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## The Study of Mathematical Problem Solving Ability after Learning Through SSCS Model Together with Team-Pair-Solo Technique At Kannasootsuksalai School, Suphanburi Province.

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### Abstract

The objectives of this study were: 1) to study the achievement of grade 3 students learning with SSCS model together with the use of cooperative learning strategy based on Team-Pair-Solo technique in studying Quadratic Equations comparing with 70 percent criteria 2) to study the mathematics ability in problem solving and 3) to survey satisfaction level in learning activities The samples were selected using simple random sampling form 48 of grade3 room 8 students in a classroom of 1<sup>st</sup> semester of academic year 2019 of Kannasootsuksalai School, Suphanburi Province. The research tools consisted of 1) Lesson plan using SSCS model together with the use of cooperative learning strategy based on Team-Pair-Solo technique in Quadratic Equations 2) Mathematics ability in problems solving test in Quadratic Equations 3) Quadratic Equations achievement test and 4) Satisfaction survey questionnaire on learning activity using SSCS model together with the use of cooperative learning strategy based on Team-Pair-Solo technique

The research showed that 1) The achievement of students in studying Quadratic Equations after the activity was higher than the 70 percent criteria with the statistical significance of .05. 2) The mathematics ability in problems solving in Quadratic Equations was at 'Very Good' level with the average score of 7.81 And 3) The satisfaction in learning activity was at 'Highest' level.

**Keyword:** Mathematical Problems Solving Ability, SSCS Model, Team-Pair-Solo Technique

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## Introduction

Mathematics serves as a tool for learning science, technology and other disciplines. It is therefore useful to one's life. It also enhances quality of life and enables a person to live in harmony with others. In accordance, Somsong Donkaewbua (1995) stated that mathematics is important and affects people life. It helps people to be cautious, reasonable and eager to find the truth. These qualities are more important than any technology advancement. Furthermore, children who are able to think and familiar with problem solving at their ages, will be able to solve life problems when they grow up. Mathematics is also the foundation of sciences and one of the main subjects. It is acknowledged as the foundation and the core of scientific breakthrough.

According to observation and testing, the problem of Grade 3 students of Kannasootsuksalai School in learning mathematics was considered from the achievement score in further Mathematics subject which was in 'Improvement needed' level. The problem was the mathematics problem solving skills of students as the students were able to understand and solve the problems given in classroom with the guidance of the mathematics teacher but they were unable to solve the problems by themselves especially the complicated ones. The solution to the problem is to encourage students to possess the characteristics listed in the curriculum based on the education reform, in the other words, to create the learning person. The important process is to improve the teaching and learning process to be more varied which will prompt students to be engaged in student-centered learning activities. Considering the learning management methods, the problems of the past mathematics learning activities were focused on memorizing the lesson instead of understanding the lesson which led students to be stressed in learning mathematics and unable to understand the whole lesson. If students learn through the mathematics problem solving processes and learning activities with the lesson's contents, their results in Mathematics will be better.

Considering achievement scores in Mathematics, the level of scores was at 'Improvement needed' which is lower than 70 percent criteria. (The average score was at 41.28 percent.) The problem was a result from the past mathematics learning activities which were focused on memorizing the lesson instead of understanding the lesson which led students to be stressful in learning mathematics and unable to understand the whole lesson. On the contrary, SSCS Model is the learning model involving the problems solving skills of students. The model helps students to think of reasons and solutions to the problems. This model is based on reasoning and realism. It is created by Pizzini, Sherdardson and Abell. Pizzini determined the four following steps of SSCS (Pizzini, 1989) Step1 Search – Searching the problems and recognizing causes of the problems: This step is consisted of brain storming to distinguish each problem and help students understand the connections of the ideas within the problems. Step 2 Solve – Solving or finding answers to the problems: In this step, students have to plan the solution. If they face any problems during the problems solving processes, they can return to step 1 or adapt the plan using the different methods to cope with the problem. Step3 Create – The information obtained by problems solving or answering the problems is organized to be more



understandable. Step 4 Share – Students comment on the answers of themselves and the others. The answers may be accepted or unaccepted and the accepted answers may lead to the new problems. The unaccepted answers may also lead to the new problems when the errors of solution planning are found by other students. The students practice their skills and mathematics process together at time. Within 4 steps, Step1 (S) and Step2 (S) will encourage students to practice problems solving skills in different contexts to find the answers. In Step3 (C) and Step4 (S), students will practice using language and mathematics symbols to communicate, present and convey the information correctly. SSCS model is coherent with child-centered learning and the model is emphasized on problems solving skills which are the essential skills to be learned and understood by students in order to apply the skills with their daily life problems because practicing problems solving skills will help students to be disciplined, think in reasonable and orderly manner and make a decision wisely (Siriporn Thipkong, 2002). Problems solving skills can be considered as the core of mathematics.

Also, cooperative learning is the learning approach which focus on the students by using grouping method to provide students a chance to work as a team and achieve the goal of the group. Cooperative learning is not limited to group works such as group reports, work pieces, discussions or experiments concluded with a summary from the teacher but the teacher has to use the strategies to urge students to summarize the knowledge from the activities and organize them into their knowledge as the principle of cooperative learning (Pimpan Dechakup, 1998) The reasons mentioned above show that cooperative learning focusing on using Team-Pair-Solo strategy which is the technique affecting group works and encouraging students to learn mathematics through working as a team, a pair and an individual. Each student will learn and understand the contexts via the process of cooperation. Kagan (Kagan, 1995, cited in Pimpan Dechakup, 1998) 3 ) also unofficially designed 52 cooperative learning techniques. Team-Pair-Solo technique is one of those 52 techniques which is defined as follows: Team-Pair-Solo is the learning management technique in which a teacher assigns the problems, questions or assignments to students and students work in group to complete the task. Then, students are divided into pairs. Within pairs, students work together until the final stage which will be an individual task.

As mentioned above, considering the importance of mathematics problem solving and cooperative learning, using of cooperative learning strategy based on Team-Pair-Solo technique is beneficial and effective in mathematics classroom. Learning activity based on SSCS is one of the alternatives for mathematics learning which emphasizes the problem solving skills in which the teacher only assigns students with the problems and encourages students to find the answers to the problems integrated with Team-Pair-Solo technique which is the technique of cooperative learning that encourages self-learning in students. The Study of Grade 3 Students' Mathematical Problems Solving Ability after Learning through SSCS Model Together with Team-Pair-Solo Technique at Kannasootsukalai School is conducted to be a guideline for effective mathematics learning management.



## **Objectives**

1. To study the achievement of Grade 3 students learning with SSCS model together with Team-Pair-Solo technique in studying Quadratic Equations comparing with 70 percent criteria
2. To study the mathematics problem solving ability after learning through SSCS model together with Team-Pair-Solo technique
3. To survey satisfaction level in Quadratic Equations learning activity of Grade 3 students learning with SSCS model together with Team-Pair-Solo technique

## **Methodology**

### **Population and Sample**

1. The population of the study was 190 first semester of academic year 2019 grade9 students from four classrooms: S.3/3, S.3/4, S.3/8 and S.3/9 of Kannasootsuksalai School, Suphanburi Province. The students with different learning ability were sorted into the classes.
2. The sample of the study was 48 first semester of academic year 2019 grade9students in from S.3/8 of Kannasootsuksalai School Suphanburi Province which were sampled by simple random sampling method.

### **Variables**

1. Independent variable was learning activities using SSCS model together with the use of cooperative learning strategy based on Team-Pair-Solo technique in studying Quadratic Equations
2. Dependent variables were:
  - The achievement of students in learning Quadratic Equations
  - The mathematics ability of students in problemsolving in Quadratic Equations
  - The satisfaction in learning activities

### **Research Methodology**

1. The study was a one-shot case study design experimental research.
2. The tools used in the study were consisted of:
  - 2.1 The 9 lesson plans for the learning activities which were presented to the 3 experts to check the validity of the lesson plan in terms of learning objectives, contents, learning activities, media, tools, evaluation and assessment. The average value from the assessment of the experts was 4.58 which is in 'Highest' quality level and all of the components in lesson plan were edited and modified regarding the suggestion of the expert.
  - 2.2 The mathematics ability in problems solving in Quadratic Equations test of grade 9 students was a subjective test that students have to answer the solutions of the questions. The 2 tests were assessed by the 3 experts. The indexes of item-objective congruence of the test were between



0.67-1.00, the item difficulty indexes were between 0.2 – 0.8 and the discrimination indexes were 0.2 or higher. The reliability of the test was determined using Cronbach's alpha coefficient and the value was 0.70.

2.3. The achievement test in Quadratic Equations was 15 multiple choices test and 1 subjective test. According to the quality assessment of the 3 experts, the indexes of item-objective congruence were between 0.67-1.00, the item difficulty were between 0.2 – 0.8 and the discrimination indexes were 0.2 or higher. The reliability of the test was determined. The reliability of the multiple choices test was determined by using KR-20 formula of Kuder-Richardson which was 0.75 and the reliability of the subjective test was determined by using Cronbach's alpha coefficient which was 0.70

2.4. The students' satisfaction questionnaire on learning activities a 5-level rating scale questionnaire consisted of 15 items. According to the assessment by the 3 experts, the indexes of item-objective congruence of the questionnaire were between 0.67-1.00

3. Accumulating and analyzing data were conducted as follows:

3.1 Using SSCS model together with the use of cooperative learning strategy based on Team-Pair-Solo technique in Quadratic Equations in the classroom 2 (55-minute periods per week) in total of 9 periods

3.2 Testing the mathematics ability in problems solving in Quadratic Equations of Grade 3 students which was 2 subjective tests consisted of 2 items (5 points each) in the first test and 1 item (10 points each) in the second test. The tests were given to students 30 minutes before the periods ended in period 5 and period 9 after the learning of each lessons

3.3 Testing the achievement in Quadratic Equations of Grade 3/8 students after the lessons using the achievement test with 55 minutes to finish it

3.4 Surveying of student's satisfaction in learning activities using SSCS model together with the use of cooperative learning strategy based on Team-Pair-Solo technique in Quadratic Equations using the satisfaction questionnaire with 10 minutes to finish it

3.5 Comparing the achievement of the students after the learning activities using SSCS model together with the use of cooperative learning strategy based on Team-Pair-Solo technique in Quadratic Equations with 70 percent criteria

3.6 Analyzing the mathematics ability in problems solving of Grade 3 students learning through the learning activities and showing the results in the form of average values and standard deviations using the rubric score

3.7 Studying the satisfaction of students on learning activities by comparing the data gathered by the 5-scale rating scale questionnaire with the following criteria: 5 means 'Highly satisfied', 4 means 'Satisfied', 3 means 'Neutral', 2 means 'Unsatisfied', 1 means 'Highly unsatisfied'. The surveyed data were analyzed in terms of individual aspects satisfaction and overall satisfaction and the results were presented in the forms of mean and standard deviation. Then, the means of the analyzed data were interpreted according to the criteria.



## Result

1. The achievement of students in Quadratic Equations of Grade 3 students learning through the learning activities using SSCS model together with Team-Pair-Solo Technique determined from comparing of the average score of students with 70 percent criteria and comparing a result with one-sample t-test was shown in Table 1.

**Table1** The analyzed data of students in Quadratic Equations through the learning activities using SSCS model together with Team-Pair-Solo Technique

Items	N	Total	$\mu$ (70%)	$\bar{x}$	S.D.	T	Sig
Samples	48	20	14.00	14.79	2.53	2.164	0.036

Note\*  $p < .05$

According to Table 1 the analyzed data of students in Quadratic Equations through the learning activities using SSCS model together with Team-Pair-Solo Technique, the average score was higher comparing with 70 percent criteria.(score = 73.96%). The achievement of students in studying Quadratic Equations after the activity was higher than the 70 percent criteria with the statistical significance of.05.

2. The analysis of mathematics problems solving ability after learning through the learning activities using SSCS model together with Team-Pair-Solo Technique Quadratic Equations using 2 tests was shown in Table 2.

**Table2** The overall scores from mathematics ability in problems solving in Quadratic Equations of Grade 3 from each test (10points each test)

Test	Total	$\bar{x}$	S. D.	Interpretation
1	10	7.85	1.07	Very Good
2	10	7.77	2.03	Very Good
Mean	10	7.81	1.55	Very Good

According to Table 2, the analysis of mathematics ability in problems solving of Grade 3 learning through the learning activities using SSCS model together with Team-Pair-Solo Technique in Quadratic Equations showed that most of the students had a mathematics problem solving ability at 'Very good' level with the average score of 7.81



3. The analysis of the satisfaction of grade 3 learning through the learning activities using SSCS model together with Team-Pair-Solo Technique in Quadratic Equations by determining the mean and standard deviation of the surveyed data was shown in Table 3.

**Table 3** The analyzed data of the satisfaction of grade 3 students on learning through the learning activities using SSCS model together with the use of cooperative learning strategy based on Team-Pair-Solo technique in Quadratic Equations

Statements	$\bar{X}$	S.D.	Interpretation
1. Students like to study in groups.	4.73	0.86	Highest level
2. Students like to participate in activities.	4.80	0.46	Highest level
3. Students have chances to show their opinions with classmates.	4.76	0.60	Highest level
4. Students have a better understanding in the lesson.	4.61	0.76	Highest level
5. Students like to do and help one another with the exercises in groups.	4.69	0.58	Highest level
6. The lessons follow the order of learning.	4.76	0.56	Highest level
7. The activities are related with the lessons.	4.82	0.44	Highest level
8. Students feel mathematics become easier.	4.53	0.94	Highest level
9. The amount of time to activities is appropriate.	4.67	0.66	Highest level
10. Students become more responsible.	4.63	0.60	Highest level
11. Students have better thinking process and working process.	4.61	0.67	Highest level
12. The learning management follows the steps.	4.65	0.60	Highest level
13. Students are happy with learning.	4.61	0.76	Highest level
14. The amount of time to finish tests is appropriate.	4.71	0.58	Highest level
15. Students have more chances to show their opinions.	4.61	0.70	Highest level
<b>Mean</b>	<b>4.68</b>	<b>0.65</b>	



According to Table 3, the satisfaction of students in learning through the learning activities using SSCS model together with the use of cooperative learning strategy based on Team-Pair-Solo technique in Quadratic Equations in the following aspects arranged in descending order: The activities are related with the lessons. Students like to participate in activities. And the average satisfaction was at 'Highest' level with the average score of 4.68.

### **Conclusion and Discussion**

The results of the study showed that the achievement of students after learning through activities using SSCS model together with the use of cooperative learning strategy based on Team-Pair-Solo technique in Quadratic Equations was higher than the 70 percent criteria with the statistical significance of .05. It was found that after learning through activities using SSCS model together with the use of cooperative learning strategy based on Team-Pair-Solo technique in Quadratic Equations, the achievement in studying mathematics was higher than the 70 percent criteria with the statistical significance of 0.05. The achievement of Grade 3 students after learning through activities in Quadratic Equation compared with 70 percent criteria had the average score of 14.79 which was higher than the 70 percent criteria (14.00 points) and the standard deviation of 2.53 which fulfilled the objectives of this study. It is consistent with Pinyada Klawkaew (2013), studying the mathematical achievement and mathematical problem-solving ability of grade 8 students about the one-variable quadratic equation using the SSCS model. PSU Wittayanusorn School, Songkhla Province, found that students have mathematics learning achievement on the quadratic equation of one variable. After learning, it was higher than before learning and higher than the criteria of 60 percent with statistical significance at the .05 level. The ability to solve mathematical problems about quadratic equations in one variable was very good. This is because organizing learning activities using the SSCS model has step-by-step activities that encourage students to be able to solve problems in sequence with the teaching methods by managing learning using teamwork, pair work and individual, the useful teaching methods in cooperative learning which students work as a group to solve problems. The research discusses the answer and exchanges classes among fellow members by encouraging the students to have the opportunity to interact and communicate with each other, develop social skills and gain confidence in speaking and expressing opinions through effective teaching and learning processes. And it is a method that creates interest and stimulates the interest of students in the classroom. Consistent with Kagan (1994) who said that single-team teaching method help students learn problem-solving skills. In the first step, students work in groups and help each other to understand the process used to solve problems as helping is the stimulation through each of problems. The second step students work in pairs which they help each other. The third step, Single step, students are ready to solve problems and learn by themselves and the assessment of the students' ability is found in this step. All of this result in higher achievement in mathematics.





The mathematics problems solving ability in Quadratic Equations of Grade 3 students learning through the learning activities using SSCS model together with the use of cooperative learning strategy based on Team-Pair-Solo technique found that most of the students had the mathematics problems solving ability at 'Very good' level with the average score of 7.81. In accordance with the research, ManeeratPhanthata (2013) studied the ability to solve math problems and learning achievement of grade 10 students by using the SSCS model together with the Polya problem solving process which found that the students have the ability to solve mathematics problems at an average of 36.37 is 72.74 percent and 33 of them are above the criteria which is 71.74 percent of the total number of students which is also higher than the specified threshold. This shows that Learning management using the SSCS model together with learning management using teamwork, working in pairs and individually is a teaching model that focuses on students to learn to solve problems step by step and encourage students to develop social skills, able to talk, communicate, exchange ideas and work with others. All leads to students' higher ability in solving mathematical problems.

The satisfaction of students in learning through the learning activities using SSCS model together with the use of cooperative learning strategy based on Team-Pair-Solo technique had the overall average satisfaction of 4.68 and the standard deviation of 0.65 which was interpreted as 'Highest' level and coheres with the study of Theerasak Sinchai (2016) in Developing English Speaking Skill of Grade 1 Students Using Cooperative Learning with the Use of Team-Pair-Solo technique which had the results of overall satisfaction in learning activities at 'Satisfied' level. In coherence with the study of ChakritRuangprapan (2013) which had the overall satisfaction of Grade 3 students in learning activities using SSCS with the use of constructivism theory in Quadratic Equations at the "Highly Satisfied" level with the average score of 4.06 shows that learning activities using the SCS model together with learning management by using teamwork, working in pairs and individually are teaching methods that can be used in teaching mathematics because it promotes interaction, social skills between friends in the group. This method focuses on the students to work as a group to think, solve problems and achieve learning goals together which makes students interest attentive in activities because the teaching and learning activities allow students to participate in activities and be able to learn independently. This respond the needs of students causing more motivation and interest than traditional teaching and learning activities



## Recommendation

1. Suggestions in using of the results of the study
  - 1.1. Studying the achievement in mathematics requires the great amount of time to allow the learning ability to be improved gradually overtime and the stages which are not clear to students should be emphasized especially Do and Check stages.
  - 1.2. Students should not be informed that they are organized in to the groups of excellent, fair and improvement needed in accordance with their learning abilities because it will affect the enthusiasm of students in learning activities.
  - 1.3. The teacher should create learning atmosphere and encourage students to engage in competition activities to make the students to realize the importance of genuinely join competition to ensure the effectiveness and enthusiasm of students in doing activities.
  - 1.4. The amount of time using in group activities should be flexible in accordance with the lesson and the potential of the students. The teacher should not be too strict with the time and the teacher should practice often.
2. Suggestion for the studies in future
  - 2.1. Extraneous variables should be studied and controlled for example, the limited duration and the individual differences.
  - 2.2. Achievement motive development should be added to encourage students to join the learning activities and develop achievement motive together. So, the students' achievement motive and understanding in lessons will be developed at the same time.

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