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Ji Yong Park and Tippawan Nuntrakune
Queensland University of Technology, AUSTRALIA

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The Thailand education reform adopted cooperative learning to improve the quality of education. However, it has been reported that the introduction and maintenance of cooperative learning has been difficult and uncertain because of the cultural differences. The study proposed a conceptual framework developed based on making a connection between Thai cultures and cooperative learning elements, and implemented a small-scale research project in a Thai primary mathematics class with a teacher and thirty-two Grade 4 students. The results uncovered that the three components including preparation of teachers, instructional strategies and preparation of students can be vehicles for the culture integration in cooperative learning.

Keywords: cooperative learning, cultural difference, mathematics education, primary education, Thailand education

INTRODUCTION

Over the past two decades Thai schools have been asked to provide more effective education in order for Thailand to keep up with an ever increasingly changing world (Becker, 2004). The national education reform law in 1999 outlines new educational goals for the nation that include improved literacy, numeracy, language capacity, and IT capabilities as well as an emphasis on the development of skills in critical thinking and independent, lifelong learning (Kantamara, Hallinger & Jatiket, 2006; The Ministry of Education Thailand [MET], 2008). In particular, the teaching and learning reforms aimed for the transformation of the education system with a strategy based upon enhancing moral and ethical values together with a core program for improving quality in education (MET, 2008). This

strategy is underpinned by His Majesty's philosophy of Sufficiency Economy, a collective vision of Thai society as "Green and Happy Society", which promotes moderation and harmony among local communities (MET, 2008). The economical background is that Thailand experienced the devaluation of the Baht in July 1997 due to an attack on neoliberalism and globalization and the resultant recession (Hewison, 1999). The domestic reaction was vigorous in its rejection of consumerism and industrialism and to create community values based on Buddhism and agriculture (Hewison, 1999).

In this context, the MET (2001; 2008) proposed relevant policies which are intertwining of three theories: 1) creating a constructivist educational environment, 2) providing all organization members with voice and power in school management and governance, and 3) placing special emphasis on morality and personal development through Buddhist mindfulness meditation (Morrison, 2009). In discussing Thailand's schooling lag, Tasker (1990) also proposed that it is fundamental to introduce socio-constructivist teaching practices into Thailand schools in order to bring about the necessary changes to improve the

Correspondence to: Ji Yong Park,
Faculty of Education, Queensland University of
Technology, Kelvin Grove, Queensland 4059
AUSTRALIA
E-mail: jiyong.park@qut.edu.au
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State of the literature

- Research indicates that science teachers rarely promote argumentation in their classes
- The theoretical antecedents of most cooperative learning strategies can be traced back to social interdependence theory, behavioral learning theory and socio-cognitive developmental theory.
- The fundamental values of cooperative learning models are to enhance either individuality through cooperation or collaboration based on a strong individuality.
- Thai and other Asian countries sharing cultural values in a high power distance and high context challenge for cooperative learning practices.

Contribution of this paper to the literature

- In order to implement cooperative learning in an Asian context, a conceptual framework integrating the elements of cooperative learning and the country's own cultural values, needs to be developed at the beginning stage.
- The framework for cooperative learning should place conceptually equal emphasis on evaluating and recognizing group achievement and individual improvement.
- A successful implementation of cooperative learning in a Thailand context or a similar culture needs to pay attention to the three components, a) preparation of teachers, b) instructional strategies, and c) preparation of students, for the cultural integration.

standard of education in Thailand primary schools. In line with the national policies, it is noteworthy that the education policies not only adopt educational benefits of constructivism to reform Thailand education, but also sustain Thailand cultural values by enhancing morality-based knowledge and resilience in order to minimize the adverse impacts of globalization (MET, 2008).

However, the socio-constructivist teaching practices in line with the educational reform have been slowly progressed (Pongwat & Rupavijetra, 2011). According to PISA (Programme for International Student Assessment, OECD, 2010), recently, Thailand ranked at 50th for Reading, 50th for Mathematics and 49th for Science among 65 countries. The ranks have not been improved during the last decade of the educational reform. Pongwat and Rupavijetra (2011) claimed that the slowness of the educational reform process is derived from uncertainty and confusion over policy directions. On the other hand, Kantamara et al. (2006) noted that the strong traditions of teacher-directed and rote learning are consistent with Thailand culture and

rigidify teachers' and students' roles and responsibilities in class. Furthermore, the researchers argued that constructivism as a learner-centered approach embedded in Thailand's educational reform has not been widely accepted by the education stakeholders including teachers, students and parents. In other words, the rhetoric of policymakers and the improvement of learner-centered approach are conflicting in Thailand classrooms.

In Asian education system, on the other hand, researchers claim that the implementation of school reforms such as the introduction and maintenance of cooperative learning has been difficult, long, and uncertain because of the cultural and system differences (e.g., Murphy & Adams, 1998; Phuong-Mai, Terlouw & Pilot, 2005). Most Asian countries which share characteristics of a collectivist society are not incorporated into the implementation of constructivism that is built on individualistic cultural values such as self-expression, self-confidence and self-motivation (Phuong-Mai et al., 2005). They thoroughly argued the malfunctions of cooperative learning in Asian cultural contexts based on Hofstede's (2001) five cultural dimensions (i.e. power distance, individualism-collectivism, masculinity-femininity, uncertainty avoidance, and short-term orientation - long-term orientation) and concluded that 'cooperative learning has ended up failures, suspicion or resistance' (Phuong-Mai et al., 2005, p. 403). On the contrary, researchers have also shown the effectiveness of cooperative learning in Asian education systems (e.g. Bulut, 2010; Ding et al., 2007; Krongthong, 2003; Puacharearn & Fisher, 2004; Tarim, 2009). Interestingly, Snowman and Biehler (2006) claimed that cooperative learning is more useful for Hispanic-America and Native America students who are from extended families emphasizing cooperation and sharing and Western cultural background students need to be more prepared to work productively.

In this context, we attempted to integrate Thai cultural values into a cooperative learning by developing a conceptual framework for the cultural integration. A small scale project as an initiative was implemented to empirically validate the conceptual framework and identify its practical implications for successful cooperative learning in Thai primary education. In doing so, a primary class (a mathematics teacher and thirty-two students of Grade 4) in Thailand was chosen, and a designed cooperative learning in mathematics class was implemented for six weeks. The teacher was trained through a five session workshop for the preparation of cooperative learning. We also discussed the relevant theories upon which cooperative learning draws for mathematics education in primary schools and Thai cultural features, followed by the study design and the results. The results revealed that the three components

including preparation of teachers, instructional strategies and preparation of students can be vehicles for the culture integration in cooperative learning.

Cooperative Learning: Theoretical Antecedents and Mathematics Education

One of the most effective methods for implementing socio-constructivist teaching practices is cooperative learning (Johnson & Johnson, 2004; Slavin, 1995). Cooperative learning involves small groups of students who work in collaboration to encourage one another and share creative solutions to their problems (Artzt & Newman 1999). The overarching notion behind cooperative learning generally is to improve academic achievement, motivation, self-confidence and behavior amongst students (Johnson & Johnson, 2004; Nuntrakune, 2009). Cooperative learning also benefits for students' social and interpersonal skills development by allowing them to learn from social interactions with their peers and teachers (Johnson & Johnson, 2004; Slavin, 1995).

The theoretical antecedents of most cooperative learning strategies can be traced back to social interdependence theory (Johnson & Johnson, 2002), behavioral learning theory (Johnson & Johnson, 2004; Slavin, 1995), and socio-cognitive developmental theory (Johnson & Johnson, 2002; Morgan, 2003; Scardamalia, 2002). First, social interdependence theories focus on how individuals interact within groups and how different types of social interaction establish the ultimate outcomes of group activity. Social interdependence exists when individuals share common goals and each individual's outcome is affected by the action of others in a group (Johnson & Johnson, 2002). Positive interdependence (cooperation) occurs when individuals understand that they can only achieve their own goals if other members in the group also achieve their goals (Johnson & Johnson, 2002).

Second, behaviorists learning theories assume that students will work harder on tasks that provide a reward and those students will fail to work on tasks that provide little or no reward (Morgan, 2003). Behavioral learning theories assume that cooperative efforts are powered by extrinsic motivation to achieve rewards (Johnson & Johnson, 2002). This is consistent with the motivationalist perspective assuming that learners focus on the reward or goal structure (Slavin, 1995). In other words, cooperative learning rewards students on the basis of the performance of their group (Slavin, 1995).

Third, most socio-cognitive development theories view cooperation as an essential prerequisite for cognitive growth (Morgan, 2003) and suggest that social interaction and language are involved in the process of human development and learning. Cognitive growth springs from the alignment of various perspectives as

individuals work together to attain the common goals of the group (Morgan, 2003; Scardamalia & Bereiter, 2003). According to Vygotsky (1978), the development occurs in settings where social interaction and the individual come together. Socio-cognitive development theories based on Vygotsky, suggest several mechanisms through which students can learn by interacting with each other and by social interaction within groups that lead to higher levels of learning and reasoning. Vygotsky's (1978) well-known Zone of Proximal Development (ZPD) for peer collaboration describes the distance between what children can do on his or her own and what they could achieve under the guidance of teaches or in collaboration with more capable peers. Within ZPD, in other words, children can complete a task, which they cannot manage, through cognitive scaffolding in the form of adult guidance or peer collaboration (Shaffer, 2005).

A constructivist approach to mathematics learning occurs where students actively assimilate new information and experience and construct their own meanings. One main purpose of mathematics education is to help students think mathematically (Ding et al., 2007) and this can be achieved by facilitating problem solving within a cooperative learning environment (Tarim, 2009). In this sense, cooperative learning activities such as group work and discussion in terms of developing a capability for using and applying knowledge, reasoning, and cognitive understanding are more important than memorization of facts and mastery of routine skills in mathematics education (Atagi, 2002). This description implies that the basic natures of cooperative learning are universally accepted. However, the influential factors such as lesson design and implementation and emotional and cultural values need to be accommodated in a cooperative learning design. For example, Bulut (2010) studied cross-cultural issues on the usage of cooperative learning in a university course with five different countries and concluded that teachers who are familiar with cooperative learning and understand students' cultural attributes and learning environments can make necessary accommodations. In order to apply cooperative learning in Thai primary mathematics education, therefore, the first stage would be that the theories of cooperative learning need to be reshaped from Thai teacher and student perspectives. To do so, existing cooperative learning modes need to be reviewed in terms of their fundamental values in comparison with Thai teacher and student perspectives. The review will lead to develop a conceptual framework for this study.

Cooperative learning models and Thai cultures

In literature, well-known cooperative learning models include Student Teams Achievement Divisions

(STAD) (Slavin, 1995), Teams-Games-Tournament (TGT) (Slavin, 1995), JIGSAW (Aronson & Patnoe, 2001), GRAFFITI (Bennett & Rolheiser, 2001), Think-Pair-Share (TPS) (Bonwell & Eison, 1991), and Affinity Research Group Model (ARG) (Gates et al., 2009) as presented in the table 1 below.

First, STAD has been used from grade two through college level and used in every imaginable subject such as mathematics, language, art, social studies and science (Slavin, 1995). Students are assigned to four or five member with different level of performance, gender, and ethnicity and once these assignments are made, a four-step cycle is initiated: teach, team study, test and recognition. Second, JIGSAW model is to facilitate racial integration through collaborative instructional settings (Aronson & Patnoe, 2001). JIGSAW requires students to take responsibility for teaching each other. A task needs to be divided based on various expert areas, and individual students will be assigned with each area. Furthermore, experts of groups will share their knowledge and skills in order to improve their expertise, and then return to their own group and teach their members (Aronson & Patnoe, 2001). Third, TGT is almost identical to the STAD model. It differs only in the fact that the end-of-the-instructional-time quiz is replaced with the end-of-the-week tournaments. TGT quizzes require students to compete at tournaments table where they are against students from other groups. In the tournaments, the students should have the same quality of past performance for fair competition (Slavin, 1995). Fourth, GRAFFITI model is a creative brainstorming process that involves collecting the wisdom of all or most of the students in the class (Bennett & Rolheiser, 2001). Students are asked to give written responses to questions posed by the teacher, so it is one of effective models to check for understanding, to evaluate instruction, or to do an informal pre-assessment. Fifth, TPS method involves a three step cooperative structure: the first step individuals think silently about a question posed by the instructor; individuals pair up during the second step and exchange thoughts; the pairs share their responses with other pairs, other teams, or the entire group (Bonwell & Eison, 1991). Sixth, ARG provides students with opportunities to learn, utilize, and integrate the knowledge for research. Through a structured team approach, students learn how to conduct scholarly research and lead effective team discussions (Gates et al., 2009).

As seen six models of cooperative learning above, they focus on enhancing either individuality through cooperation (i.e. Graffiti, TPS, ARG) or collaboration based on a strong individuality (i.e. JIGSAW, STAD, TGT). The teacher needs to be a role model for individualists who is able to present tasks and facilitate group interaction with attentive, open, secure and

engages in imaginative solutions to problem (Jackson & Mathews, 2011). Whereas the students properly read external messages and react accordingly and endeavor to continue the process and works towards an eventual decision about the action to be taken (Jackson & Mathews, 2011). In relation with the cultural integration, these models do neither directly reflect nor conceptually shape Thai cultural values. In implementing these models, Thai culture may be either by-products from cooperative learning or barriers when they conflict with the cooperative learning principles.

Thai cultural values are characterized with social harmony (Komin, 1991), high-context - an in-group being a group has similar experiences and expectations, so many things are left unsaid letting the culture explain (Hall, 1976; Komolsevin, Knutson & Datthuyawat, 2010), collective culture (Knutson, Hwang & Vivantanukul, 1995), polite interpersonal presentation (Komolsevin et al., 2010). Knutson et al. (1995) argued that the following norms strongly influencing Thai culture:

Young people are quiet in the presence of older people;
Young people seldom disagree with older people;
Teachers seldom encourage students to express their opinions in class;
Quiet is a virtue;
Parents discourage children's verbal communication; and,
Children are not likely to participate in family discussion.

Komolsevin et al. (2010) also insisted that the high power distance, high context and collective culture lead to less willingness to communicate. This means that the Thai communication culture challenges for the national educational reform, in particular, social-constructivist teaching practices. Teacher profession in Thailand has been perceived as a representative of moral goodness who bestows the gift of knowledge on students (Mulder, 2000). Most Thai teachers thus perceive their role as being the source of all knowledge and direction. Thai culture also significantly impacts on students' learning styles (Deveney, 2005). Although Thai students are friendly, sociable and academically able, they tend to be passive learners, responding only to direct questioning. They are also poor participants in classroom discussions and rarely put their hands up to answer questions (Deveney, 2005).

In a pedagogical viewpoint, Zakaria and Iksan (2007) argued that lecture-based instruction and teacher-centered instruction restrict cooperative learning as an alternative to traditional method. In promoting cooperative learning in science and mathematics education, specifically, the researchers defined the following five challenges that the teachers and students will face: 1) need to prepare extra materials for class use, 2) fear of the loss of content coverage, 3) do not trust students in acquiring knowledge by themselves, 4) lacks of familiarity with cooperative learning methods, and

Table 1. Cooperative learning models

Graffiti	JIGSAW	Think-Pair-Share	Student Teams Achievement Divisions	Teams-Games-Tournament	Affinity Research Group
Step 1. Prepare four questions	Step 1. Introduce Jigsaw	Think: Students think independently about the question that has been posed, forming ideas of their own.	Step 1. Assign a group with 4-5 heterogeneous students	Step 1. Select a instructional topic and present it to the students	Component 1. An annual orientation
Step 2. Distribute materials	Step 2. Assign groups to study teams		Step 2. A four-step cycle is initiated.	Step 2. Develop a list of questions on the topic	Component 2. A research project framework
Step 3. Answer questions	Step 3. Assemble groups to study material	Pair: Students are grouped in pairs to discuss their thoughts in order to articulate their ideas and to consider those of others.	(i) teach	Step 3. Team Game - place students in heterogeneous groups of 4-5 by ability	Component 3. Defined deliverables
Step 4. Exchange questions	Step 4. Experts teach their study teams		(ii) team study	Step 4. Tournament- place students in new groups made up of individuals from each of the "Team Review" tables (step 2)	Component 4. Research-oriented weekly meetings
Step 5. Return to original questions	Step 5. Evaluate and provide team recognition	Share: Student pairs share their ideas with a larger group or the whole class. Students' ideas will be more refined through this three-step process.	(iii) test	Step 5. Students return to their Team Game tables and report their scores.	Component 5. Skill-oriented monthly meetings
Step 6. Share information			(iv) recognition	Step 6. Students take an assessment	Component 6. Outreach activities

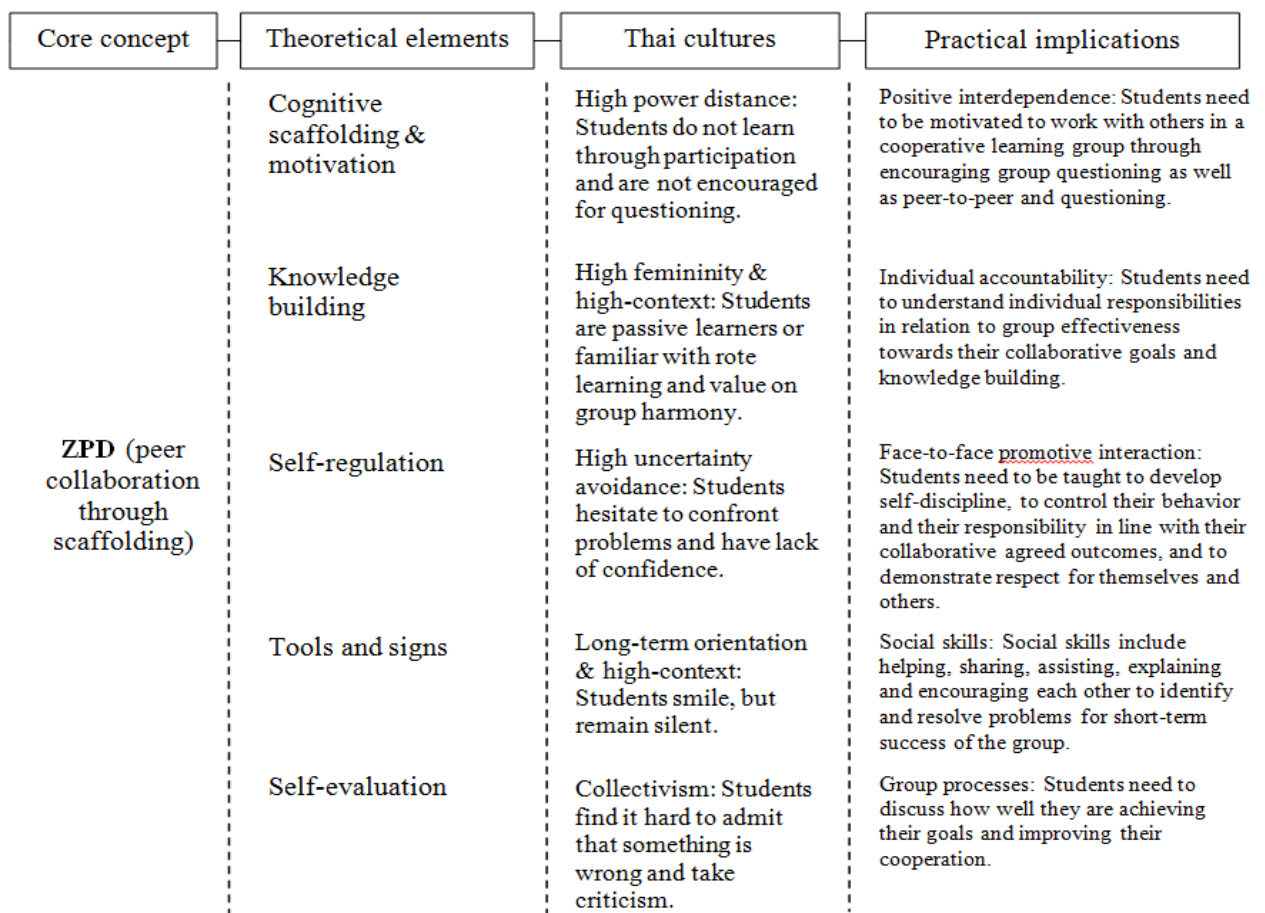


Figure 1. A conceptual framework: the elements of cooperative learning and Thai cultural features

5) students lack the skills to work in group (p. 38). These five challenges imply that the teachers' perception, preparation and implementation and students' familiarity and participation would be the important factors in cooperative learning in mathematics education in Thailand primary school. Puacharearn and Fisher (2004) also found that even though it is difficult to change the Thai classroom environments, the successful implementation of cooperative learning strategies could be achieved in Thai schools if Thai teachers are provided with sound frameworks to inform their use of cooperative learning. Some research showed that cooperative learning in mathematics in Asian education environments improves problem solving and increases students' engagement (Tarim, 2009).

In sum up, the extreme contrast implies that the best selection from the models for Asian culture is meaningless. Rather the focus of the research should be on how to implement cooperative learning by considerations of Thai cultures. As mentioned above, in practice, the teachers' perception, preparation and implementation and students' familiarity and participation need to be considered as the important factors and this need to be responded in the most applicable model. Prior to the implementation of a designed cooperative learning in Thai context, therefore, a conceptual framework, integrating the elements of cooperative learning and Thai cultural features, needs to be developed for the preparation stage. For a cooperative learning model, then a relatively systematic, yet flexible in terms of student grouping applied in primary mathematics class and Thai context needs to be chosen. More importantly, the model should place conceptually equal emphasis on evaluating and recognizing group achievement and individual improvement.

A conceptual framework for the study

The six elements of socio-cognitive developments were retrieved from the literature review of the three theories above: ZPD, cognitive scaffolding and motivation, self-regulation, knowledge building, tools and signs and self-evaluation. Among these elements, ZPD can be considered as the most conceptual and inclusive term, so the five elements practically support ZPD in terms of peer collaboration through scaffolding. They can be practically matched with Johnson and Johnson's (2002; 2004) five basic elements of cooperative learning: positive interdependence, face-to-face promotive interaction, individual accountability, social skills, and group processes skills. Figure 1 presents how these elements of cooperative learning can be linked with Thai culture. The theoretical and practical

elements provide the conceptual and methodological approaches that materialize the ZPD in cooperative learning. This framework was also used for the teacher preparation and lesson design in this study.

First, positive interdependence refers to the feel of each other or a positive correlation of student outcomes (Johnson & Johnson, 2004). Thai culture is characterized with a high power distance (Hofstede, 2001), which they are not encouraged for active participation in class. To increase participation, cognitive scaffolding and motivation can be utilized that the teacher can scaffold students by setting collaborative goals in order to make the groups move in a specific direction and share the agreed values rather than individual competition.

Second, individual accountability refers to specific and group assessment that results in the skills and outcomes of each student and a whole group (Johnson & Johnson, 2004). This should challenge Thai students who place more value on group harmony. Therefore, the knowledge building needs to be designed as a group activity towards collaborative accountability in line with high femininity & high-context cultures (i.e. harmony, relationships and nonverbal style of communication) rather than enhancing individual accountability.

Likewise, third, face-to-face promotive interaction encourages the students of a group by sharing and helping each other on specific topics (Johnson & Johnson, 2004), which as a result, enhances self-regulation, and vice versa. Thai high uncertainty avoidance seems to prevent the teacher from facilitating these values, but collaborative self-regulated students, cognizant of their strengths and weakness, need to be led to achieve their agreed outcomes.

Fourth, social skills refer to interpersonal and small group skills that each and every student of the group should have (Johnson & Johnson, 2004). Thai long-term orientation and high-context culture encourages students to endure and persevere barriers to their collaborative goals that may result in their insufficient development of social skills required for cooperative learning. Therefore, the teacher needs to apply tools and signs in order for students to formulate nonverbal style of communication and to achieve short-term success in group. This is because tools and signs are products of social, cultural and historical processes (Vygotsky, 1978).

Fifth, group processes refers to the assessment and remarking of the capabilities and actions of each group (Johnson & Johnson, 2004). Thai collectivistic culture promotes the affective and stable bond, but the students may find it hard to admit that something is wrong and take criticism. Therefore, self-evaluation needs to be combined with group processes in a way that the students undertake self evaluation as a means of achieving their collaborative goals and improving their cooperation.

Study design

A qualitative research method was utilized in this study. The reason was based on the belief that the quality of the professional development would be enhanced through the involvement of the participating teacher in the design and implementation of the classroom learning experiences (Creswell, 2005). The research method allowed collecting data about the participants' teaching and learning experiences of a cooperative learning setting through various methods including interviewing, observation, discussions and students' test score.

Participants

The participants in the study were thirty-two students (17 girls and 15 boys) mainly from a mid to high socioeconomic status background and a mathematics teacher, Mrs Malee (pseudonym). Malee has six years teaching experience. Prior to this study, she has never utilized cooperative learning in her teaching. Most of the students in this class turned ten years old during the grade 4 of the school year. Students were classified into four groups with their mathematics test score: very high achievers (over 80%), high achievers (between 70% and 79%), average achievers (between 60-69%), and low achievers (less than 59%).

Procedure

The study proceeded in four stages:
 Pre-implementation interview of teacher
 Teacher preparation workshop
 Student preparation workshop
 Implementation of program
 Post-implementation evaluation

Pre-implementation interviews of teacher: The teacher was interviewed prior to the cooperative learning professional development workshops. This interview set out to ascertain the teachers' background, teachers' initial perceptions about cooperative learning and the potential benefits of group work. The interview questions were:

What grade do you teach?
How many years have you been teaching?
How long have you been teaching at this school?
What is your personal definition of cooperative learning?
Please describe your students in general.
Please describe your mathematics classroom activities.

Teacher preparation: The teacher preparation workshop with five sessions based on the conceptual framework (Figure 1) and STAD method - places conceptually equal emphasis on evaluating and recognizing group achievement and individual improvement - was conducted during a one and a half

week period. The teacher developed an action plan for the application of acquired knowledge about cooperative learning strategies in two mathematical curriculum units her intended to implement during the following six weeks in her classroom.

Student preparation: The implementation phase began with two weeks of social skill training and cooperative learning strategies for the students.

Implementation of program: During the next four weeks, the cooperative learning skills were applied in two units of mathematics lessons units (50 minutes x 3 times per week) that focused on Time and Measurement lessons for Grade 4 students.

Post-implementation evaluation: A teacher interview was conducted for one hour with the following questions:

What were the advantages of cooperative learning?
What were the disadvantages of cooperative learning?
How did you plan for a cooperative learning lesson?
How do you describe the effectiveness of cooperative learning in your math class?

RESULTS

Analysis of data

A grounded approach adapted from Creswell (2005) was used to analyze data derived from the observation and teacher interviews and a non-grounded approach - the scoring of Students' Team Average (adapted from Slavin, 1995) was used to analyze the students' mathematical learning. This analysis of data enabled the investigation the degree of knowledge a team had learnt and cooperated together, rather than how much an individual has learnt. The scoring of the STAD was conducted in the following way. First, the teacher calculated each individual student's score with the students' improvement on a quiz score sheet. Second, the improvement score was calculated based on how much their test scores exceeded their base scores. The teacher needed to note individual improvement scores as soon as possible after each quiz. "This makes the connection between doing well and receiving recognition clear to students, and in turn increases their motivation to do their best" (Slavin, 1995, p. 80). The results show Improvement Points (IP) that "students earn points for their teams based on the degree to which their quiz scores (percentage correct) exceed their base score" (Slavin, 1995, p. 80). Table 2 shows the IP scales in this study.

- Students' engagement and achievement in cooperative learning

During the cooperative learning group work, the most students had shown their enjoyment when they worked with friends and they appreciated the opportunity to work in groups rather than to work

individually. Mrs Malee supported this by saying that, the students in this class love to work in groups and they have fun. They look forward for the math class every day. This is also supported by the gradual improvements in the Team Average Score of Time and Measurement lessons in Table 3. The result confirms that cooperative learning had positive effects on the students' mathematics knowledge. The mathematics achievement of students who used effective cooperative learning was higher after they had used this method more often, and with increased use.

As shown in Table 3, there were differences in the team average score, but every team had improved their team average. The highest team average scores were from four teams, C, D, E and F. The Time lesson score, each team had a score of 25. In the post-teacher interview, Mrs Malee mentioned that she needed to pay more attention to team D, E, and F during the sequence of the Time lesson class involving cooperative learning. This is because these teams had students who are not willing to cooperate with their friends.

Team A students performed better than other teams. The data from classroom observations confirmed that the members of team A had been helping each other by using effective social skills, participating well in group work and providing suitable support in the team. They were paying attention to their own roles. For example, a girl in this team was writing while her team members were discussing the mathematics problems. They sat facing each other and were looking at the worksheet. The following conversation of team A (Table 4) shows that each member had worked with their friends in the cooperative learning group work and supported their friends to gain understanding of the lessons. The members in team A were Noi (high achiever), Mai (average achiever), Bob (average achiever) and Nathan (low achiever). They needed to help each other to

complete the worksheet on the subject of adding and subtracting the Time. Noi and Bob helped Nathan and Mai to understand how to solve the mathematics problem (line 5, 6, 7, 9, 12, 17, 19, 21, 24, 26 and 27).

From the team A's conversation it can be concluded that low achievers can gain more understanding about mathematic knowledge from group discussion and receive better assistance from other group members in an effective cooperative learning environment.

Mrs Malee evaluated student's group work by choosing one student to answer a question. Mai (a member from team A) was chosen to answer the first question on the worksheet. Mai could easily answer this question because her group discussed this question and everyone in her group understood how to get the answer (refer to Table 5).

Malee said that she evaluated her students' understanding of mathematics by directing a question to one of the students in each team. Sometimes, she picked one student to explain the task in front of the classroom. Most of the chosen students were low achievers. Malee used classroom evaluations to assess how well the cooperative learning works in group and how much her students understood the lesson.

Teacher's experience in cooperative learning

In the post implementation phase, Mrs Malee was asked to express her opinion regarding the advantages of cooperative learning. She described that one of the advantages of cooperative learning for her students was that students learnt how to work in group and help each other. Another advantage was the improvement of student's math skills. In particular, the low achievers gained more knowledge by asking their friends and the high achievers gained explanation skills which in turn improved their own understanding of math. Malee noted:

Table 2. The results based on Slavin's (1995) IP

Quiz score	Improvement Points
More than 10 points below base score	5
10 points below to 1 point below base score	10
Base score to 10 points above base score	20
More than 10 points above base score	30
Perfect paper (regardless of base score)	30

Table 3. Improved Team Average Scores from Time and Measurement lessons

Team	Score for Time	Score for Measurement
A	16.25	27.50
B	22.50	25.00
C	25.00	25.00
D	25.00	30.00
E	25.00	30.00
F	25.00	27.50
G	23.75	25.00
H	20.00	25.00

Table 4. Team A conversation: the first question was 2:15 hours + 1: 40 hour = ?

Students' name	Students' conversations
1. Bob	Are you ready? (Everyone in the group said "yes")
2. Bob	Who wants to read the first question?
3. Noi	Nathan, don't play the MP3.
4. Bob	Can Mai read the first question please?
5. Mai	2 hour and 15 minutes + 1 hour and 40 minutes. (Noi taught Mai how to read the question and Mai followed her example)
6. Bob	We have to add in order to get the result
7. Noi	First we have to start with adding, what is the answer of 5+0
8. Bob	1+4 =5
9. Noi	What is the next method Mai
10. Mai	Not sure. Do we take 2+1
11. Noi	Yes! Correct 2+1=3
12. Bob	Okay, the answer is 3 hours and 55 minutes. Do you agree? (Everyone says "yes")
13. Noi	Second question-can Nathan read the question please?
14. Nathan	3 years 8 months – 2 years 5 months.
15. Noi	How can we get the result?
16. Mai	We take 8-5 and the result is 3.
17. Noi	Bob, what about the year?
18. Bob	Year? Take 3-2 =1.
19. Noi	Hang on. I have a technique. How many months in 1 year? Nathan, can you answer please?
20. Bob	Nathan, How many months in one year?
21. Noi	You need to answer even if you are not sure of your answer. We will correct it for you.
22. Bob	Hurry up, answer us.
23. Nathan	Um...um
24. Noi	There are 12 months. You need to remember that when you do the next question.
25. Bob	Yes, you need to remember.
26. Noi	Another question. How many seconds in 1 minute?
27. Bob	Same as minute and hour.
28. Mai	60 seconds.
29. Bob	The answer to this question is 1 year and 3 months. Do you understand?

Table 5. Classroom evaluation transcript

Teacher and Student	Teacher and student's conversation
1. Mrs Malee	Mai, can you answer question 1 please? Tell your friends how your group found out the answer of this question?
2. Mai	Take $5 + 0 =$ the result is 5, 1 plus.....
3. Mrs Malee	Can you hear Mai's voice? (Classmate said No)
4. Mrs Malee	Can you speak up Mai?
5. Mai	$5 + 0$ the result is 5, $1 + 4$ is 5 and $2 + 1$ is 3.
6. Mrs Malee	Group Kurab Phai (Team A) is correct. Very good. You need to start this method by adding from the minute first and then add the hour.

Students learn to work in groups, help each other, and accept other opinions. It makes low achievers gain more knowledge in math. Student's math skills are improved. Sometimes the low achievers do not want to ask the teacher when they do not understand the lesson or the teacher is busy, so they will never improve their understanding of math. When I use cooperative learning in my math class, low achieving students can ask their friends to teach them.

Then they can solve the problems. The high achieving students will gain the explanation skills and it makes them understand math more than before.

Mrs Malee illustrated her views about the advantages for teachers by pointing out that she believed that she could save her teaching time because the high achievers assisted her to teach low achievers. The low achievers can learn and accept their abilities

from working with their peers. Malee also stated that a disadvantage of cooperative learning can occur if students' worksheets are not well scaffolded for collaboration among students. She pointed out:

Some exercises are good only for individuals. When we adapt the lesson for group work, the low achievers never gets the chance to be involved. Also, all the worksheets are always finished by the high achieving students ... I guess that the exercise in the worksheet is not interesting and they cannot express their opinion.

FINDINGS AND DISCUSSIONS

During the six week implementation of cooperative learning, the students' cooperative learning skills have been gradually improved and their mathematics abilities have also been increased. Cooperative learning strategies helped them explore each mathematical task more deeply and in more diverse ways. In particular, the low achievers gained more knowledge in mathematics by asking their friends and the high achievers gained explanation skills which in turn improved their own understanding of mathematics. This is consistent with Tarim's (2009) experimental research that compared between cooperative learning groups and a control group to examine preschoolers' mathematics problem-solving abilities. The results revealed that the students experienced larger improvements in their active participation, problem-solving, cooperation, sharing, listening to the others, and fulfilling individual responsibilities in group work than those in the control group.

From a viewpoint of the teacher training and implementation of cooperative learning, cooperative learning could be successful and quickly implemented in Thai primary school mathematics classrooms instilled with heavy traditional passive learning culture. The successful implementation of cooperative learning strategies could be achieved in Thai classrooms if teachers engage in professional development program prior to the introduction of cooperative group learning and also during the implementation of cooperative group learning into their classrooms. This reminds Bulut (2010)'s research outcome that teachers who are familiar with cooperative learning and understand students' cultural attributes and learning environments can make necessary accommodations. For the cultural integration in implementing cooperative learning, professional development programs for teachers need to be carefully planned and implemented with a customized framework of cooperative learning reflecting Thai culture and learning objectives. In addition, students also need to have adequate repertoires of background knowledge about the beneficial of cooperative learning, social skills, and cooperative learning skills that enable them to realistically contribute to the successful completion of

task. In practice, they should know how to teach, and how to help and receive help from others by facilitating their own cultural values.

The study proposed that successful implementation of cooperative learning in a Thailand context or a similar culture requires three components: 1) preparation of teachers, 2) instructional strategies, and 3) preparation of students. For the preparation of teacher, first, the customized theoretical and practical implications of cooperative learning reflecting Thai culture enable teachers to understand the benefits of cooperative learning not only for their students but also for the advancement of teachers' repertoire of teaching skills. Second, instructional strategies need to be designed to strengthen the strength and make up for the weakness of Thai culture in a cooperative learning setting. As seen, a teacher in high power distance can effectively facilitate individual students' capabilities by utilizing collectivistic goals of attending to their social context that promote the values of social and disciplinary outcomes to collaborative growth. In a preparation of students, third, students need to be trained on how to effectively use social skills not only at an individual level, but also collaborative level constructs to introspect their relationship between support and performance. In classroom practice, in addition, the teacher needs to ensure that students of all ability levels have multiple opportunities to practice and most importantly reflect on how individual students performed their group role and groups implement their task.

CONCLUSION

The study was an initiative of applying cooperative learning in a different cultural setting. First, the findings in the study confirm that cooperative learning can improve Thai students' mathematics achievement. Second, the results from the team average scores, pre- and post-interview with the teacher and the classroom observations showed that cooperative learning in Thai school needs to be designed and implemented culturally and strategically from the beginning stage (preparation of teacher). Third, the conceptual framework for cooperative learning in Thai can be extended further for the teacher training programs and the development of instructional strategies in cooperative learning. It could enable teachers and students to effectively implement cooperative learning in mathematics or possibly other disciplines. The study demonstrated a high possibility that culture can be theoretically embedded in a conceptual design of cooperative learning and be practically reflected in the three components: preparation of teachers, instructional materials and preparation of students. Therefore, it can be concluded

that culture can support rather than hinder the implementation of cooperative learning.

As an initiative, the study has certain limitations: first, the study conditions were limited in that the participant numbers were small, the period of time was short, and only Grade 4 students in mathematics class were participated. The study results may be relevant, but need further investigation when they are applied in other subject and different student and teacher cohorts. Although the study attempted to integrate Thai cultural features into cooperative learning and proposed a conceptual framework, second, the study does not propose any implication in relation to how Thai culture has affected on the learning activities, processes and results.

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