentioned that problem-solving attitudes involve three constructs: (1) problem-solving confidence: whether one has confidence in face of a problem; (2) approach-

avoidance style: whether one will directly cope with a problem or choose to avoid it; (3) personal control: whether one can execute a decision after making a thorough plan. Following Heppner & Petersen (1982), Lee et al. (1998) also proposed that problem-solving attitudes involve “confidence in problem-solving”, “approach-avoidance style”, and “self-control”. These three constructs have been adopted in many existing studies on problem solving attitudes. The importance of education is to cultivate students with practical abilities. Before having practical abilities, students need to own problem-solving attitudes. This is just why this study integrated web-based CL and CPS to the subject of accounting and explored the effects of this innovative teaching instruction on students’ problem-solving attitudes.

## **Research Method**

### **Experimental Design**

Quasi-experimental method was conducted to overcome the students that could not be randomly assigned under school administration. “Teaching instruction” was used as an independent variable in this study. The research subjects were divided into Experimental Group 1 (EG1), Experimental Group 2 (EG2), and Control Group (CG).

### **Research Subjects**

The research subjects were composed of 162 students from three classes in the first-year of a university. One class with 53 students (12 male and 41 female) was assigned to EG1, treated with “CPS on Web-based CL” method; another for EG2 with 54 students (9 male and 45 female), with “Web-based CL” method adopted; and the last one with 55 students (17 male and 38 female) for CG, with “traditional lecturing” method.

### **Experimental Group 1 (EG1).**

For EG1, “CPS on web-based CL” method was adopted, which integrated web-based CL, proposed by Tomlinson & Henderson (1995), and CPS process, developed by Treffinger et al. (1994). The materials provided for this group were generally the same as common textbooks, and the only difference lied in its construction on the Internet platform and students have to complete the “cooperative learning sheet” of each unit, required under CPS process.

### **Experimental Group 2 (EG2).**

For EG2, “web-based CL” method was adopted. The materials provided for this group were generally the same as those for EG1. However, unlike those in EG1, students in EG2 would not be asked to complete the “cooperative learning sheet” of each unit under CPS process.

### **Control Group (CG).**

“Traditional lecturing method” was adopted for CG. The materials used were the same as those provided for the two experimental groups. The only difference was that students in CG were not engaged in web-based CL and CPS process but individual learning.

### **Research Instrument**

The “problem-solving scale” developed by Lee et al. (1998) was employed because the subjects were Taiwan students. This scale was a modification of “The Problem-Solving Inventory (PSI)” proposed by Heppner & Petersen (1982) to measure students’ attitudes and behaviour orientation in a problem-solving context. This questionnaire comprised of 32 questions in three major constructs, including “problem-solving confidence”, “approach-avoidance style”, and “self-control”, and each question was designed to be evaluated on a Likert’s 6-point scale, ranging from 1-very disagree to 6-very agree. Lower

points indicate higher disagreement, while higher points indicate higher agreement. This questionnaire was once used to test a sample of students in 12 classes of two junior high schools in Taiwan. A total of 382 valid responses were obtained, and the analysis showed that this questionnaire was developed with high validity and reliability. Therefore, it was employed in this study as the pilot-test scale. For improving the scale's content validity, two experts in the problem-solving area were invited for reviewing the questions to assess what were essential questions. A three-point Likert scale was assessed to each question. The three-point Likert scale included 1 as "It is not necessary to ask the question", 2 as "It is useful, but not essential to ask the question", and 3 as "It is essential to ask the question". Essentially, the items that got a one-point score were deleted, the items that got a two-point score were revised, and the items that got a three-point score were kept.

Later, the pilot-test was administered in March of 2007 to 134 students from three classes in an institute of technology in Taiwan. 129 valid responses were obtained. Through principle component analysis and oblique rotation, three factors were defined, and the cumulative variance explained was 45.13%. The validity of the scale was ensured. Among the questions, item No 1 had a low factor loading and correlation coefficient, only .24 and .29, respectively, so it was deleted (Hair, Anderson, Tatham, & Black, 1998; Chiu, 2005).

The reliability test was carried out through an internal consistency analysis. Result showed that the Cronbach's  $\alpha$  coefficients of the three sub-scales, namely "confidence in problem-solving", "approach-avoidance style", and "self-control" fell between .69~.90, and the Cronbach's  $\alpha$  coefficient of the scale was .92, indicating that the scale featured adequate reliability (Cortina, 1993; Schmidt & Hunter, 1996).

The formal "problem-solving scale" consisting of 31 items in three constructs was then produced.

## **Experimental Teaching**

### **Experimental teaching materials and related documents.**

In accordance with the experimental design, 6 units of experimental teaching activities were developed as below:

#### **Implementation of the teaching activities.**

Six units of experimental teaching activities have been designed, and each of these units detailed the schedule, content, teaching aid required, notes of the preparation activities, developing activities, and general activities. The experimental period spanned 8 weeks.

#### **Learning sheets.**

These sheets contained issues for group discussions during the group learning session. They were the "cooperative learning sheets" and the "creative problem-solving learning sheets". Students in EG1 would use both sheets in their learning, while those in EG2 would use only the "cooperative learning sheets". Through the use of the learning sheets in the group discussion, students' spirit of CL and CPS could be cultivated.

#### **Answers to the learning sheets.**

These were answers to the problems on the learning sheets. Release of correct answers after the group discussion was expected to familiarize the students with these problems.

#### **Quiz.**

A quiz has been designed for each of the six units, including "accounting equations", "accounting elements and accounts", "accounting vouchers",

“daily journal”, “ledger”, and “trial balance”.

#### **Quiz answers.**

These are the answers to the quiz of each unit. Release of the correct quiz answers was expected to further familiarize the students with the course content.

#### **Individual and group progress score table.**

The previous studies attested that in terms of CL techniques to improve performance in accounting classes, the most popular technique is grade incentive

(Gabbin & Wood, 2008, Ravenscroft & Buckless, 1995). This technique involves computing student exam grades based on a combination of individual exam performance and the average exam performance of group members. In this study, individual progress score was derived by deducting the base score from the quiz score. The base score is an average of scores in previous quizzes, and the quiz score is the individual score of each quiz. The score table applied to both EG1 and EG2 was shown in Table 3-1.

Table 3-1

*The Score Table for Individual Progress and Group*

Individual progress score (=quiz score-base score)	Translated group score
-10+	0
-0~9	10
+1~9	20
+10+	30
Excellent performance (above 90 or ranks top 3 in the class)	40

#### **Experimental teaching procedure.**

The practical teaching process is described as follows:

##### ***Pre-test.***

In the first week of the experimental teaching, this study provided a 50-minute introduction of the web-based teaching system and explained the implementation, evaluation, and content of the experimental teaching. Students in EG1 were given an additional introduction of the meaning and application of CPS and guided to apply CPS strategies when solving problems on the learning sheets. Later, the pre-test of problem solving scale was employed for all three classes.

##### ***Class instruction.***

This step was mainly intended to introduce a major concept to all the students or let the teacher

make a comprehensive summary or clarify some basic concepts after group activities. The instruction for the entire class was carried out before the class and at the end of the experimental process.

##### ***Grouping and logging in.***

In CL, heterogeneous groups are required. Students with different competencies should be distributed to various groups and log in the teaching system with a given account. The grouping procedure was detailed as follows:

- **Ranking:**

The students were ranked according to the results of the pre-test of accounting achievement, which served as an index of competency.

- **Deciding group size:**

EG1 was composed of 53 students, and EG2 was composed of 54. Each group was equally divided

into 9 groups. Therefore, in EG1, except 1 group with only 5 members, all the groups have 6 members. In EG 2, all the groups have 6 members.

- **Grouping:**

According to the results of the pre-test, the students in each group were divided into three levels, high, mid, and low, in proportions of 25%, 50%, and 25%, respectively. Based on the ranking, the students were later assigned to the groups by S-shape rule.

***Group discussion and learning.***

The “cooperative learning sheets” were distributed to the students in EG1 and EG2 for discussion and practice.

The “creative problem solving learning sheets” were distributed to students in EG1 only. During the practice, the teacher would observe each group discussion in the classroom to ensure that the discussion proceeded according to CPS process. Suggestions for rectification and compliment would also be given.

After all the groups in EG1 and EG2 completed the “cooperative learning sheets” and published the results, the teacher would release the correct answers to further familiarize the students with the contents of the unit.

***Evaluation of achievement in each unit.***

After students completed the learning sheet of each unit, the teachers would test the students’ competency through a quiz.

***Awarding groups and individuals.***

After converting the quiz score into progress score, the teacher would award the group or individual with the highest progress score in each unit, and these students would have one extra point added to final semester score in accounting.

***Inquiry of key points.***

Before the end of each unit, group members could inquire the teacher or both sides could engage in two-way discussions about the key points in the course content.

***Post-test.***

In the final week of the experimental teaching, students in all three classes were required to take the post-test of problem solving scale.

## **Findings**

### **Students’ Problem Solving Attitudes before Experimental Teaching**

Before the experimental teaching, the pre-test of problem solving scale was given to students in all three groups. The Levene test and Box’s test of equality of covariance matrices of the pre-test all revealed  $p > .05$ , indicating compliance with the test, so a further MANOVA could be executed. The MANOVA result was shown that a significant difference could be discovered (Wilk's  $\Lambda = .91$ ,  $p < .05$ ). Further, an ANOVA was carried out as Table 4-1. It could be discovered that the three groups have significant differences in their scores, and the EG2 had the higher scores.

Table 4-1

*Analysis of Variance (ANOVA) Summary for Pre-test*

Construct	Group	N	M	SD	F	Post-Hoc Comparison
Problem Solving Confidence	EG1	52	4.21	.38	3.15*	
	EG2	54	4.28	.46		
	CG	55	4.08	.42		
Approach Avoidance Style	EG1	52	4.02	.39	2.18	
	EG2	54	4.04	.47		
	CG	55	3.88	.51		
Personal Control	EG1	52	2.96	.66	5.32**	(2)>(3)
	EG2	54	3.34	.77		
	CG	55	2.87	.91		
Overall	EG1	52	3.99	.35	3.96*	(2)>(3)
	EG2	54	4.09	.45		
	CG	55	3.87	.45		

PS: \*  $p < .05$ , \*\*  $p < .01$

### Effects of Different Teaching Methods on Problem Solving Attitudes

A post-test of problem solving attitudes was conducted after experimental teaching. The homogeneity tests of the within-group regression lines and common slope test revealed  $p > .05$  and  $p < .05$  respectively, indicating compliance with the test and that a further MANCOVA could be executed.

Using the pre-test results as the covariance, the result of MANCOVA on the post-test was shown that a significant difference could be discovered (Wilk's

$\Lambda = .83$ ,  $p < .001$ ). To further understand how the three groups would be affected by the interventions, an ANCOVA was carried out as Table 4-2. There is a significant difference among the three groups in three dimensions and overall score ( $F = 14.94$ ,  $p < .001$ ) of problem solving attitudes.

According to the further post-hoc comparison (shown in Table 4-3 to 4-6), EG1 exhibited the best performance in all dimensions and overall score. Moreover, EG2 had the worst performance.

Table 4-2

*Analysis of Covariance (ANCOVA) Summary for Post-test*

Construct	Variation	SS	df	MS	F
Problem Solving Confidence	Between-Group	2.20	2	1.10	7.99***
	Within-Group	21.35	155	.14	
Approach Avoidance Style	Between-Group	2.30	2	1.15	7.15***
	Within-Group	24.90	155	.16	
Personal Control	Between-Group	6.04	2	3.02	8.07***
	Within-Group	57.98	155	.37	
Overall	Between-Group	2.79	2	1.40	14.94***
	Within-Group	14.68	155	.09	

PS: \*\*\*  $p < .001$

Table 4-3

*Post Hoc Comparison of Problem Solving Confidence Scale for Post-test*

<b>Adjusted Mean</b>	<b>4.50</b>	<b>4.22</b>	<b>4.29</b>
<b>Group</b>	<b>EG1</b>	<b>EG2</b>	<b>CG</b>
EG1	—	***	**
EG2	***	—	—
CG	**	—	—

PS: \*\* p&lt; .01, \*\*\* p&lt; .001

Table 4-4

*Post Hoc Comparison of Approach Avoidance Style Scale for Post-test*

<b>Adjusted Mean</b>	<b>4.30</b>	<b>4.04</b>	<b>4.05</b>
<b>Group</b>	<b>EG1</b>	<b>EG2</b>	<b>CG</b>
EG1	—	**	**
EG2	**	—	—
CG	**	—	—

PS: \*\* p&lt; .01

Table 4-5

*Post Hoc Comparison of Personal Control Scale for Post-test*

<b>Adjusted Mean</b>	<b>3.64</b>	<b>3.22</b>	<b>3.23</b>
<b>Group</b>	<b>EG1</b>	<b>EG2</b>	<b>CG</b>
EG1	—	**	**
EG2	**	—	—
CG	**	—	—

PS: \*\* p&lt; .01

Table 4-6

*Post Hoc Comparison Summary of Overall Scale for Post-test*

<b>Adjusted Mean</b>	<b>4.34</b>	<b>4.03</b>	<b>4.08</b>
<b>Group</b>	<b>EG1</b>	<b>EG2</b>	<b>CG</b>
EG1	—	***	***
EG2	***	—	—
CG	***	—	—

PS: \*\*\* p&lt; .001

## Conclusions and Discussions

Obviously, before the experimental teaching, students in the three groups had significant differences in their problem solving attitudes. After

the experimental teaching, the post-test results revealed that the difference among three groups in problem solving attitudes reached significant level. EG1 had the highest performance. Moreover,

EG1 had significantly outperformed EG2 and CG. However, no significant difference was observed between EG2 and CG. The reason would be that the CPS could cultivate problem-solving attitudes, but web-based CL or traditional lecturing could not.

According to Kahney (1986), “problem-solving” is a process in which an individual uses acquired knowledge and techniques to satisfy contextual needs and obtain a solution. Chang (2001) mentioned “problem-solving” is a brainstorming process in which an individual makes use of acquired knowledge and techniques in an attempt to accomplish a certain goal when in face of a problem. In this study, students in EG1 group usually acted with confusion due to insufficient familiarity with web-based collaborative and creative problem-solving instructions. It can be known that only a 50-minute introduction of the web-based teaching system and explanation of CPS process was not sufficient. Participants may need more guidance and supervision throughout the process and sufficient training of using web-based communication tools. Students felt excited about the instructions but were also anxious about not being able to accomplish all the tasks. With the progress of the experiment, they could gradually followed the creative problem-solving process in learning and seek all possible answers from multiple viewpoints. Through summary and classification of the dialogue among students in EG1, their main problem-solving process was induced, as shown in Figure 5-1. This process is consistent with the process proposed by Isaksen & Parnes (1985).

The course comprised of 6 units, and there were almost 6 members in each sub-group of the experimental groups. Therefore, each member

would take turns being the group leader. Through this arrangement, all the students could be more unitive to their groups and seldom intend to avoid the assigned task. It also could be discovered from the learning processes of the two experimental groups that group discussion and interactions were deeply affected by the leader. An encouraging attitude of the leader could induce better group discussions.

From the learning processes of the EG1, it could be discovered that CPS can help students to regularize the problem-solving process and come up with alternative answers. They would be more willing to understand the course content and present a proactive learning attitude.

According to the analysis results, “CPS strategy on web-based CL method” has positive effects on problem solving attitudes. In business-related departments, accounting and its related subjects are a headache to most students. However, problem solving attitudes and abilities are focuses of the contemporary education. Therefore, accounting teachers are suggested to incorporate “CPS on web-based CL method” into their instructions to increase students’ learning effectiveness. It is expected that whether students are interested in learning or not, their participation in the course could be effectively enhanced through the proposed method.

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Figure 5-1 The Problem-solving Process of Students in EG1

Divergent phase	Problem sensitivity during CPS	Convergent phase
Find some challenges in the learning sheet	1. Identify challenge	Accept the challenges and make systematic efforts
Gather related data and understand some facts through dialogue with group members	2. Collect data	Most important data are defined and analyzed
Members not sure about the problem will make as many descriptions about the primary problem and secondary problems as possible.	3. Discover problem(s)	The problems are interpreted from various viewpoints.
Opinion leaders propose multiple ideas to solve the problems and organize them.	4. Seek ideas	The relatively more feasible solutions are chosen.
Members discuss and evaluate all opinions.	5. Find a solution	Select criteria to assess the opinions.
Seek a unanimous decision on the solution.	6. Seek for Acceptance	A commonly-agreed solution is obtained.
Take action or a new challenge		

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